Dryandra Woodland

Management Plan No. 70 2011

Department of
Environment and Conservation

Conservation
Commission
WESTERN AUSTRALIA

DRYANDRA WOODLAND

Management Plan

2011

Department of Environment and Conservation

Conservation Commission of Western Australia

VISION

By 2021, Dryandra Woodland will continue to be one of the largest and most diverse remnant bushland areas in the wheatbelt, supporting a range of local flora and fauna species, including the State's mammal emblem, the numbat. The woodland will continue to attract visitors from the local and wider community, particularly to view threatened fauna up close and in their natural environment. It will provide education and interpretation that highlights the significant natural, cultural and recreation values. Management will focus on maintaining and enhancing the key values, which will be in the same or better condition than in 2011.

Front cover images:
Wandoo woodland. Photo by Michael James.
Wildlife interaction at Barna Mia. Photo by Michael James
Numbat (*Myrmecobius fasciatus*). Photo by Tricia Sprigg, DEC.

PREFACE

All national parks, conservation parks, nature reserves and state forests in Western Australia are vested in the Conservation Commission of Western Australia (Conservation Commission). In accordance with the *Conservation and Land Management Act 1984* (CALM Act), the Department of Environment and Conservation (DEC) is responsible for the management of these reserves, and prepares management plans for them on behalf of the Conservation Commission. The Commission issues draft plans for public comment and provides final plans to the Minister for Environment for approval.

The *CALM Act 1984* specifies that a management plan must contain:

- a statement of the policies or guidelines proposed to be followed; and
- a summary of operations proposed to be undertaken for a specified period not exceeding 10 years.

In accordance with Section 55 of the CALM Act, the term of this plan will be 10 years, or until the plan is superseded by a new management plan. A review may take place within the term of the plan.

Changes since the previous management plan

The existing reserves have been managed according to the *Dryandra Woodland Management Plan 1995-2005* (CALM 1995) since 2005. In that time there have been a number of developments that have led to differences between the existing plan and this proposed management plan. These include:

- The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999 and Amendments* provides protection for threatened species and communities.
- Changes to the CALM Act in 2000 have replaced the National Parks and Nature Conservation Authority with the Conservation Commission as the controlling body for the terrestrial conservation reserve system in WA. This change has given the Conservation Commission responsibility for submitting management plans to the Minister and developing guidelines for monitoring and assessing the implementation of management plans. Consequently, management plans are now outcome-based in terms of performance assessment, and include Key Performance Indicators against which the Conservation Commission will assess performance.
- the State Government's acknowledgement of the interests of Aboriginal people in the management of conservation lands;
- The development of the updated Policy Statement No. 19 *Fire Management* which includes 12 scientific principles which places a greater emphasis on burning for biodiversity and fire ecology.
- The development of the *Conservation and Land Management Regulations 2002* and a revised Policy Statement No. 18 *Recreation, Tourism and Visitor Services* and associated guidelines which reflect the new regulations, incorporates a wider range of recreational activities and clarifies issues with pre-existing uses that may not be necessarily permitted in national parks but have arisen from the creation of new national parks from state forests where these activities were formerly permitted.
- increased knowledge of the values of the wheatbelt, in particular the completion of the report *A biodiversity survey of the Western Australian agricultural zone* (Keighery *et al*. 2004).

NOMENCLATURE

Inclusion of a name in this publication does not imply its approval by the relevant nomenclature authority. The meanings of abbreviations and general terms used throughout this plan are given below. A glossary of technical terms and phrases is provided on page 102.

The Department of Environment and Conservation (DEC) is referred to as 'the Department'.

The Department is responsible for the administration of the *Conservation and Land Management Act 1984* (CALM Act) on lands vested with the Conservation Commission of Western Australia.

The planning area includes those portions of Department-managed lands at both Dryandra (Lol Gray and Montague State forests) and Highbury (Highbury State forests).

When 'south-west' is used it refers to the general south-west corner of Western Australia between Geraldton and Esperance.

'Wheatbelt' refers to the Department's Wheatbelt Region.

The term 'Nyoongar' refers to Aboriginal people who live in the south-west corner of Western Australia, between Jurien Bay and Esperance. The word 'Nyoongar' can be spelt in different ways, and spelling in this form should also be seen to encompass the Noongar, Nyungar, Noongah and Nyungah spellings.

ACKNOWLEDGMENTS

This management plan was prepared by the planning team for Dryandra Woodland, which consisted of Kathryn McGuane and Paul McCluskey (Final Plan coordinators), Daryl Moncrieff (former Management Planning Unit Coordinator), Aminya Ennis (former Regional Leader Parks and Visitor Services) and Greg Durell (District Manager Great Southern District).

Many individuals contributed to the planning process, and their assistance is acknowledged, in particular Bruce Bone, Tricia Sprigg, Steve Gorton, Peter Lacey, Aaron Rivers and Sean Bryce.

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PART A. INTRODUCTION

1. BRIEF OVERVIEW

The Dryandra Woodland (Lol Gray, Highbury and Montague State forests) lies about 160 kilometres southeast of Perth in the Wheatbelt Region of the Department of Environment and Conservation (see Map 1). It comprises 17 discrete blocks scattered across a north-south distance of about 50 kilometres and separated by areas of agricultural land. The total area is 28,066 hectares, with blocks ranging in size from 87 hectares to 12,283 hectares.

This management plan will replace *Dryandra Woodland Management Plan 1995 – 2005*. The *Forest Management Plan 2004 – 2013* (FMP) will complement this plan. Where there is a conflict between the FMP and this plan, this management plan takes precedence.

2. REGIONAL CONTEXT

Dryandra is situated between the 500 millimetres and 600 millimetres isohyets, receiving significantly less rainfall than the Darling Range to the west. The structure and composition of the vegetation reflects this: forests of jarrah (*Eucalyptus marginata*) have been replaced by woodlands with a more open canopy, typically comprising wandoo (*E. wandoo*) and powderbark wandoo (*E. accedens*). In recognising this fundamental difference, management principles within this plan are more closely aligned to those of other woodland communities within the wheatbelt than the Darling Range forests.

Land clearing in the wheatbelt has reduced the area of native bushland to isolated remnants. In the Dryandra area, clearing has been comparatively recent, mainly occurring in the last fifty years (see Figure 1). As late as 1962, Dryandra was connected to the main forest belt of the Darling Range, and other large areas of native bush existed to the east. With the continued clearing of private property, the blocks of Dryandra have eventually become separated from these other areas and each other. The impacts associated with habitat fragmentation are still likely to be affecting the biota of Dryandra. For example, Saunders (1989) predicts further losses of bird species from wheatbelt reserves, depending on the extent of removal of native vegetation and the length of time since clearing occurred.

Despite Dryandra's overall large size in comparison with other reserves of the central western wheatbelt, it is subject to similar problems to those of other fragmented areas of native vegetation. These include:

- susceptibility to hydrological changes;
- inward drift of fertilisers and weeds from agricultural land;
- restrictions on fauna movement;
- inappropriate fire regimes; and
- vulnerability to single catastrophic events, such as a wildfire that burns a large proportion of a block.

Re-colonisation by plants and animals may be very slow, or may not occur at all. Such events could therefore lead to local extinctions. The continued persistence of Dryandra's values is dependent not only on the protection of Department-managed land, but also on the enhancement of the remaining isolated remnant vegetation (by fencing and strategic revegetation on the surrounding farmland).

A primary value of Dryandra is its role in conserving a representative sample of the flora and fauna communities of the central western wheatbelt. The area also makes an important contribution to maintaining biodiversity on an international scale by providing habitat for nine threatened species of fauna. In recognition of these values part of Dryandra Woodland is listed by the Australian Heritage Commission on the Register of the National Estate. The amendments to the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) will see the phasing out of the Register of the National Estate as a statutory register from February 2012, after which it will be retained as an archival record only.

Dryandra Woodland caters for a range of different land uses, including nature conservation, recreation, education, timber production and Aboriginal land use. These uses, and Dryandra’s fragmented nature,

demonstrate how the integration of management across crown land and private property boundaries contributes to ecologically sustainable land-use.

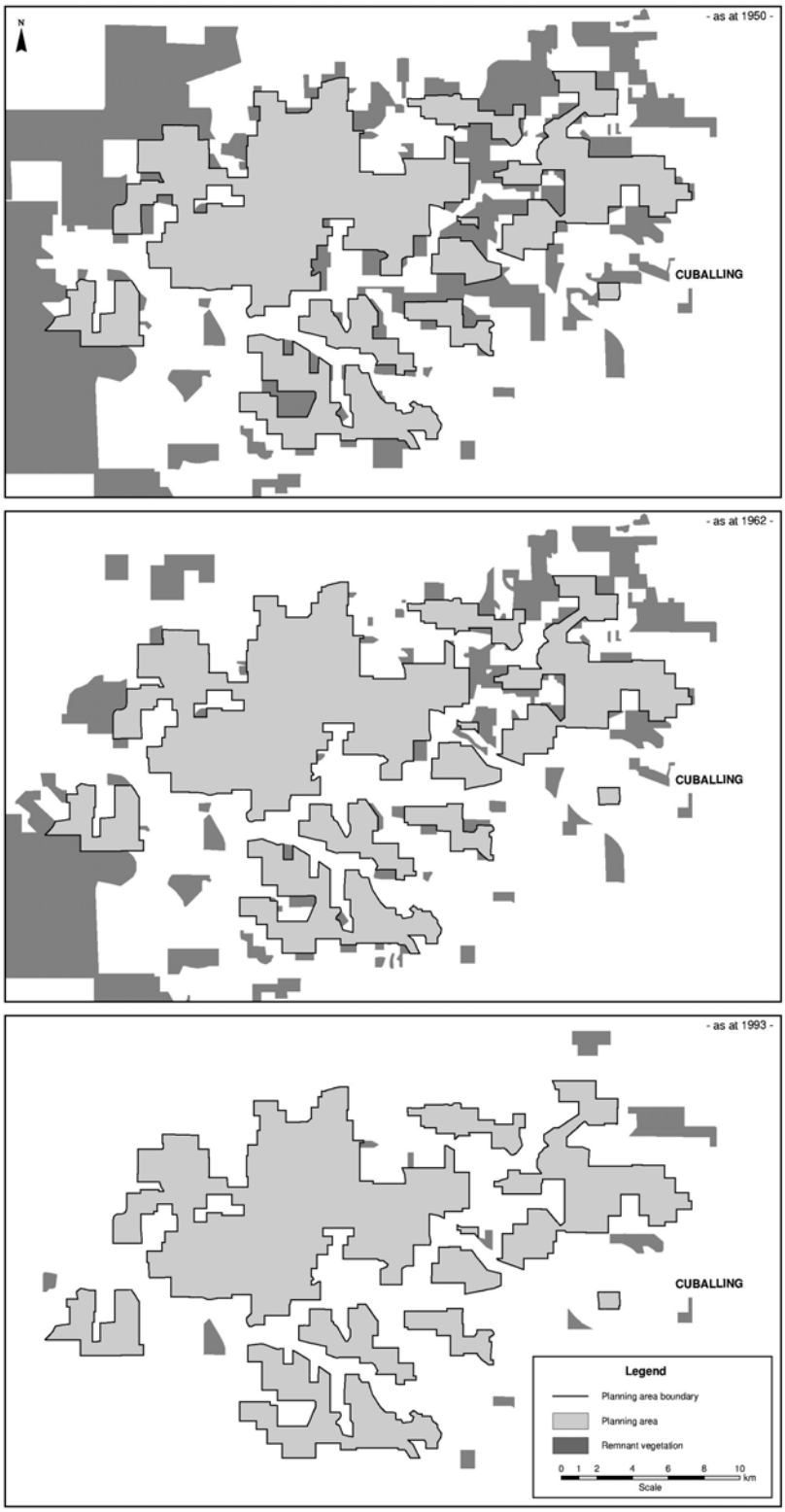

Figure 1. Remnant Vegetation Outside Dryandra Woodland

3. MANAGEMENT PLAN AREA

This management plan covers the existing Dryandra Woodland State Forest. The planning area includes those portions of lands at both Dryandra (Lol Gray and Montague State forests) and Highbury (Highbury State forests) (see Map 1). In the event that any areas discussed in section 9 *Existing and Proposed Tenure* of the plan are added to the public conservation estate, these areas will be managed in accordance with this management plan.

4. KEY VALUES

The key values of the planning area include:

Natural

- The largest and most diverse remnants of the central western wheatbelt vegetation which provide important habitat for threatened and priority fauna.
- Twelve distinct vegetation associations, comprising over 800 native plant species, including one species declared as rare[1] and 8 priority species.
- Ten threatened species of fauna, and a further two in need of special protection.
- A rich mosaic of vegetation communities and significant habitats.
- Extremely diverse flora and fauna due to Dryandra's transitional location between the arid zone and the wetter environment to the west and south-west.
- Development of science through the study of ecosystem function.

Recreation and Tourism

- A terrestrial environment with a diverse range of nature-based recreational tourism opportunities within close proximity to Perth. Specific activities include viewing threatened native marsupials (at Barna Mia), bushwalking, camping, scenic driving (e.g. two self-guided drive trails) and wildflower appreciation.
- The cottages in the original forestry settlement, now known as the Dryandra Woodland Village, provide low cost, basic accommodation for overnight visitors.

Education and Interpretation

- A range of education and interpretation opportunities, especially at the Irabina Study Centre and Barna Mia, which are great resources for informing visitors and the community about the values of Dryandra.
- Ecological field studies by university, school and naturalist groups, the attraction to Dryandra being the biological diversity of the woodland, the Irabina Study Centre, Barna Mia and low-cost on-site accommodation.
- Information for visitors about the rich cultural heritage associated with the timber industry and Indigenous use of the area.

Cultural

- Indigenous and archaeological sites, including an ochre quarry, stone arrangements, artefact scatters and scar trees, and landscapes of cultural significance to Aboriginal people.
- Non-indigenous cultural heritage associated with early settlements and the timber industry.

Economic

- Natural values for nature-based tourism that contribute to regional expenditure and the local tourism economy.
- Timber production from mallet harvesting provides revenue and employment. The mallet plantation provides potential opportunities for the future development of new mallet products.

5. PUBLIC PARTICIPATION

This management plan derives from a review of the *Dryandra Woodland Management Plan 1995 - 2005*. Revised components of this plan were circulated for public comment in the following ways:

[1] 'Rare flora' refers to taxa declared under Section 23F(1) of the Wildlife Conservation Act (1950) as rare, likely to become extinct or in need of special protection. 'Priority species' are taxa that are under consideration for declaration under the Act.

- public submissions were invited through state and local newspapers during preparation of the draft;
- specific stakeholders were contacted and invited to make a submission; and
- government agencies were contacted and invited to provide comment.

Changes were then made based on an analysis of the public submissions.

PART B. MANAGEMENT DIRECTIONS AND PURPOSE

6. VISION

The vision of this plan is:

By 2021, Dryandra Woodland will continue to be one of the largest and most diverse remnant bushland areas in the wheatbelt, supporting a range of local flora and fauna species, including the State's mammal emblem, the numbat. The woodland will continue to attract visitors from the local and wider community, particularly to view threatened fauna up close and in their natural environment. It will provide education and interpretation that highlights the significant natural, cultural and recreation values. Management will focus on maintaining and enhancing the key values, which will be in the same or better condition than in 2011.

This vision is derived from State legislation and policy, and the policies of the Department and the Conservation Commission. It reflects the key values of the planning area and the importance of sustainable management of those values (see Section 4 – *Key Values*).

7. LEGISLATIVE FRAMEWORK

Legislation and Policy

The *Conservation and Land Management Act 1984* (CALM Act) covers such matters as defining categories of lands and waters managed by the Department, establishing controlling bodies, establishing and defining the functions of the Department and the controlling bodies, management planning and auditing, control and eradication of forest diseases, permits, licences, contracts, leases, offences and enforcement. Under the CALM Act, the Department is responsible for administering the *Wildlife Conservation Act 1950* (Wildlife Conservation Act), which provides for the conservation and protection of indigenous flora and fauna on all lands and waters within the State.

State forest, proposed national park and proposed nature reserve are the categories of land comprising this management plan. These lands are vested in the Conservation Commission and managed by the Department in accordance with the CALM Act. Management of these reserves includes the preparation of management plans as required by section 54(3)(a)(i) of the Act. These 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 plan (section 55).

National parks are a category of protected area under the CALM Act and, according to section 56 of the CALM Act, the objective of management plans for these reserves is to "… *fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest ...*". Commercial exploitation of flora and fauna is not permitted and only low-impact recreational pursuits that do not adversely affect ecosystems and landscapes may be permitted.

State forests are a category of protected area under the CALM Act. These reserves are managed for one or more of the following purposes, including conservation, recreation, and timber production on a sustained yield basis or water catchment protection.

Each management plan is subject to audit by the Conservation Commission and remains in force until such time as a new plan is prepared in accordance with sections 54-60 of the CALM Act. The procedure to make an amendment to a gazetted final management plan is governed by section 61 of the CALM Act and involves a public consultation process.

The EPBC Act contains provisions relating to the protection of nationally-listed threatened species and ecological communities, provides for heritage protection including world heritage properties, national heritage places and lists key threatening processes. The provisions of the EPBC Act require referral to and consultation with the relevant Commonwealth Minister responsible for this Act unless under section 46, an action is approved under and taken in accordance with a State management plan that is accredited by the Commonwealth. Therefore this management plan is required to be consistent with the provisions of the EPBC Act.

This management plan is required to conform to the *Bush Fires Act 1954* (Bush Fires Act) and satisfy the Fire and Emergency Services Authority that adequate fire protection will be provided for the reserves. Under section 34 (1a)(a) of that Act, the management plan requires approval from the Authority.

Under the *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act), the Department is required to report Aboriginal heritage sites and ensure that sites are protected. The Department's Aboriginal Heritage Unit should also be notified of any sites within the planning area. The (Commonwealth) *Native Title Act 1993* requires that native title claimants and representative bodies be advised 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 planning area and has a number of functions prescribed under the Native Title Act.

The *Forest Products Act 2000* (Forest Products Act) establishes the Forest Products Commission who is responsible for establishing, maintaining and managing plantations of forest products on public land.

Recreational fishing in the planning area is managed under the *Fish Resources Protection Act 1994*. However, under the Conservation and Land Management Regulations 2002 (regulations 3 and 9), fishing on lands managed by the Department may be prohibited in restricted areas.

The CALM Act does not negate any of the powers of the *Mining Act 1978* (Mining Act), *Petroleum and Geothermal Energy resources Act 1967* (Petroleum and Geothermal Energy Resources Act) or Government Agreement Acts.

In addition to legislative specifications, this management plan also conforms to the policies of the Department.

Obligations and Agreements

Australia is a participant of or signatory to a number of important conservation agreements, many of which affect management of Departmental estate. For the planning area these 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, including the EPBC Act.

The Burra Charter

In 1979 the Australia International Council on Monuments and Sites (ICOMOS) adopted a charter for the conservation of places of cultural significance, now known as the *Australia ICOMOS Burra Charter, 1999* (Burra Charter). The charter has been widely been adopted as the standard for heritage conservation practice in Australia and applies to all types of places of cultural significance including natural, Indigenous and historic places with cultural values.

8. MANAGEMENT ARRANGEMENTS WITH ABORIGINAL PEOPLE

There is a strong interest by Nyoongar people to be involved in the management of conservation estate in the south-west and to strengthen cultural ties to the land. Working together with Aboriginal people to care for the land will be beneficial to the preservation of natural and cultural heritage as well as for cross-cultural awareness.

A memorandum of understanding (MOU) is already in place between the Department and the South West Aboriginal Land and Sea Council, which, under the Native Title Act, is the representative body for the south-west of the state. This MOU 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 CALM Act.

There are currently no formal management arrangements with Aboriginal people in place for Dryandra Woodland.

9. EXISTING AND PROPOSED TENURE

Existing Tenure

Dryandra Woodland comprises State forests 51 (Lol Gray), 52 (Highbury), and 53 (Montague): they have a combined area of 28,066 hectares and are vested in the Conservation Commission for the purpose of 'State forest'. Conservation of flora and fauna is currently the primary use, with mallet timber production and recreation as secondary uses. State forest 52 lies south of Narrogin, while State forests 51 and 53 (formerly known as 'Dryandra forest') are both north of Narrogin (see Maps 2a and 2b).

The three State forests are known collectively as Dryandra Woodland, and within this entity are areas of State forest, nature reserve and proposed nature reserve, and proposed national park, all managed by the Department according to the objectives and strategies established in this management plan.

Proposed Tenure Options

Under the CALM Act there are seven possible land categories to which all or part of Dryandra Woodland could be assigned. These are: nature reserve, national park, conservation park, State forest, timber reserve and miscellaneous reserve (areas managed under sections 5(1)(g) and 5(1)(h) of the CALM Act).

In 1992, the Lands and Forest Commission (LFC) in conjunction with the then National Parks and Nature Conservation Authority (NPNCA) considered the future tenure for Dryandra Woodland. Both bodies agreed that plantations supporting the mallet industry should remain as State forest, whilst the remainder of the area should become either national park or nature reserve with vesting in the NPNCA. The LFC and NPNCA have since been amalgamated to form the Conservation Commission of Western Australia. The Conservation Commission continues to endorse these possible tenure changes.

Given Dryandra's high biological values and their need for protection, it was proposed to separate the areas comprising Dryandra Woodland into the following land categories:

- **national park** - for larger, contiguous areas of natural bush with high nature conservation and recreation values, and for which no timber production is proposed (see Map 2a). Areas of natural bush in the central block of Dryandra and some of the larger blocks satisfy these criteria. The total area proposed as national park is 16,337 hectares (about 58 per cent of the total area).
- **nature reserve** - for isolated areas of natural bush with high nature conservation value, and limited recreation potential (see Maps 2a and 2b). Much of Highbury, and the smaller, isolated blocks of natural bush north of Narrogin satisfy these criteria. While logistically it would be easier to make all natural bush areas national park, the classification of the smaller areas as nature reserve is consistent with the tenure of similar areas within the vicinity of Dryandra. The total area of proposed nature reserve is 3294 hectares (about 12 per cent of the total area).
- **State forest** - for the mallet plantations, the Sandalwood plots on Gura Rd, and Quinns Block (see Maps 2a and 2b). The plantation areas are primarily important for sustainable mallet timber production, but have simultaneous value for nature and cultural conservation, recreation, and water catchment protection. Quinns Block, although not containing areas of mallet plantation, will remain State forest at least until the use of such areas for Aboriginal cultural activities are determined. (If cultural activities are deemed inappropriate, then the area would become nature reserve). Mallet plantations that are regenerated back to the original natural vegetation during the life of this plan, i.e.. 'poor quality' plantations, will remain as State forest at least until the plan is reviewed. The total area to remain as State forest at this stage is 8316 hectares (about 30 per cent of the total area).

Although Dryandra Woodland is the largest remaining area of intact bushland in a mostly cleared landscape in the western Wheatbelt, it is still a mostly fragmented area of bushland. This aspect adds to the difficulty of management and any additions to the conservation estate through acquisition of Crown reserves or freehold land that adds to the viability of the bushland area delivers a conservation benefit. Any reserve additions, or changes in the classification of existing reserves or the category of land, will be subject to usual Government consideration and determination.

9. Existing and Proposed Tenure

Key Points

- Dryandra comprises three State forests, within which are areas of State forest, nature reserve and proposed nature reserve, and proposed national park.
- The existing and proposed land tenure of Dryandra Woodland reflects the conservation, recreation and production values of each area.
- As a result of past clearing for agriculture, many of the original vegetation associations of the central western wheatbelt are poorly represented in, or absent from, Dryandra. Surrounding areas of remnant vegetation on private and Crown land enhance the conservation value of Dryandra.
- The high boundary-to-area ratio of Dryandra increases management issues in relation to fire protection, weed invasion, fertiliser drift, access, domestic animals entering Dryandra and native animals damaging crops and fences. The purchase of key properties, should they come up for sale, would help to reduce these threats and improve management of the planning area.

The objective is to ensure that land tenure reflects the high natural values of Dryandra Woodland, and takes into consideration its key values.

This will be achieved by:

1. implementing the proposed tenure changes shown on Maps 2a and 2b;
2. ensuring changes to land tenure boundaries are easily located in the field;
3. assessing the conservation values of adjoining private properties, as they come up for sale, to determine its suitability for addition to the conservation estate, subject to usual Government consideration and determination; and
4. assessing nearby Crown land, as it becomes available, to determine its suitability for addition to the conservation estate, subject to usual Government consideration and determination.

Key Performance Indicator (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
9.1 Changes in land tenure and purpose	9.1 To implement all proposed changes to tenure and purpose over the life of the management plan.	After 5 years

10. PERFORMANCE ASSESSMENT AND MONITORING

The Conservation Commission will measure the success of this plan by using the 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 or values 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.*"

Each key performance indicator comprises evaluation of a measure and target, reporting requirements and a management response to any 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 evaluate the success of the Department's management in 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 will identify factors that have led to the target shortfall,

and propose alternative management actions 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 CALM 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 1.

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

11. ADMINISTRATION

For administrative purposes, the Department is structured into nine geographic regions that may be further sub-divided into districts. Dryandra Woodland is part of the Great Southern District of the Wheatbelt Region. The day-to-day implementation of the final management plan will be the responsibility of the District Manager, Great Southern District, who coordinates the operational management of reserves in the planning area. Staff from specialist branches within the Department provide services, advice and assistance as required.

12. TERM OF THE PLAN

This management plan is for a period not exceeding 10 years and comes into operation from the date that a notice is published in the Gazette. However, the plan shall remain in force until it is revoked and a new plan is approved and substituted for it. At any time, the plan may be amended.

This plan replaces the *Dryandra Woodland Management Plan 1995-2005*.

PART C. MANAGING THE NATURAL ENVIRONMENT

13. BIOGEOGRAPHY

The Interim Biogeographic Regionalisation for Australia (IBRA) provides a planning framework for selecting a comprehensive, adequate and representative[2] (CAR) reserve system of protected areas to conserve Australia's biodiversity (Thackway and Cresswell 1995).

In addition to using scientifically-based CAR criteria, areas that serve as buffers to marine or terrestrial reserves, protect threatened species or otherwise assist with conservation management are also commonly included in parks and reserves. Natural areas with spectacular landforms and scenery subject to high public use may also be included.

Bioregions

The IBRA divides WA into 26 biogeographic regions, based on dominant landscape characteristics of climate, lithology, geology, landforms and vegetation. The planning area is an important component of the Avon Wheatbelt 2 (AW2) subregion of the Avon Wheatbelt bioregion (see Figure 2), supporting extant populations of several critical weight range marsupials (see Section 18 *Native Animals and Habitats*) and having at least 800 species of vascular flora (see Section 17 *Native Plants and Plant Communities*).

The Avon Wheatbelt bioregion is situated in the South West Botanical Province of Western Australia, and is predominantly located within the jurisdictions of the Avon Catchment Council and the Northern Agricultural Catchment Council NRM region. It encompasses an area of 93,520 square kilometres, of which 93 per cent has been cleared, predominantly for agriculture (Beard 1990). The Avon Wheatbelt bioregion is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton, with a gently undulating landscape of low relief. AW2, in the western portion of the bioregion, is an erosional surface of gently undulating rises to low hills with breakaways (May and McKenzie 2003). A rejuvenated drainage system in AW2 results in continuous streams that flow in years of average rainfall. Lateritic uplands and associated sandplains support proteaceous scrub-heath while erosional slopes and valley floors are dominated by Wandoo, York, Casuarina and Jam woodlands (NACC 2005).

Agriculture is the primary landuse in this bioregion, which is the most intensely farmed region in WA (Beard 1990). The majority of native vegetation has been cleared for cropping and grazing enterprises, which is the biggest constraint to achieving CAR reservation goals in the wheatbelt (May and McKenzie 2003). In addition, rising saline groundwater threatens up to 30 per cent of the area. Hence, virtually all remnants in this region are important for biodiversity conservation and building towards CAR targets (May and McKenzie 2003). Dryandra Woodland is the largest remaining area of intact bushland in a mostly cleared landscape. In addition it is representative of the western wheatbelt and therefore has very high conservation value.

Only 1.7 per cent (about 166,331 hectares) of the Avon Wheatbelt bioregion is within a conservation reserve[3]. As such, it is a poorly represented bioregion in the conservation reserve system.

[2] Comprehensiveness – inclusion of the full range of ecosystems recognised at an appropriate scale within and across each bioregion. Adequacy – the maintenance of the ecological viability and integrity of populations, species and ecosystems. Representativeness – the principle that those areas that are selected for inclusion in reserves reasonably reflect the biotic diversity of the ecosystems from which they derive.

[3] Conservation reserves include nature reserves, national parks, conservation parks and 5(1)(g) and (h) reserves which have a purpose of conservation.

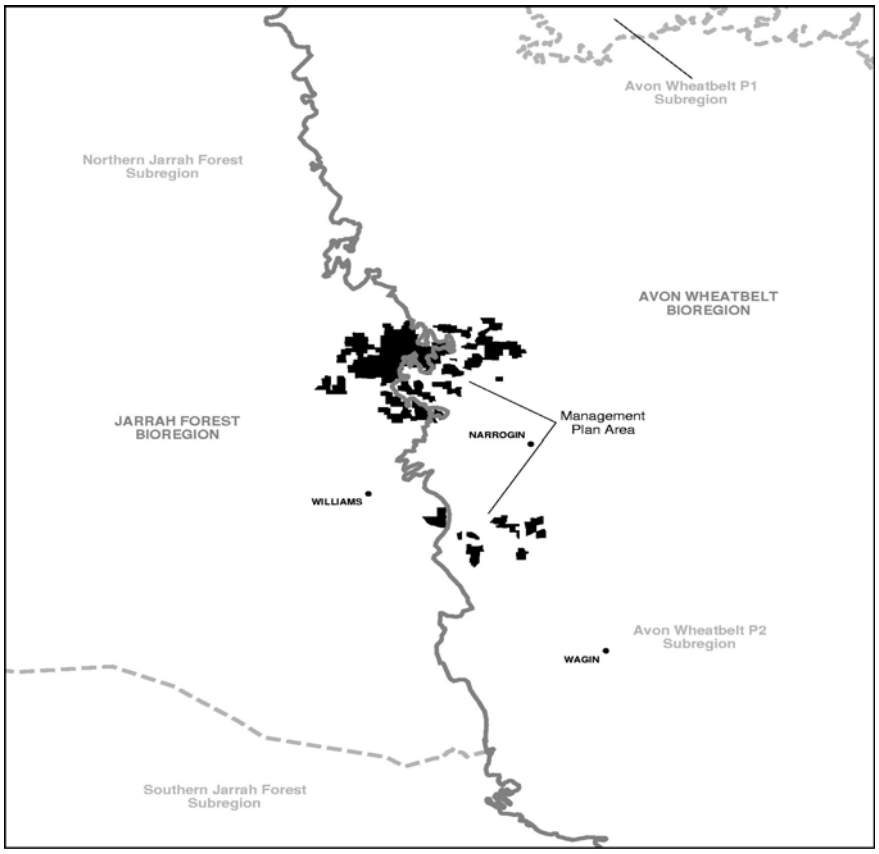

Figure 2. IBRA Bioregions and Sub-regions

13. Biogeography

Key Points

- The IBRA provides a planning framework for selecting a CAR reserve system of protected areas to conserve Australia's biodiversity.
- The planning area lies within the Avon Wheatbelt 2 subregion of the Avon Wheatbelt bioregion.
- Ninety-three per cent of the bioregion is cleared for agricultural purposes, which is the biggest constraint to achieving CAR reservation goals.
- Only 1.7 per cent of the bioregion is contained within a CAR conservation reserve.

The objective is to contribute to the establishment of a comprehensive, adequate and representative conservation reserve system.

This will be achieved by:

1. acquiring lands to deliver a reserve system that meets criteria of comprehensiveness, adequateness and representativeness (CAR); and
2. encouraging and facilitating off-reserve conservation and cross boundary management where it assists in the protection of the planning area and particularly where biogeography is under-represented.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

14. CLIMATE AND CLIMATE CHANGE

Climate

The Dryandra Woodland experiences a Mediterranean climate with warm to hot, dry summers and mild, wet winters (McArthur *et al.* 1977*).* Seasonal changes in temperature, rainfall and wind direction are marked and more extreme than coastal areas of the south-west.

While fire is normally cited as the main disturbance event leading to changes in vegetation structure, other events such as windstorms, drought and thunderstorms may all significantly affect the native flora and fauna of the wheatbelt. Examples in Dryandra Woodland where extreme weather events have impacted upon the biota include the loss of natural tree canopy and mallet plantation canopy as a result of windstorms, and more recently the collapse of some thickets following drought or extreme and prolonged heat.

Less obvious weather events such as declining rainfall over a long period may also affect the biota; for example, the ability of plant communities to survive and regenerate lead to a decline in the range of species and structure of vegetation over a 10 – 40 year period.

Observed and Projected Climate Change

Global climate change, or the greenhouse effect, is the result of changes to atmospheric concentrations of greenhouse gases. In the south-west of WA, changes in greenhouse gas concentrations, combined with natural variability, have contributed to an observed decline in rainfall (IOCI 2006), especially in early winter (May, June and July).

Future climate change projections for the south-west of WA are for continued warming (increased mean annual temperature) and reduced rainfall (IPCC 2007), with slightly less warming in coastal areas. The Indian Ocean Climate Initiative (IOCI 2006) projects a rise in temperature in all seasons in the south-west by 2030 as well as more declines in winter rainfall. Catchments can expect more reductions in runoff. There are also indications that weather events may be more extreme, with more frequent and prolonged droughts. Changes in ground moisture, temperature and vegetation may also lead to more vigorous fire behaviour in traditionally cooler months and therefore more restricted burning seasons, which is likely to have implications for fire management. It is likely that there will be more days of very high and extreme fire danger (Williams *et al*. 2001) and consequently more frequent bushfires.

Impacts of Climate Change

The potential impacts of climate change on biodiversity are uncertain and poorly understood, although the south-west of WA is considered to be at considerable risk of significant biodiversity loss (IPCC 2007). Potential direct impacts on biodiversity include changes in animal and plant physiology, changes in life cycle timing, and changes in species distribution and abundance. Indirect impacts may arise from changes in species competition and predation, or through alteration to the nature and intensity of existing biodiversity pressures (e.g. disease, salinisation, density and distribution of weeds, erosion, habitat fragmentation and loss of wetlands). The combination of direct and indirect impacts resulting from climate change could place considerable stress on ecological systems and result in:

- local species extinctions
- changes to ecosystem composition and processes
- changes in fire behaviour
- a contraction or fragmentation in the range of native species
- the dispersal or migration of species from their current locations to locations having more appropriate conditions.

Some plant and vertebrate species in the south-west require specific local climate conditions that may disappear entirely with as little as 0.5-1 degrees Celsius warming. Modelling by the CSIRO shows that with only 0.5 degrees Celsius warming, the habitats for all frog and many mammal species would be significantly reduced and 15 species of endangered or threatened WA mammals would disappear or be restricted to small areas.

Species most likely to be affected are those:

- with narrow temperature or cool temperature requirements
- with narrow geographic ranges that are closely associated with local environmental conditions
- dependent on relatively high rainfall
- which are unable to evolve in situ.

Responses to Climate Change

In Western Australia a climate change and adaptation strategy is being developed. The department has also begun work on modelling biodiversity response, to investigate the potential vulnerability of WA's plants and animals to climate change, and development of a climate-biodiversity strategy.

At the individual reserve level, implementing strategies that create and expand reserves, control introduced animals and weeds, manage fire, and re-introduce or translocate threatened native plants and animals, will help improve the resilience of species and ecosystems and hence decrease their vulnerability to climate change. A system of monitoring sites should also be established to ensure any changes to ecosystem composition and structure is quickly detected, enabling remedial strategies to be developed and implemented in a timely manner.

14. Climate and Climate Change

Key Points

- The south-west of Western Australia has been identified as a region that is especially vulnerable to climate change and a priority area for developing climate change strategies within Australia. Decreases in rainfall and river flows, as well as increased temperatures, are already apparent.
- Climate change will have significant impacts on vulnerable species and ecosystems, and adaptation strategies are required to improve understanding and increase the resilience of natural systems to these changes.
- Reserve creation, introduced pest and weed control, fire management and re-introduction programs could help improve the resilience of species and ecosystems within the planning area, and decrease their vulnerability to climate change.

The objective is to understand and consider the effects of climate change on the planning area.

This will be achieved by:

1. monitoring weather data for use in the management of Dryandra, particularly severe events, rainfall, wind speed and direction, frosts and times of high fire risk;
2. investigating the potential vulnerability of species and communities of the planning area to climate change (in particular species and communities of special conservation significance or likely to be highly vulnerable to climate change);
3. adapting climate change management approaches as necessary in response to new knowledge or changes in State-wide climate-biodiversity strategies;
4. protecting adequate and appropriate space within the reserve system to provide buffers, corridors and climate refugia (e.g. implementing proposed additions to the public conservation estate as indicated in Section 9 *Proposed and Existing Tenure*);
5. incorporating the potential for climate change impacts into recovery plans for threatened species and communities; and
6. limiting non-climate stresses for species and communities that are vulnerable to climate change.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

15. GEOLOGY, LANDFORMS AND SOILS

The Dryandra Woodland lies within the south-western Province of the Yilgarn Block, an ancient plateau composed mainly of granite, with intrusions of dolerite, and capped with laterite.

Past weathering of the plateau in the Dryandra area has produced a gently undulating countryside featuring distinct breakaway slopes, that can be partitioned into three broad landform units: Norrine (lateritic uplands),

Noombling (valley slopes) and Biberkine (valley floors) (McArthur *et al*. 1977). The vegetation communities of Dryandra are closely linked to these landform units (see Table 2).

15. Geology, Landforms and Soils

Key Points

- The soils of the Dryandra Woodland are generally not prone to erosion although gullying may occur on steeper slopes and where there is a change in the penetrability of the soil profile, e.g. duplex soils (Dames and Moore 1985).
- Granite outcrops and valley floors, and their associated plant communities, are sensitive to disturbance.
- As a result of past clearing of these relatively fertile valley floors for agriculture, the Biberkine landform unit is poorly represented in Dryandra.

The objective is to protect all soils, landforms and geological features, and the processes that sustain them.

This will be achieved by:

1. minimising access and management activities in areas prone to erosion and disturbance, for example, on breakaway slopes, soils subject to waterlogging, valley floors and granite outcrops;
2. considering for acquisition, by purchase or exchange when available, private property enclaves and Crown lands adjoining Dryandra that contain the Biberkine landform unity;
3. providing interpretive information on the relationship between the geology, landforms and soils, and the distribution of plant and animal communities; and
4. monitoring the effectiveness of erosion control techniques and incorporate new practices where appropriate.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

16. HYDROLOGY AND CATCHMENT PROTECTION

Hydrology

Catchments

Dryandra Woodland is within the upper reaches of the Murray River and Blackwood River catchments. Areas of the woodland to the north of Narrogin are located between the Williams and Hotham Rivers, which drain into the Murray River. Woodland areas to the south-west of Narrogin are located on the boundary between the Murray and Blackwood catchments. The north-western most blocks drain into the Williams River, whilst the remaining blocks in the Highbury area feed into the Arthur River, a tributary of the Blackwood.

Water Quality

There is a trend of increasing water salinity from west to east within the Murray and Blackwood rivers. This reflects an increasing concentration of salts within the soil profile with diminishing rainfall (McArthur *et al.* 1977). The surface water within Dryandra Woodland, although a blend of surface runoff and saline ground water, is considered fresh (J. Davis *pers comm.*).

Water Supplies

Several dams exist within Dryandra Woodland, including:

- Congelin Dam, which previously serviced steam trains;
- the Old Mill Dam, which was associated with a sawmill; and
- two dams within the village area, one of which supplies the domestic water. In addition, water tanks are located at the old Lol Gray and Contine homestead sites.

Hydrological Processes

The water cycle in the south-west forests and woodlands consists of a series of four interrelated processes: precipitation, evapotranspiration, soil water storage and movement, and streamflow. Changes in land use which alter these processes and, thus, change the water balance, have the potential to cause environmental problems.

Salinity

Western Australia has the largest area of dryland salinity in Australia and the highest risk of increased salinity in the next 50 years (Short and McConnell 2000). An estimated 4.3 million ha (16 per cent) of the south-west (mostly agricultural land) has a high potential of developing salinity, caused by shallow water tables. This is predicted to rise to 8.8 million ha (33 per cent) by 2050 (National Land and Water Resources Audit 2001). The potential for salinity to become a problem in the wheatbelt is increasing, due to extensive clearing in the region and subsequent rising groundwater levels. Rising saline groundwater threatens up to 30 per cent of the area. However, Dryandra itself is not at risk from salinity, and, being vegetated, will be beneficial to surrounding areas in lowering groundwater tables.

When the audit was done in 2000, the risk was predominantly in the eastern wheat belt in valley floors and adjacent areas. Eastern sections of the northern wheat belt also exhibited high risk. Salinity expansion by 2050 is mainly in the Great Southern and South Coast regions (National Land and Water Resources Audit 2001).

Salinisation can have significant affects on groundwater dependent ecosystems, TEC's, wetland habitats, frogs, aquatic invertebrates as well as vegetation and fish composition. Salinised lakes may also have an impact on waterbird breeding. The State Salinity Strategy (State Salinity Council 2000) recommends an integrated catchment-scale approach to biodiversity conservation across all land tenures, including seed collection, storage and databasing, protecting fauna from extinction through the retention and protection of remnant vegetation, protection of wetlands and initiating natural diversity and water resource recovery catchments. The strategy also highlighted the need to change land use practices.

Knowledge of the effect of salinity, acidity, nutrient and metal water content on species and communities of the planning area is limited or lacking and requires further study.

16. Hydrology and Catchment Protection

Key Points

- Land uses within the immediate catchments have the potential to influence the water quality and quantity in the tributaries and dams in the planning area and on surrounding farmland.
- The water stored in a number of small dams in Dryandra is used for recreation, fire control, and as habitat for aquatic flora and fauna.
- The supply of domestic quality water to the village needs to be maintained.
- Liquid wastes from the village and recreation sites have the potential to pollute streams and dams.
- Increasing soil salinity, as a result of rising groundwater, is a problem on agricultural lands surrounding Dryandra. Baseline data on the level and pressure of the groundwater in the woodland is required to detect potential salinity problems.

The objective is to protect the conservation, recreation and production values of Dryandra by managing water resources and the surrounding catchments.

This will be achieved by:

1. managing Dryandra's water resources on a catchment basis;
2. liaising with the Department of Agriculture and Food, Land Conservation District Committees and landowners to encourage land use practices that improve the water quality;
3. ensuring hydrological processes are considered during planning for all management activities, particularly timber production;
4. maintaining a potable water supply for the village by protecting the catchment area of the Settlement Dam;
5. maintaining Congelin Dam and the Old Mill Dam and their catchments for fire control purposes;
6. ensuring that liquid wastes from the village and recreation sites do not pollute streams and dams; and
7. liaising with relevant Departments and NRM groups to monitor potential soil salinity problems across the catchment.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

17. NATIVE PLANTS AND PLANT COMMUNITIES

Native Plants

Dryandra Woodland lies on the boundary between the Darling and the Avon botanical districts of the south-west Botanical Province (Beard 1980). This boundary approximates the replacement of jarrah (*Eucalyptus marginata*) by powderbark wandoo (*E. accedens*) and brown mallet (*E. astringens*) on lateritic residual soils, the retirement of marri (*E. calophylla*) from the mid slope, and the appearance of York gum (*E. loxophleba*) on the lower slopes (Beard 1980). As a result, Dryandra's flora is transitional between that of the moister jarrah forest and the semi-arid wheatbelt. The structure of the vegetation also changes, assuming a more open form typical of woodlands, where canopies are clearly separated (McDonald *et al*. 1984).

The central western wheatbelt (400-600 mm rainfall), although originally supporting woodlands similar to that found in Dryandra, is now largely cleared. The remaining areas of natural vegetation, particularly the larger remnants such as Dryandra Woodland and the Boyagin and Tutanning nature reserves (see Map 1), are thus of major conservation significance.

With just over 800 identified native plant species, Dryandra Woodland has a rich flora that includes species from both the moister jarrah forest and the semi-arid wheatbelt. In comparison, the nearby nature reserve of Tutanning contains about 700 recorded species (A. Hopkins *pers comm*.), and the south coast national parks of Fitzgerald River and Walpole-Nornalup contain about 1750 and 700 species respectively (CALM 1992a, CALM 1991a).

Rare and Priority Flora

All flora native to 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' (DRF). A permit from the Minister for Environment is required before such flora can be 'taken'. Currently there is one DRF species within Dryandra Woodland (see Table 1).

In addition to rare flora, the Department also refers to 'priority' species. This classification applies to both flora and fauna 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 listed as threatened (DRF) 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 weed control, disease control, fire management and site development.

Species are grouped from Priority 1 to Priority 5, each with their own definition according to the perceived urgency for further survey (see Appendix 3).

Eight priority species have been recorded in Dryandra (see Table 1).

Table 1. Rare and Priority Flora of Dryandra Woodland[4]

Botanical name	Location	Rank[5]
Darwinia carnea[6]	Dryandra	Rare
Acacia gemina	Dryandra	Priority 2
Andersonia carinata	Dryandra	Priority 2
Banksia subpinnatifida* var. *subpinnatifida*	Dryandra	Priority 2

[4] This data is from DEFL, the Department's Rare and Priority flora list, and only contains confirmed locations and species from Department and Herbarium data.
[5] For definition and explanation of rare and priority flora, see Appendix 3.
[6] Translocated population

Botanical name	Location	Rank[5]
Persoonia hakeiformis	Dryandra	Priority 2
Anigozanthos bicolor subsp. *exstans*	Dryandra	Priority 3
Stenanthemum coronatum	Dryandra	Priority 3
Leucopogon florulentus	Dryandra	Priority 3
Eucalyptus latens	Dryandra/Highbury	Priority 4

* Dryandra has undergone a name change to Banksia in early 2008

Fungi, Mosses and Liverworts

In addition to the diverse array of vascular plants, there are many species of fungi, mosses, liverworts and lichens. While only limited surveys of these groups have been conducted, to date more than 100 species of 'larger fungi' have been recorded in Dryandra. Many of the 'larger fungi' are hypogean (underground) species, an integral part of the woylie's (*Bettongia penicillata*) diet (Christensen 1980). Most species of hypogean fungi are also mycorrhizal, growing within or on the outside of plant roots. This symbiotic relationship assists nutrient uptake by plants.

Keystone Species

A keystone species is one which, if removed, would precipitate significant losses of other species (Gilbert 1980). Structurally dominant species that fruit, flower or seed outside the normal peaks in community production, or that produce high levels of a reliable resource, may be important in maintaining community cohesion. Possible keystone species of the woodland include the hypogean fungi.

Vegetation Communities

One of the features of Dryandra Woodland is the contrast in vegetation structure between tall, open woodlands of wandoo and powderbark wandoo, and low, dense heathlands. A survey by Coates (1993) identified 12 vegetation communities in Dryandra. These communities are closely linked to landform and soil, and can be rated for management purposes according to the incidence of priority plant species, and weed invasion and dieback disease hazard (Table 2).
The greatest floristic diversity can be found in the Lateritic Plateau Woodlands, *Dryandra/ Petrophile* Shrublands, Low Kwongan, Marri Woodlands and Lithic Complexes. These communities make up only a small proportion of the total area of Dryandra. At a community level, Wandoo and Powderbark Wandoo woodlands occupy nearly 50 per cent of the area of Dryandra, yet have only about 25 per cent of the recorded native flora species. The major families represented are Myrtaceae (76 species), Proteaceae (75), Papilionaceae (73), Asteraceae (72), Orchidaceae (65), Mimosaceae (37), Poaceae (32), Anthericaceae (29) and Cyperaceae (26).

Table 2. Vegetation Communities of Dryandra Woodland

Vegetation Community Types	Landform	Occurrence of vegetation communities	Incidence of priority plants	Weed invasion hazard	Fungal invasion hazard
1. Lateritic Plateau Woodlands	Norrine (lateritic uplands)	Common, but covers only small areas.	***	*	P*** (susceptible species) A*
2. *Dryandra*[#-] *Petrophile* Shrubland	Norrine (lateritic uplands)	Uncommon, and covers only small area.	**	*	P*** (susceptible species) A*
3. Low Kwongan	Noombling (upper valley)	Common, but covers only small areas.	**	*	P*** (susceptible species) A*
4. Brown Mallet Forest	Noombling (upper valley)	Common, but covers only small areas in natural bushland.		*	P* A* (susceptible species)
5. Powderbark Wandoo Woodland	Noombling (upper valley)	Common, covers extensive areas.	*	*	P* A*** (susceptible species)

Vegetation Community Types	Landform	Occurrence of vegetation communities	Incidence of priority plants	Weed invasion hazard	Fungal invasion hazard
6. Wandoo Woodland	Noombling (mid-lower valley)	Common, covers extensive areas.		*	P* A*** (susceptible species)
7. Wandoo-Sheoak Forest	Noombling (mid-lower valley)	Common, but covers only small areas.		*	P* A*** (susceptible species)
8. Marri Woodland	Noombling (mid-lower valley)	Uncommon, and covers only small area.		** (sandy soils)	P* A** (susceptible species)
9. Sheoak Low Forest	Noombling (valley slopes)	Common, but covers only small areas.	***	*	P* A* (moist site)
10. Lithic Complex (granite)	Noombling (valley slopes)	Common, but covers only small areas.	***	*** (moist site)	P** A** (moist site)
11. York Gum Woodland	Biberkine (valley floor)	Occasional, covers only small areas.		*** (moist site)	P* A*
12. Jam Low Forest	Biberkine (valley floor)	Occasional, covers only small areas.		*** (moist site)	P* A*

* Low ** Medium *** High

Note: The ratings were developed in consultation with A. Coates, G. Keighery and B. Shearer.

P = *Phytophthora* species A = *Armillaria luteobubalina*

[#] Dryandra has undergone a name change to Banksia in early 2008. The former name has been retained here to describe the vegetation complex.

Disturbance Cycles

Plant communities and populations may be severely disrupted by disturbances such as windstorms, flood, fire and drought. Depending on factors such as season, species and frequency of disturbance, plants may temporarily disappear or be reduced in numbers. Often these disturbance events act as 'reset mechanisms', returning a plant community to an earlier seral stage. Rock sheoak (*Allocasuarina huegeliana*) and brown mallet forests are both vegetation associations that can regenerate as single-aged stands following a disturbance event such as fire (see also Section 22 *Fire*). Rock sheoak also re-colonises areas following a long absence of fire.

In the absence of natural disturbance events, it may be necessary to use a range or combination of management tools, such as prescribed burning or manual removal of specific species, such as rock sheoak, to maintain the full range of physiological ages of some plant communities, e.g. kwongan, which can, without appropriate management over time, become locally extinct due to the invasion of other species (Brown and Hopkins 1983) (see Sections 19 *Environmental Weeds* and 22 *Fire*).

17. Native Plants and Plant Communities

Key Points

- There is one rare and 8 priority species occurring in Dryandra (see Table 1). Many of the priority species require further survey or taxonomic study to assess adequately their conservation status.
- The jam low forests, which include stands of sandalwood (*Santalum spicatum*), and York gum woodlands are poorly represented within Dryandra (see Table 2). Other vegetation associations of the Narrogin area, such as salmon gum woodlands, do not occur in Dryandra Woodland but as isolated stands on surrounding private property. Management strategies should aim at ensuring the continued persistence of the full range of plant communities within the vicinity of Dryandra.
- Vegetation types 10, 11, and 12, which are associated with moist, fertile soils, are highly susceptible to weed invasion (see Table 2).
- Although permanent vegetation approximating a natural composition and structure would be preferred, nature conservation objectives within the immediate surrounds of Dryandra could be further enhanced by linking the fragmented blocks of Dryandra with permanent or semi-permanent vegetation on private property that has a commercial use. Increasing the effective, available habitat at Dryandra

may be crucial to the long term viability of the area's conservation values.
- In the absence of natural disturbance events, it may be necessary to use a range or combination of management tools, such as prescribed burning or manual removal of specific species, to maintain the full range of physiological ages of some plant communities.
- The role of many ecological factors in Dryandra (such as keystone species, mycorrhizal fungi, pollinators and 'natural' episodic disturbance cycles) is poorly understood.

The objective is to identify, protect and conserve the diversity and distribution of specially protected and other native plants and plant communities.

This will be achieved by:
1. protecting Dryandra's plant communities from weeds and plant diseases by implementing strategies in Sections 19 *Environmental Weeds* and 21 *Diseases*;
2. protecting threatened and priority species, especially those susceptible to plant fungal diseases, weed invasion and frequent fire, and developing and implementing management strategies for their conservation;
3. ensuring that a record of the location of threatened and priority flora species is readily accessible at the Department's Great Southern District Office, and that these records are consulted before development or management actions are undertaken;
4. ensuring, through appropriate management, that a range of physiological ages of plant communities are represented in Dryandra;
5. ensuring the continued persistence of the full range of plant communities within Dryandra Woodland and the surrounding areas by:
   - liaising with neighbouring private property owners to protect areas of remnant vegetation, especially those types not well represented on Department-managed land;
   - providing advice to landowners on species suitable for planting in vegetation corridors;
   - giving management priority to existing areas of kwongan jam low forests (including stands of sandalwood) and York gum woodlands e.g. for weed control and plant re-establishment;
   - controlling invasive species such as rock sheoak, as necessary and with a range of management tools to conserve other vegetation types, such as kwongan; and
   - incorporating into Dryandra, nearby areas of Crown land assessed as having conservation value suitable for addition to the conservation estate.
6. undertaking research into management regimes required to manipulate or maintain vegetation communities;
7. researching the response to disturbance (such as plant disease, fire, weeds and erosion), reproductive biology, taxonomy and age to maturity of all threatened and priority flora;
8. recording and describing the frequency, intensity and impact of severe disturbances (natural and human) on plant communities, and, as far as practicable, describing recovery;
9. identifying keystone species and vegetation communities of critical conservation importance;
10. keeping abreast of new information on the flora and ecology of Dryandra and utilising such knowledge to modify management where appropriate, using specialist assistance; and
11. investigating landscape scale techniques to monitor vegetation health over time.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
17.1 Diversity, cover and condition of native vegetation communities.	17.1 No significant decrease in known level of diversity, cover and condition over the life of the plan.	Every 5 years
17.2 Cover and condition of threatened, priority or otherwise significant flora species.	17.2 Remain stable or increase in cover and condition over the life of the plan subject to natural variations.	Every 5 years

18. NATIVE ANIMALS AND HABITATS

Dryandra supports a rich assemblage of fauna, reflecting the transitional nature of the vegetation. Most wheatbelt species have distributions that also encompass either the arid inland or the wetter environments to the west and south-west. For example, of the mammal species, only the Western mouse (*Pseudomys occidentalis*)

and the now extinct broad-faced potoroo (*Potorous platyops*) were historically restricted to the wheatbelt (Sanders and Harold 1991).

Following extensive clearing of the bush for agriculture and the subsequent introduction of exotic animals, plants and disease, both the number of species and the area inhabited by them has been greatly reduced. Only a few isolated pockets of bushland now remain which are large and varied enough to continue to provide a habitat for the remaining species (Burbidge 1977). Of these, Dryandra Woodland is one of the larger and more diverse areas, retaining 26 of the 46 species of native mammals which remain in the wheatbelt. In addition to this, there are two species that have been reintroduced to the planning area as part of the 'Return to Dryandra' program; the bilby (*Macrotis lagotis*) and boodie (*Bettongia lesueur*).

The persistence of several threatened species of mammal and two species of birds means that Dryandra plays a number of important roles in conserving the fauna of the wheatbelt and the State. Firstly, the Dryandra populations provide some measure of security for each of these species. For example, the numbat (*Myrmecobius fasciatus*) population at Dryandra represents perhaps 30 per cent of the total number of the species and is one of the most genetically diverse populations (J. A. Friend *pers. comm.*). Secondly, fox baiting in Dryandra has allowed these populations to increase to the point where a proportion of the numbers can be translocated to other areas where populations have become extinct. Individuals from the Dryandra populations of both the woylie (*Bettongia penicillata*) and the numbat have formed the basis of re-introductions of populations in other areas. The natural dispersal of threatened species from Dryandra along vegetated corridors to nearby remnant bush has also occurred (J. A. Friend *pers comm*.).

An additional way in which Dryandra may contribute to the conservation of threatened fauna is by providing secure habitat for the re-introduction of fauna once found in the area but now thought to be locally extinct. The quenda, or southern brown bandicoot (*Isoodon obesulus*), which is currently in the viewing enclosure at Barna Mia, is an example of a threatened species that was once locally extinct in Dryandra. However, over the past several years, this species has been sighted in Dryandra without a formal re-introduction occurring. Several road kills have been collected there also. It is not yet known how this species arrived at Dryandra. However, it may have dispersed from other known populations or been informally re-introduced.

Threatened and Other Specially Protected Fauna

The Commonwealth's EPBC Act provides a listing of nationally threatened fauna species. Threatened fauna are also listed at international level in the *IUCN (World Conservation Union) Red List of Threatened Animals* (1994).

At a State level, the Department has the statutory responsibility under the Wildlife Conservation Act for fauna conservation, and all fauna native to WA is protected under this Act. The Act provides for the Minister for Environment to declare fauna species to be specially protected under one of four Schedules for the following reasons:

- they are rare or likely to become extinct (commonly referred to as 'threatened') (Schedule 1);
- they are presumed to be extinct but may be rediscovered (Schedule 2);
- they are subject to international agreements, such as JAMBA, CAMBA or ROKAMBA (Schedule 3) (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) (Schedule 4).

The Department also classifies species into one of five IUCN categories: extinct (EX), shown on Schedule 2; and extinct in the wild (EW), critically endangered (CR), endangered (EN) or vulnerable (VU), all listed on Schedule 1.

Management direction for specially protected and priority fauna (and flora and ecological communities) is provided through the Department's proposed Policy Statement 9 – *Conserving Threatened Species and Ecological Communities* (subject to final consultation).

Within the planning area there are 12 species of specially protected wildlife (Wildlife Conservation (Specially Protected Fauna) Notice 2008(2) (see Table 3 and Appendix 2).

Table 3. Threatened and Specially Protected Fauna

Status	Scientific Name	Common Name
Threatened	*Phascogale calura*	Red-tailed phascogale
	Myrinecobius fasciatus	Numbat
	Dasyurus geoffroii	Chuditch
	Bettongia penicillata	Woylie
	Bettongia lesueur	Boodie
	Macrotis lagotis	Bilby
	Perameles bougainville	Western barred bandicoot
	Leipoa ocellata	Malleefowl
	Falcunculus frontatus	Crested shrike-tit
	Calyptorhynchus funereus latirostris	Carnaby's black cockatoo
Specially Protected	*Falco peregrinus*	Peregrine falcon
	Morelia spilota imbricata	Carpet python

The Department prepares and implements recovery plans and wildlife management programs for threatened fauna according to priorities determined by the Department, in consultation with the Conservation Commission, and relevant consultative committees. There is an existing recovery plan for the woylie, and one for the numbat was being prepared at the time of writing this plan.

A rapid decline in woylie numbers has recently been observed, with the population size being reduced by about 75 per cent in the last five years to around 10,000 individuals. The cause for the decline is still unknown but is the subject of research by the Department (the Woylie Conservation Research Project). Woylies in Dryandra have been part of a large four-year study, the mesopredator project, which is running between 2006 and the end of 2009. The project includes four different biomes, of which Dryandra is one, and aims to increase the number of one or more subordinate predators (native or otherwise) via the removal or reduction in numbers of a more dominant predator (such as the fox).

As of January 2008, the woylie is again listed under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2008 and is ranked as Endangered using IUCN criteria. A referral will be made to the Federal Government to also re-list the woylie as threatened under the EPBC Act. Results of the latest research are inconclusive at this stage, but it is intended that there will be immediate management implications when results are known, as well as the development of a revised woylie recovery plan.

Capture rates from long-term monitoring and research has indicated that the woylie population at Dryandra declined by 93 per cent between 2000 and 2006 (DEC 2008).

The Department's Return to Dryandra project (RTD) was established in 1997 with the goal of reintroducing five Critical Weight Range[7] (CWR) threatened marsupials (see Table 4) extinct in the south-west of Western Australia to Dryandra Woodland (CALM 2003b). RTD is a sub project of the Department's Western Shield Program and complements the objectives of that program, directly supporting four of the five Western Shield objectives through:

- breeding animals in captivity specifically for translocation into the wild at sites protected from introduced predators;
- implementing the Barna Mia education and public relations program to increase awareness of the effects of fox and feral cat predation on native fauna and what can be done to mitigate such impacts;
- making the best use of new and existing research to enhance its recovery programs; and
- providing opportunities to develop and maintain partnerships with groups and organisations (such as Kanyana Wildlife Rehabilitation Centre).

The aims of RTD are to:

- re-establish self sustaining populations of at least five CWR threatened marsupial species (now extinct in the wheatbelt) in Dryandra Woodland;
- compare the success of different reintroduction methodologies for each species and to develop optimal release strategies;

[7] Australian mammals weighing 35-5500 grams that are prone to declines and extinction since European settlement (Burbidge & McKenzie 1989).

- provide stock for other reconstruction sites; and
- involve the community in order to increase public awareness and provide educational opportunities.

Table 4. Target Species for Return to Dryandra Program

Scientific Name	Preferred Common name	Alternative Common Name
Bettongia lesueur	Boodie	Burrowing bettong
Lagorchestes hirsutus	Wurrup	Rufous hare-wallaby
Lagostrophus fasciatus	Mernine	Banded hare-wallaby
Macrotis lagotis	Dalgyte	Bilby
Perameles bougainville	Marl	Western barred bandicoot

Vertebrates

The number of mammal species found in the Department's Wheatbelt Region has declined considerably since European settlement, with six species no longer found in this area and three species presumed extinct (Strahan 1983). This decline has been attributed primarily to land clearing. However, other factors such as changing fire regimes and the introduction of competitors, predators and diseases have caused significant losses.

Twenty eight species of native mammal are found in the woodland, including six that are threatened - the numbat, woylie, chuditch, bilby, boodie and red-tailed phascogale (see Table 3) - and one priority 5 species, the tammar wallaby (*Macropus eugenii*). The woodland also has populations of rarely seen species such as honey possums (*Tarsipes rostratus*), western pygmy possums (*Cercartetus concinnus*) and mardos (*Antechinus flavipes*).

Close to 100 species of birds have been recorded in Dryandra Woodland, including three species that are threatened and one that is gazetted as specially protected (see Table 3). The diversity of birds is probably a reflection of the wide range of habitats found in the woodland.

About 50 species of reptiles have been recorded at Dryandra. Of these, only one, the carpet python, is gazetted as specially protected (see Table 3), because although currently not threatened they are uncommon and, due to their high commercial value they may be poached, making the species vulnerable.

There are eight frog species that have been recorded in Dryandra Woodland, including the golden-flecked burrowing frog (*Heleioporus barycragus*) which is largely restricted to the western Darling Range (Burbidge 1977). Dams and drainage lines support the greatest number of frog species.

Further vertebrate surveys of Dryandra are likely to record additional species of reptiles and frogs.

Invertebrates

Little is known of the invertebrates of the woodland; studies have been restricted to termites (J. A. Friend *pers comm.*), litter and ground-surface arthropods (Majer 1985) and arboreal spider communities (L. Thomas *pers comm.*).

Termites are an important component of the fauna of Dryandra, performing a crucial role in nutrient cycling and maintaining soil structure. Termites comprise the entire diet of numbats, and one species, *Coptotermes acinaciformis raffrayi*, is the only species of termite that forms hollows in wandoo and powderbark wandoo and, as such, may be considered a keystone species.

Mallet Plantations

The use of mallet plantations by native vertebrate animals is influenced by the age of the plantation, the amount of regrowth other than mallet, and the inclusion of natural vegetation isolates or rocky outcrops (Ninox 1991). Older mallet stands with a relatively large number of natural regrowth eucalypts support a greater diversity than young, uniform stands.

Disturbance Cycles

Animal communities and populations are severely disrupted by disturbances such as fire, flood and drought. Depending on factors such as season, the species, and intensity of disturbance, animals may temporarily disappear or be reduced in numbers. Recovery is by re-invasion from nearby undisturbed areas and expansion of resident populations as the vegetation returns (CALM 1992b).

The diversity of animal communities and populations in Dryandra reflects not only the variation in climate, soils, topography and vegetation, but past natural and human disturbances.

Corridors

Dryandra Woodland comprises 17 vegetation 'islands' within a largely cleared landscape. However, in some cases, corridors of uncleared vegetation remain (e.g. road reserves), linking the woodland's remnants. In addition, some local landowners have revegetated areas to form corridors between remnants, through several different NRM funded projects. For many animals, movement between blocks is necessary on a daily, seasonal or intermittent basis, to enable them to find food, shelter, breeding sites or partners (Hussey *et al.* 1991). Additional benefits of vegetation corridors include:

- provision of habitat for flora and fauna;
- representation of the vegetation communities which were present prior to clearing;
- a prominent and accessible education resource;
- an improvement in landscape quality; and
- potential increased farm productivity through prevention of erosion, control of salinity, and provision of shade and shelter for stock.

There is no formal program in place to monitor the use of corridors by native animals at Dryandra.

18. Native Animals and Habitats

Key Points

- Six mammal, four bird and one reptile species are threatened or in need of special protection. Specific management strategies are required to maintain species' habitats and control predators.
- Dryandra Woodland is a source of species for translocation to other reserves and a possible location for future releases.
- Native fauna, especially numbats, woylies and malleefowl are of major interest to visitors (see Section 30 *Tourism and Commercial Operations*).
- The populations of some native mammal species have increased in Dryandra over recent years. This increase has primarily been due to the control of foxes.
- A rapid decline in woylie numbers has been observed over the past five years, which has resulted in the woylie being ranked as Endangered using IUCN criteria.
- Termites are an important component of the fauna of Dryandra, performing a crucial role in nutrient cycling and maintaining soil structure, and comprising the entire diet of numbats.
- Owing to their limited capacity to survive in saline water, all frogs in the wheatbelt are considered to be at risk from salinity (Sanders and Harold 1991).
- Little is known of the invertebrate fauna (including aquatic fauna) of Dryandra or of their role in nutrient cycling and other ecosystem processes of the woodland.
- The movement of fauna between isolated blocks of remnant vegetation in Dryandra is restricted by fenced and cleared farmland. Vegetated corridors linking these blocks will aid in the dispersal of fauna, as well as providing additional habitat and improving landscape quality. Existing corridors are not currently monitored.
- The use of mallet plantations by native vertebrate animals is influenced by the age of the plantation, the amount of regrowth other than mallet and the inclusion of natural vegetation isolates or rocky outcrops (Ninox 1991). Older mallet stands with a relatively large number of regrowth original eucalypts, such as wandoo and powderbark wandoo, support a greater diversity than young, uniform stands.

The objective is to protect native fauna and their habitats.

This will be achieved by:

1. protecting flora and fauna habitats from threatening processes such as the spread of weeds and disease, pest and problem animals, wildfire and human disturbance, giving priority to threatened species;
2. providing statutory protection for specially protected species by listing them under the Wildlife Conservation Act and/or EPBC Act, subject to satisfaction of the criteria for listing;
3. managing native animals and habitats according to Department Policies;
4. facilitating support for fauna conservation by encouraging and promoting the use of Dryandra for nature-based tourism purposes (see Section 28.2 *Nature Study and Appreciation*);

5. supporting Departmental programs to develop and implement recovery plans, for threatened species which occur or once occurred in Dryandra. The plans may include recommendations to re-introduce native animals that were once found in Dryandra and to use Dryandra as a source of native animals for re-introduction into other areas;
6. determining and implementing management required to maintain or enhance populations of fauna species thought to be at risk and not covered by a specific recovery plan, using the results of current research and monitoring, and where appropriate, specialist assistance;
7. seeking to establish and protect vegetation corridors between woodland remnants, in consultation with neighbours, Land Conservation District Committees and local authorities;
8. providing information to the public, particularly the farming community, on the values of vegetation corridors and remnant vegetation to both sustainable agriculture and native biota;
9. encouraging and undertaking general research on fauna ecology in Dryandra, with particular emphasis on threatened and specially protected species, and those species thought to be at risk (e.g. woylies and frogs);
10. encouraging and undertaking research on the abundance, diversity and ecology of invertebrate fauna and on the impact of present management activities upon invertebrate fauna; and
11. recording and describing the frequency, intensity, and impact of severe disturbances (natural and human) affecting animal communities, and, as far as practicable, describing recovery of populations following disturbance.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
18.1 Maintain viable populations of representative CWR fauna species.	18.1 No loss of known representative CWR fauna species over the life of the plan, subject to natural variations.	Every 5 years
18.2 Population numbers and range of specially protected fauna species or otherwise significant fauna.	18.2 Maintain or increase over the life of the plan, subject to natural variations.	Every 5 years
18.3 Successful reintroduction of threatened fauna species.	18.3 Reintroduced fauna species established and maintaining sustaining populations.	Every 5 years

19. ENVIRONMENTAL WEEDS

An 'environmental weed' is an unwanted species, either introduced or native, growing in natural ecosystems. Environmental weeds displace native plants, particularly on disturbed sites, by competing with them for light, nutrients, water and space. They also change nutrient conditions, hydrological patterns, soil erosion patterns, light distribution, geomorphological processes, biomass distribution and substantially reduce regeneration of native plants. Environmental weeds can also have a significant adverse impact on other natural 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* (EWS) (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:

1. *Invasiveness* - ability to invade bushland in good to excellent condition or ability to invade waterways.
2. *Distribution* - wide current or potential distribution including consideration of known history of wide spread elsewhere in the world.
3. *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 EWS will be supplemented and might eventually be replaced by a new system currently being developed for prioritising weed for each of the 26 bioregions in Western Australia. Weeds will be prioritised according to their

invasiveness, impacts, potential and current distribution, feasibility of control and value of the environmental asset to be protected.

Further guidance for weed management is provided by the Department's *Policy Statement No. 14 – Weeds on CALM Lands* (CALM 1986b) and proposed *Policy Statement – Environmental Weed Management* (subject to final consultation). Together these guide the approach and priority setting for the control of environmental weeds on Department-managed lands and waters. Priorities for action are basically 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, asset protection, monitoring or limited action. 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.

Weeds may cause major structural change to native plant communities, altering flammability, displacing threatened species and regenerating seedlings, dispossessing native animals of habitat or food, and changing ecosystem processes such as the cycling of water or nutrients.

Healthy native vegetation is normally able to resist invasion of weeds. However, evidence from Tutanning Nature Reserve indicates that, in the absence of fire, rock sheoak (*Allocasuarina huegeliana*) is known to invade kwongan vegetation types, causing a decline in the number of species present (see Section 17 *Native Plants and Plant Communities*).

Most weeds require certain conditions, including the opening up of the canopy, soil disturbance or influx of nutrients before they can spread.

The major source of introduced weeds at Dryandra is from adjacent lands. Major routes of spread are across private property boundaries, along linear disturbance features such as roads, tracks, and railway formations, and along creek lines. Weed dispersal can be increased by vectors including vehicles and machinery, soil movement, and by native and domestic animals.

Environmental Weeds within the Planning Area

Of the 800 plus plant species recorded within the woodland, 72 are introduced. Of these, cape tulips (*Homeria flaccida* and *H. collina*) are declared category P3 weeds under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Category P3 plants are those where the numbers of plants or distribution, or both, should be reduced. Soursob (*Oxalis pes-caprae*) is declared P4, that is, those plants that should be prevented from spreading beyond their present distribution.

Table 5. Environmental Weeds in Dryandra Woodland*

Botanical Name	Common Name	Location	Rating
Asparagus asparagoides	Bridal creeper	Dryandra	High
Brassica tournefortii	Mediterranean turnip	Dryandra	High
Freesia alba x leichtlini[8]	Freesia	Dryandra	High
Romulea rosea	Guildford grass	Dryandra	High
Allocasuarina huegeliana	Rock sheoak	Dryandra, Highbury	High (selected sites only)
Anagallis arvensis		Dryandra	Moderate
Arctotheca calendula	Cape weed	Dryandra	Moderate
Briza maxima	Blowfly grass	Dryandra, Highbury	Moderate
Briza minor	Shivery grass	Dryandra, Highbury	Moderate
Centaurea melitensis	Maltese cockspur	Dryandra	Moderate
Cirsium vulgare	Slender thistle	Dryandra	Moderate
Crassula natans		Dryandra	Moderate

[8] At the time of writing, this species had been removed from Dryandra.

Botanical Name	Common Name	Location	Rating
Cyperus tenellus		Dryandra	Moderate
Galium murale	Small goosegrass	Dryandra	Moderate
Homeria flaccida	Cape tulip	Dryandra	Moderate
Homeria collina		Dryandra	Moderate
Hypochaeris glabra	Smooth cat's ear flat weed	Dryandra	Moderate
Juncus acutus	Spiny rush	Dryandra	Moderate
Juncus bufonius	Toad rush	Dryandra	Moderate
Orobanche minor	Lesser broomerape	Dryandra	Moderate
Parentucellia latifolia	Common bartsia	Dryandra	Moderate
Pinus pinaster	Pinaster pine	Dryandra	Moderate
Pseudognaphalium luteoalbum	Jersey cudweed	Dryandra	Moderate
Solanum nigrum[9]		Dryandra	Moderate
Sonchus asper subsp. asper		Dryandra	Moderate
Sonchus oleaceus	Common sowthistle	Dryandra	Moderate
Trifolium arvense		Dryandra	Moderate
Trifolium subterraneum	Subterranean clover	Dryandra	Moderate
Ursinia anthemoides	Ursinia	Dryandra	Moderate
Vellereophyton dealbatum	White cudweed	Dryandra	Moderate

*Rated as 'High' or 'Moderate'

Some areas, such as creeklines and granite outcrops, are highly susceptible to weed spread due to the high water and nutrient status of these sites. Weed propagules can also be carried down streamlines by water. Most of Dryandra is uplands; consequently weed spread by this route is slow. However, upstream spread of cape tulip, Guildford grass (*Romulea rosea*), cape weed (*Arctotheca calendula*), clovers (*Trifolium* species) and soursob is occurring on some of the creek lines.

Grasses such as veldt grass (*Ehrharta* species), wild oats (*Avena* species) and African love grass (*Eragrostis curvula*) can increase the fire hazard and out compete native vegetation for water and nutrients.

Other weeds such as bridal creeper *(Myrsiphyllum asparagoides*), watsonia *(Watsonia* species), freesias (*Freesia leichtlinii*) and perennial grasses are not yet a problem in Dryandra. However, they do pose a threat to native vegetation because of their ability to invade and then dominate native plant communities.

The impact of some widespread weeds, such as shivery grass (*Briza minor*) and Guildford grass is unknown.

There are also many planted species along tracks and firebreaks, including *Pinus pinaster* and many non-local native species, some of which may have potential to cause woody weed problems. The occurrence of these and other woody weed species such as *Acacia pycnantha, A. baileyana* and tagasaste (*Chamaecytisus palmensis*), which are associated with historic settlement and the old school sites, need to be monitored.

19. Environmental Weeds

Key Points

- Major weed threats in Dryandra are cape tulip and soursob.
- The high boundary to area ratio of Dryandra, and the large number of internal tracks, increase the potential for the introduction and spread of weeds.
- The potential for weed introduction and spread needs to be considered in all management strategies, especially those involving disturbance such as timber harvesting, fire suppression, and track and firebreak maintenance.
- Active recreation, such as scenic driving, horse-riding, cycling and bush walking are possible methods of weed spread.
- Populations of threatened and priority flora need to be protected from weed invasion.
- Vegetation types 10 (granite outcrops), 11 (York gum woodland) and 12 (Jam low forest), which are associated with moist, fertile soils, are highly susceptible to weed invasion (see Table 2).
- *Pinus* species and other exotic trees and shrubs have the potential to become future weed problems.
- Given the high diversity of kwongan heath and the potential risk of loss of this species, the invasion of rock sheoak into kwongan heath requires monitoring and on-ground action.

[9] At the time of writing, this species had been removed from Dryandra.

The objective is to minimise the impacts of environmental weeds on key values.

This will be achieved by:

1. continuing to monitor the location, extent, spread and, where possible, ecological effects of weeds in Dryandra, using the results to modify management practices or instigate control measures as appropriate;
2. conducting control programs in areas of greatest conservation value, for example, monitoring known priority flora populations for weed invasion and undertaking control measures as necessary;
3. identifying areas of high value kwongan heath and giving consideration to the removal of invading rock sheoak trees;
4. identifying and giving priority to control of major weed threats such as cape tulip and soursob;
5. eradicating, where practical, isolated outbreaks of weeds while the infestations are small and easily controlled;
6. removing exotic and non-local trees and shrubs where considered necessary, and, where records exist about the establishment of exotic plantings, measuring and documenting growth details;
7. liaising with government authorities and adjacent landowners to promote the control of environmental weeds on lands adjoining Dryandra;
8. considering the potential for weed introduction and spread when planning management operations, e.g. road maintenance, particularly where adjacent to weed sources, and modifying strategies as necessary;
9. monitoring the occurrence of woody weeds at the historic settlement and old school sites;
10. keeping abreast of new information in weed research and new methods of control and utilising such knowledge to modify control programs, where appropriate, using specialist assistance;
11. monitoring and reporting on the effectiveness and potential ecological side-effects of control programs; and
12. involving volunteer groups in weed control where appropriate (see Section 38 *Community Involvement and Volunteers*).

Key Performance Indicator (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
19.1 Changes in the abundance and distribution of environmental weeds rated as high or moderate in the EWS or similar system.	19.1 No increase in the abundance or distribution of high and moderate priority weeds.	Every 5 years

20. INTRODUCED AND OTHER PROBLEM ANIMALS

Problem animals may be either introduced feral species that have become established as wild or naturalised populations, or native species, which for some reason, have altered their natural distribution and population to the detriment of other native species and habitats. Problem animals have the 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 (King 1985).

A primary objective of the Department is to achieve the systematic and safe control of pest animals on the lands and waters it manages. The Department's proposed Policy Statement – *Management of Introduced and Other Problem Animals on CALM Managed Lands* (subject to final consultation) provides guidance for this by identifying State-wide priorities and strategic approaches to management.

The Department also has responsibilities for control of declared animals on the lands it manages under the BAM Act, viz "A Government Department shall control declared plants and declared animals on or in relation to public land under its control".

Non-indigenous animals such as foxes, rabbits, feral[10] cats and pigs, and domestic pets are pests in the natural environment and have a detrimental effect on native biota. They predate on native fauna, compete with them for

[10] The term 'feral' is generally accepted as referring to domesticated or captive animals gone wild. Feral animal biology and control is a rapidly growing field of research, and new methods of biological control of feral animals are being developed. Recently, public awareness of the impact of feral animals has increased, resulting in actions such as the involvement of local groups in fox control.

food and shelter, and cause damage to native plants and habitats by grazing, trampling and digging. Introduced animals present in Dryandra are listed in Table 6.

Under the BAM Act, foxes and pigs are declared as 'animals subject to control and restricted introductions and keeping', whilst the rabbit is categorised as a 'prohibited animal'.

Table 6. Introduced Animals Recorded in the Planning Area

Common Name	Species
Mammals	
Red fox*	*Vulpes vulpes*
Cat	*Felis catus*
Rabbit	*Oryctolagus cuniculus*
Pig	*Sus scrofa*
House mouse	*Mus musculus*
Black rat	*Rattus rattus*
Goat	*Capra hirsutus*
Birds	
Laughing turtle-dove	*Streptopelia senegalensis*
Laughing kookaburra	*Dacelo novaeguineae*
Fish	
Redfin	*Perca fluviatillus*
Crustaceans	
Yabby	*Cherax albidus*

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

The fox is a major predator of fauna, and has been implicated in the decline of many threatened animals (Kinnear *et al.* 1988, Friend 1990a). Dryandra was one of the areas where current fox control methods were developed and researched, and research continues on optimising methods of fox control. In most, if not all, of Dryandra, foxes are controlled by monthly hand baiting operations using 1080-impregnated meat baits. This initially resulted in population increases of numbats, woylies and tammar wallabies (Friend 1990b, Kinnear 1992). However, more recently, since 2001, there has been a purported decline of woylie numbers, not just at Dryandra but throughout the south-west (see Section 18 *Native Animals and Habitats*).

Cats are also present in Dryandra and could have a similar impact to that of foxes. They appear not to be controlled by the current method of 1080 baiting.
Rabbits can cause erosion, weed invasion, loss of native plant species by overgrazing, and compete with native fauna for food and shelter. Rabbits, which are present throughout Dryandra, are currently controlled by intermittent baiting with 1080 when it is considered necessary.

There have been reports of feral pigs in Dryandra, and they are currently monitored by the District in the Highbury block (Conservation Commission 2007). There are also reports of extensive pig activity west of Wandering townsite, with all indications that the level of activity is on the increase.

Rooting in soil by pigs has the potential to spread plant diseases, and physically damage the habitats of native fauna. Pigs can also predate on lambs and damage agricultural crops. Guidance for management is provided by the draft *Feral Pig Management Strategy* (Freegard 2005), which outlines the approach and priority setting for control of feral pigs according to the protection of specific values. In addition, a threat abatement plan has been developed at a national level following the listing of feral pigs as a threatening process under the EPBC Act.

Feral goats also occur at Dryandra, although in relatively small numbers.

Feral honeybees are also present in Dryandra. Feral populations originate from poorly maintained commercial hives. Favourable conditions in the hive can lead to a rapid increase in bee numbers, causing the queen bee and many of her workers to leave the hive and establish a feral colony. There has been considerable debate over the possible effects of honeybees on native flora and fauna (see also Section 35 *Beekeeping*). In summary, the effects attributed include:

- interference with recreation sites;
- competition for nectar and pollen resources with native pollinators;
- inefficient pollination of native plants; and
- displacement of native birds and mammals from nesting hollows by feral colonies.

There is an issue with the number of western grey kangaroos (*Macropus fuliginosus*) at Dryandra. This is currently managed in line with the Department's Good Neighbour Policy (see Section 38 *Community Involvement and Volunteers*), and issuing of damage licences to neighbouring land-holders. If the problem becomes worse than a range of control methods may be considered by the Department, such as translocation of animals, culling and/or improved fencing.

House mice are common in Dryandra and throughout all of Western Australia, sometimes reaching plague numbers. Their impact on native flora and fauna is unknown.

The impact of other introduced animals in Dryandra is not well documented.

20. Introduced and Other Problem Animals

Key Points

- The impact on the native biota by some introduced animals (such as cats, house mice, black rats and feral honeybees) is not well documented and economic, effective control methods are not yet available.
- Current fox control methods involve using vehicles which increases the risk of spreading weeds and dieback.
- Domestic animals are not permitted in Dryandra because of their impacts on native fauna and because of the likelihood that they may consume the 1080 baits laid as part of the fox eradication program. Accidental poisoning of farm working dogs from 1080 baits can occur along boundaries between Dryandra and neighbouring properties.

The objective is to minimise the impacts of introduced and other problem animals on key values.

This will be achieved by:

1. recording the incidence of feral animals, and monitoring their location, extent, spread and ecological effects, and instigating control measures, with pigs, foxes and cats receiving high priority;
2. liaising with the Agriculture Protection Board, adjacent landowners and local authorities regarding pest control in Dryandra and on surrounding lands, and integrating control programs wherever possible;
3. continuing the current fox baiting program, modifying methods in light of new information or with specialist advice;
4. continuing to implement strategies that minimise the risk of accidental poisoning of working dogs, including liaison with adjacent landowners and providing information to the public on the risk of poisoning working dogs;
5. continuing to follow a policy of prohibiting domestic animals from Dryandra, except for guide dogs accompanying blind persons and horses on permitted routes, and providing information as to why domestic animals are not allowed in Dryandra, and the location of alternative bushland areas where they are permitted (e.g. Foxes Lair within the Narrogin townsite);
6. ensuring adequate hygiene methods to prevent spread of weeds or plant diseases when using vehicles for fox baiting;
7. continuing to control rabbits where necessary and modifying control methods in light of new information or with specialist advice;
8. liaising with the apiculture industry to minimise the likelihood of swarming events;
9. eradicating feral honeybee colonies that interfere with recreation sites;
10. participating in research on introduced animals and their control;
11. keeping abreast of new information in introduced animal research and new methods of control, and utilising such knowledge to modify control programs where appropriate, using specialist assistance; and
12. monitoring and reporting on the effectiveness and potential ecological side-effects of control programs.

Key Performance Indicator (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
20.1 Diversity of native fauna species and habitat.	20.1 No loss of known species or habitat diversity over the life of the plan.	Every 5 years

21. DISEASES

Plant Diseases

Plant diseases, caused by *Phytophthora* species and *Armillaria luteobubalina,* are of particular concern in Dryandra. Other fungal diseases such as wind-borne canker, of which there are many species, are also present.

Disease caused by *Phytophthora*

Fungi belonging to the genus *Phytophthora* are exotic to the Western Australian environment. Several species affect the native flora of Western Australia - *P. cinnamomi, P. citricola, P. cryptogea, P. megasperma* var *sojae, P. megasperma* var *megasperma, P. nicotianae* var *parasitica* and *P. drechsleri.* Of these, a *P. cinnamomi* infection occurs within ten kilometres of Dryandra and a *P. citricola* infection has been recorded within the woodland.

Management guidelines for *P. cinnamomi* are described in the Department's Manual: *Phytophthora cinnamomi and disease caused by it* (2000) and *Policy Statement 3 – Management of Phytophthora and disease caused by it*. The management of *Phytophthora* in Dryandra is also guided by *Proposals for the Management of Phytophthora Root Rot in the Great Southern District* (Blankendaal 2007). Dieback caused by *P. cinnamomi* is a key threatening process under the EPBC Act and a threat abatement plan has been prepared (Environment Australia 2001).

Although the climate at Dryandra is not generally conducive to the spread of *Phytophthora* species, under particular conditions (e.g. after significant summer rain) or within a micro-habitat (e.g. around granite outcrops) the disease may survive. Once released the spores survive well in moist or wet soil and any movement of the soil can spread the disease.

The spores of the fungus may infect a wide range of plants. However, it only flourishes in susceptible plant tissue. Dryandra Woodland vegetation types 1, 2 and 3 have a high proportion of susceptible species, while vegetation type 10 is associated with moisture gaining sites, increasing the disease hazard (see Table 2).

Other Diseases

Honey-Fungus (Armillaria luteobubalina)

This fungus has spores borne on the gills of a fruiting body, similar to the common mushroom. The fruiting body is 12-15 cm across and golden yellow, generally growing in clumps near tree bases in the wetter months of the year (June-July). A white mycelial mat is formed under the bark at the base of the affected tree. *Armillaria* feeds on new wood and bark, eventually girdling and killing its host. It has a large host range and is widespread throughout the world. Wandoo is particularly susceptible to *A. luteobubalina* (B. Shearer *pers comm*.).

Unlike dieback disease fungi, *A. luteobubalina* is naturally occurring in the south-west of Western Australia. The fungus spreads by growing along infected roots and then out on to uninfected roots. In an undisturbed environment this is a slow process. Air-borne spores landing on damaged bark may also establish infections, but this is not considered to happen frequently.

To date, *A. luteobubalina* has been recorded at two locations within Dryandra, with vegetation types 5, 6 and 7 (susceptible species), and type 10 (moisture gaining sites) appearing to be the most susceptible (see Table 2). Although the area of infection is relatively small, the environmental impact of the disease is high. At present, there is no simple method for controlling *Armillaria,* with prevention through appropriate hygiene practices the best treatment.

Canker Fungus Disease

This disease is caused by canker fungi, which are thought to be exotic to Western Australia. There are at least six different species, all of which have aerially dispersed spores. These spores spread by wind and rain splash settling on the stems of plants. Over time the spores grow into the stems, forming a canker or lesion, which moves down the stem gradually killing the plant from the top down. This is in contrast to *Phytophthora* and *Armillaria* where the fungi infect plant roots and gradually starve the plant.

The range of plants affected appears to be wide, with many *Banksia* and *Eucalyptus* species (including wandoo) having been found to be infected. The geographical range of these fungi currently extends from Eneabba to Hopetoun, encompassing Dryandra Woodland, where the canker *Botryosphaeria ribis* is present (B. Shearer *pers comm*.).

Animal Diseases

Diseases in native animals can be a major contributing factor to poor population health, reduced fertility and local extinctions. Under the *Animal Welfare Act 2002* (Animal Welfare Act), proposals by the Department involving the care and use of animals for scientific purposes must be referred to the Animal Ethics Committee for approval. The Department's Administrative Instruction No. 67 refers to requirements under the Animal Welfare Act and the Animal Ethics Committee. The Department's Administrative Instruction No. 67 *Minimising Disease Risk in Wildlife Management Standard Operating Procedures* gives general guidelines and standard operating procedures for reducing the risk of disease transmission in field practice (CALM 2005a).

Mammals

An ocular disease or conjunctivitis in the Western barred bandicoot was first noted in captive bred animals in October 2000 (CALM 2002). These animals displayed various symptoms including corneal opacity, conjunctivitis, ocular discharge, swollen eyelids and ruptured eyeballs (CALM 2002). These symptoms, were recorded from both captive animals at Dryandra and wild individuals on Bernier and Dorre Islands, and were associated with the identification of a novel chlamydials. Chlamydiasis found in koalas, can lead to blindness and infertility. An experimental treatment was implemented and, although requiring daily treatment, was very successful with all affected eyes returning to normal. 'Chlamydia', an intracellular bacterial organism, (2 separate genuses, with up to 9 different species identified to date) can infect multiple species of native mammals and humans (CALM 2002).

A wart-like growth disease has also been identified in Western barred bandicoots and is currently without effective treatment. This cutaneous papillomatosis and carcinomatosis is clinically expressed as wart-like lesions on feet, around eyes, pouch, cloaca and ears particularly, but can occur anywhere on the body (CALM 2002). The wart-like lesions proliferate and the animals become increasingly debilitated and in many cases, older lesions develop into squamous cell carcinomas, resulting in death or euthanasia of animals. The causative organism has been identified as a virus with characteristics of a papilloma/polyoma type, which may prove to be a new virus with combined features of both groups. No treatment is currently available (CALM 2002).

Recent studies on the wild western barred bandicoot populations on Bernier and Dorre Islands have identified ticks from this species carrying the bacteria *Coxiella burnetii* which causes the disease Q fever in humans. Q fever causes a febrile disease and pneumonia in humans and has been associated with abortion in species such as cats, cattle, sheep and goats which are all common domestic reservoirs. It is known that bandicoots and other wildlife species can also act as a reservoir for this organism, but not what, if any disease it causes in these species. This organism can be transmitted by inhalation of infected aerosols and via tick bites. It has the potential to pose a health risk to all mammal species on the islands (probably low risk) and has significance as a potential zoonosis for visitors and researchers. It is possible that the presence of this pathogen is a legacy of the past presence of stock and humans on the islands.

The discovery of symptoms of these two clinical diseases in both wild and captive populations of the western barred bandicoot (as well as the multi-species pathogen present in this species' ectoparasites on the islands) has caused concern in relation to the proposed translocation of this and other mammal species, and the well-being of the two surviving natural island populations of this species. The possibility that pathogens may be transported with animals and trapping equipment or transferred direct to other species, needs to be addressed in planning captive breeding, fauna trapping and translocations programs, and in future research.

There is a requirement for establishing appropriate hygiene and quarantine protocols for working with mammals that are part of a research, breeding and translocation program. Different levels of protocols are required according to the level of concern for a particular species. Translocations are covered by stringent guidelines that address hygiene requirements. Routine trapping for research and monitoring involves lower levels of risk and guidelines should be designed appropriately. However, small isolated and island populations of threatened fauna are at particular risk due to a lack of exposure to common pathogens and potentially reduced genetic diversity and immune function, and thus require stringent quarantine protocols to be maintained. Staff and carers handling wildlife can also be at risk of being exposed to animal diseases.

Recent observations and initial research indicate a decline in woylie populations in the south-west (Dr A. Wayne *pers. comm.* 2007). At this stage the cause for the decline is unclear although it may be related to a disease. Ongoing research is aimed at uncovering the cause and identifying future management strategies. This decline has resulted in the woylie being re-listed as a specially protected species.

21. Diseases

Key Points

- Dryandra is within the known distribution of dieback, a plant disease caused by fungi of the *Phytophthora* genus. An infection of both *P.cinnamomi* and *P. citricola* are recorded within the woodland.
- Vegetation types 1, 2 and 3 have a high proportion of susceptible species, while type 10 is associated with moisture gaining sites, increasing the disease hazard (see Table 2).
- *Armillaria luteobubalina* has been recorded at two locations within Dryandra, with vegetation types 5, 6 and 7 (susceptible species), and type 10 (moisture gaining sites) appearing to be the most susceptible (see Table 2). While it is difficult to control the spread of this naturally occurring fungus, monitoring plays an important role in the management of infected sites.
- *Phytophthora, Armillaria* and canker disease fungi infections have the potential to impact on Dryandra, not only in terms of the loss of plant diversity and abundance, but also through the loss of food sources and habitats of fauna.
- Dieback disease hygiene practices need to be carried out for all activities involving the movement of soil, particularly the maintenance of tracks.

The objective is to prevent the introduction and minimise the spread of plant and animal diseases in the planning area

This will be achieved by:

1. continuing to follow the department's *Proposals for the Management of Phytophthora Root Rot in the Great Southern District* (Blankendaal 2007), in all operations, as well as the hygiene practices given in the Department's policies and Dieback Hygiene Manual, and developing new procedures as necessary;
2. continuing disease surveys of Dryandra to identify and then isolate diseased areas, and redeveloping or closing any access tracks (vehicular, horse or pedestrian) that pass through inundated, infected or high risk areas;
3. considering provision of footbaths (containing fungicide) at the entrances to walk tracks that traverse dieback disease susceptible plant communities;
4. considering temporary closure of tracks when the risk of disease spread is high, for example, after significant summer rainfall;
5. informing and educating woodland users about plant diseases and the need to stay on well-formed roads or tracks, and including dieback hygiene information in each of the huts in the village;
6. ensuring staff associated with Dryandra are trained in plant disease recognition, sampling and management techniques;
7. monitoring known fungal disease infections and developing a comprehensive description of each, including information on species affected, vegetation association, infection area, rate of spread, soil profile, topography and threat to ground and surface waters, and using this information to update predicted hazard ratings for vegetation associations in the planning area; and
8. investigating possible disease control and eradication procedures, while ensuring that they do not place other areas or values at risk.

Key Performance Indicator (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
21.1 Changes in the occurrence of plant diseases within the planning area.	21.1 No new human assisted occurrence or spread of plant diseases over the life of the plan.	Every 5 years

22. FIRE

Fire is both an ancient ecosystem process essential to the conservation of biodiversity and a phenomenon capable of threatening biodiversity, life and community assets. As a result, the management of fire is integral to the Department's activities and a core management responsibility. The challenge for managers is to devise practical and feasible fire regimes that conserve biodiversity at appropriate spatial scales, and minimise the adverse impact of wildfires on key values.

The Department's management of fire, including the use of fire, fire suppression and wildfire prevention, is regulated by legislation (e.g. Bush Fires Act, CALM Act and precedents established under Common Law). It is also guided by the Department's Good Neighbour Policy (DEC 2007a) and Policy Statement No. 19 - *Fire Management* (CALM 2005b), which includes a number of scientific principles (Burrows and Friend 1998, Fire Ecology Working Group 1999).

This management plan presents an adaptive fire management approach where management policies and practices are continually improved by learning from the outcomes of operational programs, scientific research (e.g. on fire ecology) and monitoring. This acknowledges a level of uncertainty about what policy and practices are best, but consistent with adaptive management, this plan utilises best available knowledge to implement programs aimed at meeting specific management objectives. Monitoring, regular review, analysis of management outcomes and ongoing research are critical if fire management in the region is to continuously improve.

The management of fire in Dryandra will need to be flexible to achieve the multiple objectives of management. During the term of this plan there will be an on-going requirement for the protection of life, property and the commercial brown mallet plantations, and an increasing emphasis upon the maintenance of habitat and species diversity.

Fire History

There is not a complete understanding of the fire regimes of the wheatbelt area prior to European settlement. However, in other south-west areas, especially the coastal plain, it is well known that Aboriginal people used fire to modify their environment and increase the availability of food resources. This activity has commonly been termed fire stick farming. The object of fire stick farming in wooded areas was probably to favour or attract game, and to improve access to food sources such as rivers and swamps (Hallam 1985). The present vegetation types have evolved under a fire regime that was influenced by Aboriginal burning and occasional lightning fires.

Since records have been kept, there have been very few wildfires which have started in Dryandra. Of the nine wildfires started in Dryandra between 1938 and 1985, the largest burnt 260ha of the woodland and the average area burnt was 40ha. Clearing for farmland has led to further fragmentation and a reduction in the area of native vegetation over this period (see Map 2). To date, no wildfire has burnt out of Dryandra into private property.

Over this same period, there were about 69 wildfires in surrounding farmland within a 20 kilometres radius of Dryandra's fire tower. The period 1946-1970 was the worst in terms of numbers of wildfires and total area burnt by wildfire. This was due to the clearing of vegetation and associated burning which took place after the Second World War. There have been considerably fewer wildfires since the 1970s following the reduction in land clearing.

These records suggest that Dryandra is under greater threat from wildfires burning into the woodland than vice versa, and that the fire risk is lower than for the forests in higher rainfall areas of the south-west. This is despite Dryandra experiencing more severe fire weather conditions than the main jarrah forest belt. The primary reasons for the absence of large and devastating wildfires by comparison with the main forest belt to the west are:

- the lower levels and discontinuous distribution of fuels and their composition and structure;
- lower spotting distances due to the lack of fibrous-barked trees;
- the fragmented nature of Dryandra; and
- the efficient local fire detection and suppression system, which is supported by local land-holders.

Fire Ecology

Fire ecology is the study of the interaction of fire, the biota (plant and animals species), and the habitats in which they live. Knowledge of the impacts of this interaction is integral in protecting biodiversity, but also life and community assets. While numerous studies report on the changing species assemblages, species diversity,

vegetation composition and structure, and habitat characteristics in response to time since last fire, fire season, fire interval, and fire intensity, and on the ways in which fire can influence ecosystem processes, not enough is known about local fire ecology. Therefore, fire management will continue to evolve with this accumulated knowledge and management experience (Burrows 2004).

Burrows *et al.* (1987) considered the natural fire frequency at Dryandra to be relatively infrequent based on the following factors:

- the rate of litter accumulation is variable, depending on canopy density, but is generally slow. For most of Dryandra, litter fuel accumulation rates in the order of 0.5 tonnes per year over the first ten years are typical. Rates slow even further as the canopy ages;
- the high proportion of fire sensitive species, i.e.. those species that are killed outright by full foliage scorch;
- lack of epicormic crown recovery following fire; and
- the slow post-fire response of rootstock species.

Based on these factors, Burrows *et al.* (1987) considered that infrequent fires in the order of every 20-60 years may be important in maintaining a diversity of successional stages, but that fires less than about 15 years apart could lead to a change in community floristics and structure, e.g. fire sensitive species with a long juvenile period could be eliminated.

While many fire management issues at Dryandra are similar to that elsewhere, complicating features are:

- the difficulty of predicting fire effects when regeneration is relatively slow;
- the presence of many plant species 'vulnerable' to fire[11] ; and
- the highly fragmented nature of the woodland.

Fire Management within the Planning Area

Since 1938, most of Dryandra has been subjected only to prescribed edge burning of major roads and tracks. Edge burning involves the use of wind driven fires planned to burn a short distance from the road before self-extinguishing. Historically, very little broad-acre burning for fuel reduction purposes was done, but it is likely that some of the edging (especially in autumn) ran some distance into the blocks. Between 1979 and 1985 there was some prescribed broad-acre burning, with variable results. Since 1985 a system of 50-100m internal buffers, based upon existing roads, has been the cornerstone of wildfire protection, although two larger research block burns have been conducted to investigate the effects of fire on numbats (J. A. Friend *pers comm.*). The buffers are burnt in autumn when fuel levels reach 7-8 tonnes per hectare. Alternative sides of the road are burnt to reduce the frequency of burning of any particular strip to minimise any possible effects on fire sensitive species. Maps 3a and 3b show the location of proposed fuel reduction buffers. Fuel reduction burning on the boundaries is not generally undertaken as this may result in an increase in the invasion of weeds into the woodland.

The main objectives of fire management within the planning area are to:

- maintain and promote/enhance biodiversity;
- reduce the threat that wildfire presents to life and community assets; and
- communicate with neighbours, the community and other stakeholders with regards to fire management.

In addition to the buffer burns it is proposed to use prescribed fire:

- to protect life and property values at Dryandra Village and other recreation sites;
- for fuel reduction around, and revegetation purposes within, the mallet plantations; and
- for experimental vegetation management burns, particularly for the regeneration of mallet or conversion of plantations to other native species.

[11] Plant species vulnerable to fire: vulnerability will depend on the stage of plant development and recent fire history. For example, it is unlikely that a single fire will be catastrophic, but it may well render the population vulnerable to disturbance for a period until reproductive capacity recovers.

Managing Fire to Conserve Biodiversity

The scientific complexity of fire behaviour and ecology means there will continue to be uncertainty and risks surrounding ecosystem responses to fire (planned and unplanned) and the outcomes of various planned fire regimes. Fire managers recognise this uncertainty but also understand that it is not a valid reason to avoid taking action to protect biodiversity, life and community assets from inappropriate fire regimes. Actively applying prescribed fire in managed ways can achieve many benefits for biodiversity that outweigh the risk of uncertainty and can also contribute to the better understanding of ecosystems over time.

Managing Fire to Protect Ecologically Sensitive Areas

Many of the native fauna species for which Dryandra is noted have specific habitat requirements that may be maintained through the appropriate management of fire. For example, dense thickets of rock sheoak, and poisonous plants such as *Gastrolobium microcarpum*, provide protection for the woylie and tammar wallaby, while hollow wandoo logs are of particular importance to numbats.

Rock sheoak is sensitive to fire, but has seed stored in the canopy and regenerates prolifically after fire. It will also invade some vegetation types, such as kwongan, in the absence of fire (see Sections 17 *Native Plants and Plant Communities* and 19 *Environmental Weeds*). The resulting thickets created by fire are ideal habitat for a range of species including the tammar wallaby and the woylie.

It is important to maintain different age classes of vegetation communities in the planning area in order to maximise the ability of a range of fauna species to survive there. Fire planning at Dryandra may require the protection of some thickets from disturbance (including fire) for several decades, and some of the rock sheoak and kwongan may eventually require regeneration burns.

Currently, some poison thickets are being maintained by a low level of seedling establishment in the absence of fire, while other thickets have collapsed through senescence or have not regenerated satisfactorily following fire. A burn under dry soil conditions is one management tool that can be used to regenerate the poison thickets, provided that there is adequate soil-stored seed. As such seed is rapidly predated by birds and insects following seed release in early summer (Burrows *et al*. 1987), regeneration is likely to be more prolific after an autumn burn than a spring burn.

Fire also influences the availability of hollow logs through destruction of existing logs and the creation of new logs when hollow trees fall. The balance between these two processes depends on the intensity of the fire. Very intense fires destroy logs, but replace them by bringing down trees. Less intense fires destroy logs without replacing them. Mild fires (especially in spring when logs are waterlogged) have almost no impact. Hence, fire intensity must be carefully managed. The continued decomposition of logs may necessitate habitat manipulation in the future. Further research on the effect of fire intensity on hollow log production is required. In the planning for prescribed fire, protection of important log refuges may need to be considered, along with the ability of the woodland to replace those logs consumed by fire.

Managing Fire to Protect Life and Community Assets

The existence of towns and settlements, farmland and other developments, as well as the increasing use of natural areas for recreation, requires that the protection of life and community assets be considered in fire management for the planning area.

Identifying fire vulnerable community assets within and surrounding the planning area, and determining the risk, likelihood and consequences posed by wildfire to those assets will assist in managing the threat posed by high intensity wildfires. The Department's wildfire threat analysis[12] provides a strategic framework for this to occur and provides the basis for a more detailed analysis and evaluation of susceptible areas and specific fire pre-suppression tactics. This process will also assist in developing strategies to mitigate the threat to biodiversity values. The wildfire threat analysis process aims to:

[12] The wildfire threat analysis is consistent with the accepted framework under which risk assessments are implemented in Australia – the *Australian/New Zealand Standard AS/NZS 4360:2004 – Risk Management*. Variables in the analysis procedure, such as fuel age, may change over time and hence the analysis only provides an assessment of risk at the time of analysis. Consequently, the analysis process is used as a guide and Department expertise and experience is necessary to formulate long-term risk mitigation strategies.

- provide a framework to analyse the best available information on all factors contributing to the wildfire threat, and allow evaluation of alternative responses;
- provide a standard and repeatable process for decision-making;
- permit objective comparisons between different areas with different problems;
- support the clear and explicit explanation of the rationale behind fire management decisions; and
- provide a rational basis for discussion and conflict resolution in the preparation of plans.

To achieve this, the wildfire threat analysis process considers:

- the likelihood of an ignition occurring (past fire history);
- the potential behaviour of fire following that ignition (fuel, landform, weather);
- the capacity to mount an effective suppression response (detection, travel time and access for suppression forces and the quantum of those resources); and
- the potential consequence on social, economic and environmental values impacted before suppression is achieved.

A Wildfire Threat Analysis (WTA) has been prepared for Dryandra. Community values identified as being at risk within the woodland include:

- the village;
- recreation sites including day use, camp sites and Barna Mia;
- assets such as powerlines, fences;
- farm homesteads and associated sheds, machinery and equipment;
- vegetation where known rare fauna occurs;
- long-unburnt vegetation (fuel datum areas);
- mallet plantations;
- wandoo woodlands separated from the main block; and
- cultural sites

The WTA also considers the risk of ignition, suppression response capability, and potential headfire behaviour in protecting these assets. The WTA revealed that:

- the risk of ignition is low;
- there is a good detection, access and suppression capability in the area;
- if a fire did start under extreme conditions and was not quickly attacked it would become very difficult to control;
- there are some values vulnerable to broadscale fuel reduction burning, e.g. fuel datum areas, vegetation where known rare fauna occurs; and
- strategic protection burning (for example, roadside buffers) would help to reduce the risk of a fire developing, improve the safety of evacuation routes, provide sites at which some wildfires may be controlled, and provide a reasonable level of fire protection. Some broad area burning for research and habitat regeneration will provide further opportunities for strategic protection.

Based on the WTA of Dryandra Woodland, it is proposed that effective fire protection be achieved by a combination of fuel reduced buffers, the maintenance of efficient detection and suppression systems, and regular and constructive liaison with reserve neighbours and visitors, the wider community, local government, volunteer bush fire brigades, FESA and other State government agencies. Maps 3a and 3b show the location of the fuel reduced buffers.

22. Fire

Key Points

- Special values requiring protection and potential risks have been identified in the WTA for Dryandra.
- Fire management within the planning area will focus on biodiversity conservation and protection of life and community assets.
- Much of Dryandra Woodland has a common boundary with well developed assets such as farms, the protection of which reduces the flexibility for fire management, but increases the role of the community in the detection and suppression of fires.
- A range of habitats is required in Dryandra to maintain the current level of biodiversity. Within some habitats, such as the poison thickets, there are areas that are currently senescent and research is required to develop management prescriptions for the maintenance or restoration of these areas.

- The very slow growth of rootstock species, the poor crown recovery of trees, the high proportion of species likely to be vulnerable to a short rotation fire regime (<15 years) and the slow rates of litter accumulation suggest that fires are infrequent in this environment. Therefore, if broad-acre fuel reduction burns are conducted less than 15 years apart, damage may occur to ecologically important vegetation types over large areas.
- Prompt wildfire suppression will continue to rely upon the local bush fire brigades and adjoining land-holders.
- Liaison with reserve neighbours and visitors, the wider community, local government, volunteer bush fire brigades, FESA and other State government agencies will be necessary to ensure effective fire management across jurisdictions.

The objective is to conserve biodiversity across the landscape and to protect life and community assets in and near the planning area.

This will be achieved by:

1. maintaining a system of burn buffers along strategic access routes and high risk public roads to assist containment of wildfires to blocks of about 400 to 600ha, as depicted on maps 3a and 3b;
2. maintaining fuel levels within the burn buffers at less than 7- 8 tonnes/ha, and, where practicable, linking the buffers with natural low fuel areas, such as breakaways and wandoo flats;
3. maintaining low fuel levels (less than 7 - 8 tonnes/ha) in buffer strips and areas immediately adjoining the village, recreation sites and other facilities;
4. considering, and implementing where necessary, strategic burning to enhance vegetation communities and structure;
5. reducing the risk of wildfire by progressively phasing in gas barbecues, and in the interim period allowing fires in constructed fireplaces only;
6. restricting backpack campers to using only portable fuel stoves for cooking;
7. considering closing areas within Dryandra to the public to protect environmental assets (e.g. long unburnt areas) during extreme fire conditions;
8. maintaining an appropriate range of vegetation community age classes to ensure maximum habitat diversity;
9. ensuring all prescribed burns comply with written prescriptions approved by the Regional or District Manager, which incorporate an environmental checklist that takes into consideration the impact of burning on the environment, and consulting the appropriate research officer when monitoring sites or research plots are involved;
10. modifying, relocating or deferring proposed burns where threatened flora occurs within these areas. Where it is a necessary component of the species' life cycle, or where in exceptional circumstances it is considered by the Department that the burn should proceed, Ministerial permission will be obtained;
11. continuing to map and document all burning and fuel modification operations, as well as wildfire outbreaks in or near Dryandra;
12. undertaking all burns according to visual resource management principles, particularly in visually significant areas (see Section 29 *Visual Landscape*);
13. maintaining a network of roads to enable safe and rapid access for fire control to blocks of about 400 to 600ha;
14. minimising construction of any new firelines during wildfire suppression, and ensuring post-fire rehabilitation occurs, and constructing new firelines and firebreaks according to dieback disease hygiene guidelines;
15. actively promoting public education and awareness of fire risk, safety and survival through pamphlets, information boards and personal contact by staff;
16. regularly reviewing the Dryandra Settlement Fire Protection Plan and providing opportunities for visitors to the village to view this document;
17. maintaining an effective fire suppression capability within the Great Southern District in accordance with the Great Southern District Preparedness and Response Plan;
18. continuing to liaise with the local Bush Fire Brigades and neighbouring shires to ensure an effective fire management force is in place;
19. mapping the health and vigour of vegetation, and conducting experimental burns as necessary during the life of this plan, with the aim of forming blocks of thickets.
20. monitoring subsequent thicket development and use by fauna, and, if successful, preparing and implementing a rehabilitation program for degraded poison thickets;
21. researching and monitoring:
    - the effects of fire on selected biota, including vulnerable species, within fuel datum areas, buffer burns and experimental burns;

- burning strategies aimed at maintaining the supply of hollow stumps, logs and trees; and
- the effects of rotational burning for habitat management.

22. reviewing relevant fire information from other areas that may be applicable to Dryandra; and
23. investigating the role of fire in the silvicultural treatment and revegetation of mallet plantations, and in the conversion of plantations to other native species.

Key Performance Indicator applies (see also Appendix 1):

Performance Measure	Target	Reporting requirements
22.1 The impact of wildfire on life, property or significant community assets.	22.1 No loss of life, property or significant community assets, or serious injury attributable to the Department's fire management.	Annually

PART D. MANAGING OUR CULTURAL HERITAGE

23. ABORIGINAL HERITAGE

Aboriginal Use and Occupation

There is sufficient archaeological evidence to indicate that Aboriginal people have occupied the south-west of Western Australia almost certainly for 40 000 years (Merrilees *et al.* 1973, Hallam 1975) and, possibly, for as long as 50,000 years (Hallam 1981).

There were thought to be at least 13 different Aboriginal clans in the south-west region: collectively the people are known as Nyoongars. The word Nyoongar, or its linguistic equivalent, is identifiable as the word for Aboriginal (or person) in many of the vocabularies in this region. The people from the Narrogin district belonged to the Wiilman Clan.

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 Aboriginal lifestyle had all but disappeared as the new dominant culture set about transforming most of this region into an agricultural-based economy. As a result of agricultural activities most of the original vegetation was cleared, leaving isolated areas of native vegetation.

Little is known of Aboriginal use of the Dryandra area. Evidence of Aboriginal occupation and links to the area survive in the form of archaeological sites and the ever-growing interest of local Nyoongars in re-establishing cultural ties to the land. The Department of Indigenous Affairs has recorded five such sites within Dryandra. These sites include an ochre quarry, artefact scatters, stone arrangements, and a scarred tree. However, the planning area has not been comprehensively surveyed for Aboriginal sites and it is likely that others exist.

There has been a significant resurgence of interest in Nyoongar culture in recent years. Many Aboriginal people in the south-west are seeking a more active and cooperative relationship with the Department concerning management and use of the conservation estate and other natural bushlands. Although most Nyoongar concerns centre on the preservation of sites within Dryandra, other interests include the use of Dryandra for cultural activities, maintaining the Aboriginal knowledge of Dryandra's plants and animals, and conducting guided tours.

Section 23 of the Wildlife Conservation Act provides for a person of Aboriginal descent to take sufficient food for himself and his family from Crown land, excluding nature reserves or wildlife sanctuaries, with the permission of the occupier[13]. Permission is generally not needed to hunt on unvested reserves or unallocated Crown land, although these occupy only a very small proportion of land in the central wheatbelt area. About 80 per cent of Department-managed land in the Great Southern District is nature reserve or proposed to become so, and is thus excluded from any future hunting proposals. The remainder mostly comprises State forest within the Dryandra Woodland, of which a further 58 per cent is proposed to become national park.

Local Aboriginal people identified Quinns Block, within Highbury State forest, as a favoured location for future cultural activities, including hunting, camping, and passing on cultural knowledge (i.e.. 'the Nyoongar way') to the younger generation. It is also the largest of the Highbury blocks and receives relatively little recreation use compared to those areas of Dryandra north of Narrogin. Cultural activities will need to be carefully monitored to ensure they are sustainable and do not adversely affect other users, including neighbours.

23. Aboriginal Heritage

Key Points

- There are potential benefits for the protection of the biological diversity and for Aboriginal people if

[13] The 'occupier' of each tenure category is the associated vesting or managing authority.

there is close liaison between the Department and local Nyoongars.
- Within Dryandra, there is potential for local Aboriginal people to explain and demonstrate their culture through community education programs and on commercial tours.
- All Aboriginal sites are protected under the Aboriginal Heritage Act.
- Local Aboriginal people have requested permission to use Quinns Block for cultural activities, including hunting (CALM 1991a). If approved, the sustainability of such activities would require compliance with management prescriptions, and careful monitoring.

The objective is to conserve the Indigenous cultural heritage and cultural resources of the planning area.

This will be achieved by:

1. working with local Aboriginal groups that have an interest in undertaking cultural activities in Dryandra, and, in consultation with such people:
   - implementing recommendations of the current review. If cultural activities, including hunting, are identified as being compatible with Department objectives, permit such activities in Quinns Block. Consult with local Nyoongars, reserve neighbours and other relevant interest groups to determine the sustainability, safety considerations and monitoring requirements of any activities;
   - providing opportunities for involvement in the management of Dryandra. For example, local Aboriginal people could be involved in:
     - developing interpretive displays, community education programs and commercial tours incorporating the cultural history of the area;
     - researching past and contemporary Aboriginal use of Dryandra; and
     - undertaking anthropological and archaeological surveys of Dryandra as required.
2. consulting with the Department of Indigenous Affairs prior to all major development proposals to ensure Aboriginal heritage is protected.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

24. NON-INDIGENOUS HERITAGE

European occupation in the Williams - Narrogin area was first recorded in the 1860s with the issuing of pastoral leases to early settlers. Sandalwood cutters, mallet bark strippers, and kangaroo and possum hunters also visited this area prior to the closer settlement associated with tillage leases (Pustkuchen 1981).

During the earliest years of this century mallet forests were heavily utilised for tannins. The settlers needed capital to develop their farms and saw mallet as a means of supplementing their income.

Mallet bark worth 859 pounds was exported from Western Australia in 1903. In 1905 a scientist, Dr Johannes Passler, delivered a lecture to the German Leather Industry in which he concluded '...that we have in Malletto Bark a tanning agent which in regard to tanning property, equals those hitherto known as the richest tanning substances such as Mangrove bark...'. The bark became well sought after by countries with limited tanning sources. However, there were already concerns by the importers and the Western Australian Government that the '...tanning material will be exhausted.' (Paton 1988).

After 1905, there was a steady decline in the volume of bark exports and by 1907 areas within payable distance of the Great Southern Railway were virtually cut out and harvesting had spread throughout the Great Southern District. The real danger of the species being cut out completely was reported as early as 1908 in the Annual Report of the Woods and Forests Department (Germantse 1987). By the mid 1920s, the shortage of mallet was acute whilst world demand for vegetable tannins remained high (Paton 1988).

Following extensive surveys of land west of Cuballing, the first portions of Dryandra were reserved by the Forests Department in 1924 for the purpose of protecting natural mallet stands and establishing plantations. A house for a resident overseer and stables were erected at Lol Gray in 1925 and preparatory work for the establishment of mallet plantations commenced in 1926 (Forests Department 1926).

During the depression years extensive areas of Dryandra were sown to mallet with the aid of sustenance workers. Forest Department staff were located at the Dryandra Settlement and additional outstations at Contine, Congelin, Montague and Highbury. The outstations were strategically located on the highest hills overlooking the mallet

plantations and each had a fire tower. The overseer's wives performed the tower work, informing the staff at the settlement of any fires within the vicinity of Dryandra. The fire tower at Lol Gray was restored by the WA Division of the Institute of Foresters of Australia in 1986.

After 1959, the amount of mallet bark produced declined rapidly. A glut on the world market, increased royalty and production costs, and increased competition from synthetic products eventually led to the collapse of the industry in the early 1960s (Paton 1988).

In 1967, a tool handle business was established near Narrogin after tests had demonstrated the potential of mallet for this purpose. An earlier tool handle enterprise had closed in 1944. Plantation mallet is now used as a firewood resource following the closure of the tool handle and fence post plant. Due to a number of factors, including its availability, the possibility of establishing a contributing resource on farms and its wood properties, there is scope for further research and development of mallet as a timber product.

Since 1972 the Dryandra village has been leased to the Lions Dryandra Woodland Village (Inc.) for the purpose of providing visitor accommodation.

Heritage Sites

In 1979 the Australia International Council on Monuments and Sites (ICOMOS) adopted a charter for the conservation of places of cultural significance, now known as the *Australia ICOMOS Burra Charter, 1999* (Burra Charter). The charter has been widely been adopted as the standard for heritage conservation practice in Australia and applies to all types of places of cultural significance including natural, Indigenous and historic places with cultural values.

The main European sites of interest in Dryandra are:

- the village area, including the Arboretum, Old Mill shed and dam;
- two survey markers erected by John Forrest in the 1870s as part of a route survey between Perth and Albany;
- house sites and fire towers associated with the early mallet industry;
- Congelin railway siding and associated structures and formations; and
- the old school site at Lol Gray.

24. Non-indigenous Heritage

Key Points

- There is a need to assess the condition of the existing European sites and take action as necessary to preserve them.
- Some sites are being degraded through visitor misuse, e.g. it is suspected that timbers from the horse yards at Congelin have previously been used for firewood by visitors.
- The “Sounds of Dryandra Woodland” audio drive trail conveys messages and tales of the early European heritage of the area.

The objective is to conserve the non-Indigenous cultural heritage and cultural resources.

This will be achieved by:

1. ensuring that all management decisions concerning the conservation and restoration of places of historic interest within Dryandra adhere to the principles of the Burra charter;
2. assessing the condition of existing European sites and taking action as necessary to preserve them;
3. developing interpretive and education opportunities incorporating the European history of the area; and
4. researching past and contemporary European use of Dryandra.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART E. MANAGING VISITOR USE

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. In doing so the conservation estate contributes significantly to the social, psychological, physical and economic well-being of the community, with a subsequent benefit being that people develop greater attachment to, regard for and understanding of conservation places by spending time in them.

The number of visitors to the State's reserve system has increased markedly over the past decade, from 8.4 million visits in 1999-2000 to over 14.6 million in 2009-10. As of June 2010 the estate managed by the Department covered about 27.5 million hectares of lands and waters, protecting unique landscapes, seascapes, geological formations, flora and fauna, and cultural sites.

Conserving these lands and waters for future generations and managing them for use by the present one is a complex process for a number of reasons. Public expectations for recreation and tourism are as diverse as the environments the Department manages, and whilst the public conservation estate brings many benefits to the community as well as the environment, the desire to interact with these unique environments can lead to unacceptable impacts.

This part of the management plan addresses these issues, and at the same time ensures that visitors gain an awareness of the area's values which should, in turn, foster an appreciation and understanding of conservation. In the planning area, the major aims for managing visitor use are to:

- manage recreational use of the woodland to complement and assist with management of the 'Return to Dryandra' program;
- promote Barna Mia as the key facility for educating visitors on fauna conservation and the 'Return to Dryandra' program;
- minimise environmental impacts by directing visitors to sites that are away from known populations of key fauna species;
- maintain and improve the quality, rather than quantity, of existing recreational opportunities and facilities;
- retain natural experiences of the planning area by capping the level of development; and
- link the Department's visitor management and recreational facilities with interpretation to improve visitor amenity and environmental safeguards as well as ensuring sustainable recreation by portraying a stronger conservation education message.

The provision of visitor services, facilities and experiences in the planning area is guided by the Department's Policy Statement No. 18 *Recreation, tourism and visitor services* (DEC 2006b), which outlines the Department's principles, operational guidelines, procedures and administrative controls in relation to facilitating recreation and tourism on the public conservation estate. It should also be determined in the context of the range of opportunities available in neighbouring parks and reserves across the region and opportunities offered by neighbouring land holders and tourism providers. Managing the way people use the planning area applies an adaptive management approach, where management policies and practices are continually improved by learning from the outcomes of operational programs, experience, research and monitoring.

25. VISITOR USE PLANNING

Managing the way people use Dryandra involves the management of recreation, commercial activities, public safety, and visitor education, interpretation and information. Recreation and tourism planning considers a range of factors including visitor risk, environmental impacts, social benefit, equity, public demand and potential economic benefit. The provision of visitor services, facilities and experiences in the planning area should also consider the range of opportunities that are or may become available within the local region over the next 10-15 years.

As the use of natural areas increases, resource conditions can change until the character of the place has been modified to a point where it no longer has the attributes that originally attracted people to the area. As a consequence, 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 is provided within the natural

area. This is the concept of 'recreational succession' – where the very conditions of an area that attract recreational use are inevitably changed by that use (Prosser 1986).

The issue of recreational succession in natural areas can be addressed by a standard planning tool, the Recreation Opportunity Spectrum (ROS) (Clarke and Stankey 1979). It enables managers to provide for the greatest possible range of opportunities in a given area, while limiting unintended incremental development (Stankey and Wood 1982).

The principles of the ROS have been considered in establishing the various recreation opportunities and activities in Dryandra. While specific areas will be developed to facilitate access by the public, thus providing an important avenue for discovering parts of the woodland, much of Dryandra will remain substantially unchanged. Recreation and tourism management in the planning area will aim to encourage non-disruptive, passive uses that are reliant on/compatible with the special environmental qualities of Dryandra. Consistent with this principle:

- activities such as sightseeing and bushwalking will be promoted, while events with potentially high impacts, such as competitive car rallies, will be restricted to areas outside Dryandra that can sustain such use; and
- Dryandra will be managed to attract a clientele that is appreciative of the natural environment. Main target audiences will include the local community, schools and universities, naturalists, nature-based tourists, and others seeking passive recreation in a natural setting.

25. Visitor Use Planning

Key Points

- The intent of visitor use planning is to limit the unintended incremental development of parts of the planning area and ensure impacts on the environment are managed within acceptable limits and key values are protected.
- Potential impacts from visitor use include compaction of soil, deforestation, decline of flora and fauna species, introduction of weeds and diseases and increased fire risk.
- Recreation and tourism management in the planning area will aim to encourage non-disruptive, passive uses that are reliant on/compatible with the special environmental qualities of Dryandra.

The objective is to provide visitors with a range of nature-based experiences whilst ensuring the impacts on key values are minimised.

This will be achieved by:

1. ensuring existing and future recreation and tourism developments and visitor activities are consistent with Department policies and proposed recreation site developments as shown in Table 7;
2. applying suitable criteria for assessing and minimising the environmental, visual cultural and social impacts of any recreation and tourism developments and visitor activities; and
3. ensuring recreation and tourism developments and visitor activities are designed and constructed to minimise environmental, cultural and social impacts.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

26. VISITOR OPPORTUNITIES

Regional Context

The Wheatbelt Planning Region of WA attracted just over 605,000 overnight visitors in 2005/2006, 84 per cent of which were from WA. Ten per cent of visitors were from interstate, and six per cent from overseas. Together, these visitors contributed almost $189 million in direct tourism expenditure (Tourism WA 2007c).

Tourism WA has divided the State into five tourism destinations. Dryandra is in "Australia's Golden Outback", which covers 54 per cent of WA and comprises four tourism regions – Goldfields, Gascoyne/Murchison, Coastal sub-regions and wheatbelt, of which Dryandra is part.

Tourism WA's *Destination Development Strategy for Australia's Golden Outback* (Tourism WA 2007a) identifies Dryandra Woodland as being one of the prime places in Australia's Golden Outback for viewing wildlife, and describing it as being "market ready"; that is, it is believed to meet the needs of key intrastate, interstate and international target markets (Tourism WA 2007a).

Visitor Profile

Visitor Numbers

Visitation to the planning area is focused on the Dryandra Woodland Village and Barna Mia, and also at Congelin campground in peak times.

In the 2009-10 year, there were about 49,000 visits to Dryandra Woodland, of which about 5000 visitor nights were spent at the village. Visitor surveys have been conducted at Dryandra on several occasions in recent years. Visitor surveys conducted in 2005 showed that bushwalking still rates as the most popular activity (Calm 2005a). However, Congelin Campground (12,172 visits) was the most visited recreation area while Barna Mia (2,206 visits in 2009-10) also remains a popular activity. Recreational use across the planning area remains focused on nature appreciation and relaxation.

The primary attractions of Dryandra Woodland are the naturalness, peacefulness and scenic quality of its open woodlands and the opportunity to see threatened mammal species. These features provide Dryandra with a unique ambience that is becoming increasingly scarce in our ever developing world. Many people see access to such places as essential for human health, and it is therefore considered crucial that these precious qualities are protected for future generations. Management prescriptions for recreation and tourism management and development in Dryandra will ensure that these qualities will be maintained in perpetuity.

Visitor Trends

The main period of visitation to the planning area is in the autumn and spring months, especially during school holidays and on holiday weekends. At these times, the campground is generally at its capacity and overcrowding can occur, which results in visitors camping in various places in the woodland, outside of designated camp sites (T. Sprigg *pers. comm*.).

Most people visiting the planning area (about 85 per cent) are from within Western Australia. A further nine per cent of visitors are from interstate, with overseas tourists making up only about five per cent of visitors. These figures reflect those from the Wheatbelt Region (see above). The main activities undertaken at Dryandra include bushwalking, sightseeing, bird watching, camping, picnicking and viewing native fauna (CALM 2005a).

Two thirds (66 per cent) of visitors to Dryandra are aged above 40 years, with those under 17 years of age making up just over 10 per cent of visitors. Most people (over 80 per cent) visit with friends or family, with about one third visiting with just one other person. Ninety four per cent of visitors said that, given the chance, they would visit Dryandra again in the future (CALM 2005a).

According to the latest visitor statistics, about 18.5 per cent of visitors to Dryandra stay more than one day (CALM 2005a). This figure does not account for those visitors staying in other accommodation in the vicinity of Dryandra, and is expected to rise as the area continues to be promoted as a tourist destination. An increased level of use has been accommodated in the plan with improved access, better provision of information, the redesign of most recreation areas, and the expansion of recreation opportunities at key areas.

Further social research can assist in determining visitor trends, and hence guide planning for visitor services. In part, this is achieved using the Department's standard Visitor Satisfaction Surveys and Visitor Statistics Program, which are ongoing programs throughout the State. The Nature Based Tourism Research Reference Group also undertakes social research.

26. Visitor Opportunities

Key Points

- The provision of recreation and tourism opportunities, facilities and services in a given area should consider what is available in neighbouring areas to avoid unnecessary duplication and allow greater diversity.
- Most of Dryandra's visitors (about 85 per cent) are from WA.

The objective is to provide a range of sustainable and quality nature-based recreation and tourism opportunities based on visitor demand and trends.

This will be achieved by:

1. liaising with regional and local organisations such as Tourism Associations, and including the provision and exchange of information;
2. recording visitor numbers and monitoring visitor satisfaction across a range of activities and sites in the planning area;
3. undertaking social research to assist in recreation planning and development including projects nominated through the Department's Nature Based Tourism Research Reference Group (see section 39 *Research and Monitoring*);
4. using the data collected from visitor numbers and satisfaction surveys and social research, to improve management and minimise environmental, social and economic impacts across a range of sites in the planning area; and
5. considering other recreation and tourism opportunities within the region to avoid unnecessary duplication of opportunities within the planning area.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
26.1 Visitor satisfaction levels of nature-based experiences.	26.1 Visitor satisfaction levels of nature-based experiences are maintained or increased from 2011 levels.	Every five years
26.2 The perceived level of environmental degradation at high-use sites from visitor impacts as determined by visitor surveys.	26.2 The perceived level of environmental degradation at high-use sites from visitor impacts does not increase over the life of the plan.	Every five years

27. VISITOR ACCESS

The public conservation estate is generally available for a variety of recreational uses where conservation values are not unduly compromised. Provision of access is the main management tool the Department uses to enable visitors to recreate in these areas. This can include access to reach a destination for recreation, or for the experience provided by the type of access itself (e.g. scenic viewing, four-wheel driving, bush walking). However, there are some areas where public access may need to be restricted due to concerns over public safety, cultural sensitivity, protection of conservation values (e.g. risk of spreading *P. cinnamomi*) and/or the preservation of a particular recreational experience. Current visitation, the physical capacity to accommodate further access and the cost of maintenance also needs to be considered.

Public access to the planning area is available primarily by motor vehicles (see below), but also by walking, cycling or horse-riding (see Section 28 *Visitor Activities and Use*).

A range of access will continue to be provided to meet visitor and management demands. Access for bushwalking and cycling, as well as horse-riding, is covered in Section 28 *Visitor Activities and Use*.

27.1 Vehicle Access

The strategy for vehicle access is to maintain selected roads and tracks that lead to existing features of interest. This will maintain the number of recreation opportunities available in the woodland, reduce the risk of spreading dieback, and reduce maintenance costs. Many tracks within Dryandra lead to the same destination, so closures of these are likely to cause minimal inconvenience. There is the possibility of converting some of the closed vehicle tracks to bushwalking or cycle trails if deemed appropriate and demand exists.

All vehicle access to private property will be retained.

Dryandra is accessible by sealed roads from all major population centres. Most of the roads and tracks within the blocks north of Narrogin are formed gravel, and generally accessible to 2WD vehicles.

Within the woodland there is also an extensive network of vehicle tracks and fire access tracks which have evolved with past land uses, such as wandoo timber production and mallet plantation management. Some of the tracks now comprise part of Dryandra's two drive trails (see 28.3 *Scenic Driving and Sightseeing)*. All tracks within the woodland are maintained by the Department, and not only provide access for visitors, but for management activities such as fire, feral animal and weed control, maintenance of recreation areas and scientific research.

Access to Dryandra Woodland is predominantly from the Wandering - Narrogin Road for blocks north of Narrogin, and from the Dumberning Road for blocks in the Highbury area (see Maps 4a and 4b). These, and other gazetted roads that traverse the woodland, are maintained by the local shires.

The most frequently used road is Tomingley Road, which essentially is the main thoroughfare between the Wandering-Narrogin Road in the east and the York-Williams Road in the west. Tomingley Road recorded about 29,000 visits in 2009-10 (DEC 2007b).

27.2 Access for Visitors with Disabilities

The Australian Bureau of Statistics Survey of Disability, Ageing and Carers (2003) states that 20 per cent of the population identify themselves as having some form of disability. Based on these figures, it is likely that over a million visits per year are made to the public conservation estate by people with some form of disability. A disability can be defined as a condition which is attributable to an intellectual, psychiatric, cognitive, neurological, sensory or physical impairment.

The Department's *Disability Access and Inclusion Plan 2007-2010* (DEC 2007c) outlines what steps the Department will be undertaking to improve access to its services, information and facilities for people with disabilities. The Department's policy on access and inclusion is to ensure that everyone in the community is able to access, use and enjoy the natural area and associated facilities, services and programs provided by the Department (DEC 2007c).

The plan has seven desired outcomes, which include that:

- recreation areas managed by the Department are accessible to people with disabilities;
- Departmental buildings are accessible to people with disabilities; and
- information and services provided by the Department are accessible to people with disabilities and in a format that will enable them to readily access the information.

Strategies identified to help deliver these outcomes include:

- continuing to upgrade access to Department-managed recreation areas, with priorities based on visitor numbers, costs and ease of modification of existing facilities;
- ensuring that, wherever practicable, new recreation facilities are accessible to people with disabilities;
- improving staff awareness of accessible information needs and how to obtain information in other formats;
- ensuring that all information presented by the Department is clear, visible and complies with the required standards for people with disabilities; and
- improving community awareness about Departmental consultation processes.

27.3 Management Access

There is often a requirement for some access within natural areas to be closed to the public for management purposes. They may be used for controlling feral animals and weeds, water monitoring, access for maintenance and fire management. While further assessment is required, management access is not likely to dramatically change from that existing at present. Roads that are designated as 'management access only' may be signposted accordingly.

The roads shown on Maps 4a and 4b are those that will be open to the public for the life of the plan. All others will be closed, become access for 'management vehicles only' or converted to bushwalking or cycle trails, and sign-posted accordingly.

27. Visitor Access

Key Points

- Public access to the planning area is primarily available by motor vehicles, but also by walking, cycling or horse-riding (see Section 28 *Visitor Activities and Use*).
- Many tracks in Dryandra, especially those associated with prior timber harvesting operations, are rarely used by the public, but are important for management purposes, e.g. fire control.
- Tracks not needed for access to recreation sites will be closed to public vehicle access.
- Roads, tracks and parking areas will need to sustain greater use as the numbers of visitors to Dryandra increases.
- Vehicles leaving defined roads can cause soil compaction, damage vegetation and spread diseases.
- Adjoining landowners have traditionally used tracks within the woodland for the movement of stock, vehicles and machinery.
- Vehicles are responsible for an increasing number of native animal deaths.

The objective is to provide and maintain access that minimises the impact on natural, cultural and recreation values.

This will be achieved by:

1. maintaining and, where necessary, upgrading the vehicle access network shown on Maps 4a and 4b to a standard that provides for all-weather, two-wheel drive vehicle access;
2. maintaining access for tourist coaches and caravans along Tomingley Road;
3. improving visitor safety by providing vehicle stopping points along main routes and advisory traffic signs where necessary;
4. making some minor tracks that are closed to public vehicles available for bushwalking and cycling (see Sections 28.5 *Bushwalking* and 28.6 *Cycling*);
5. promoting responsible driving practices throughout the woodland to minimise native animal road kills, and installing advisory signs as appropriate;
6. carrying out road maintenance according to dieback disease hygiene measures and visual resource management principles;
7. negotiating alternative routes or options for adjoining landowners needing to transfer stock through the woodland;
8. avoiding the construction of any other tracks for management purposes except when values of a high priority are threatened, e.g. by a wildfire (see Section 22 *Fire*)
9. retaining all vehicle access to private property;
10. monitoring the use of public access routes in Dryandra to establish long-term trends in visitor numbers; and
11. monitoring the condition of the access network in the woodland, including vehicular and pedestrian access, and taking appropriate management action where necessary.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

28. VISITOR ACTIVITIES AND USE

The major sites and facilities providing for visitor use in Dryandra are outlined in Table 7.

The latest visitor surveys indicate that the current facilities are sufficient to meet existing visitors needs, and the results demonstrate a high level of satisfaction with the facilities and services offered at Dryandra (DEC 2005). However some of the sites do require further development and upgrading, including the Old Mill Dam day use site and the Congelin campground (see Table 7 and 28.1 *Overnight Stays*).

Management proposals outlined in Table 7 aim to ensure all recreation sites are capable of sustaining increased use and that future public expectations are met. Priorities in Table 7 reflect current visitor and management requirements and, therefore, may change according to future monitoring of the patterns and levels of visitor use.

Consistent with the Department's *Disability Access and Inclusion Pla*n (DEC 2007c), and where appropriate, access, facilities and services for disabled visitors will be improved by: considering disabled access in the design of new facilities; and ensuring information is accessible, clear, and visible and complies with the required standards (see 27.2 *Access for Visitors with Disabilities*).

Table 7. Recommended Site Developments

Location*	Feature	Present Facilities	Proposed Development
Dryandra Village	Accommodation complex, open field	Overnight accommodation and day visitor area. Self-contained accommodation, study centre, sports field, toilets, BBQs, picnic shelter	Village to continue to provide built accommodation, and developing caravan bays
Barna Mia	Interpretation Centre, night time animal viewing	Interpretation Centre, displays, merchandise	Maintain existing facility
Old Mill Dam Day Use Site	Dam, historical features	Information shelter, trail heads for Woylie and Wandoo Walks, wood BBQs, picnic tables	Continue to develop this site as a day use focal point. Provide facilities for disabled visitors. Develop walktrail between Dryandra Village and the dam
Congelin Dam Day Use Site	Dam, historical features associated with railway	BBQs, picnic tables, interpretive walktrail between day use area and campground	Continue to provide day use facilities at the dam
Congelin Campground	Historical features associated with railway	Camp sites, gas BBQs, picnic tables, interpretive walktrail between campground and day use site	Redevelop and expand overnight camping including necessary facilities
Contine Hill	Lookout point, site of historic tower and house	BBQs, picnic tables	Maintain basic picnic facilities
Dryandra Arboretum	Native plant arboretum	BBQs, picnic tables, labelled trees, interpretive walk	Develop as a key interpretive site
Lol Gray	Lookout point, site of historic tower and house	BBQs, picnic tables, trail heads for Lol Gray Loop and Lol Gray Trail	Maintain basic picnic facilities, walktrails and tower
Lol Gray school site	Site of former Lol Gray school, commemorated by a monument	None provided.	Maintain site in current state.
Congelin House site	Historic tower and house site	None provided	Maintain site in current state. Retain as a stop-over on the audio Drive Trail
Montague House site	Historic house site, paddock and dam	None provided	Maintain site in current state
Highbury	Historic house site	None provided	Maintain site in current state

*See Maps 4a and 4b for site locations

28. Visitor Activities and Use

Key Points

- Recreation opportunities are strongly influenced by the type of facilities provided. The level of development at different sites should vary to maximise the range of opportunities available.
- Currently, not all existing facilities are in an adequate condition and not all recreation areas and facilities are capable of sustaining increased use.
- Maintenance of recreation areas and facilities is costly to the Department.

The objective is to provide a range of recreation areas and facilities within the planning area that do not conflict with other users, damage the environment or cause injury to visitors and their vehicles.

This will be achieved by:

1. redesigning, modifying and managing recreation areas and facilities as outlined in Table 7 and preparing site development plans for all proposals as required;
2. ensuring all facilities are developed in accordance with Departmental standards;
3. basing all recreation development plans on an up-to-date plant disease hygiene plan and hygiene evaluation (see Section 21 *Diseases*) and ensuring that no threatened flora or fauna are adversely affected;
4. designing all facilities and access tracks to minimise maintenance;
5. encouraging users to help reduce maintenance (for example, take home rubbish);
6. where possible, providing facilities for universal access at sites such as Barna Mia, Dryandra Village and Old Mill Dam and Congelin Dam day use sites;
7. minimising conflict between users by careful site location and design;
8. designing recreation areas and facilities to minimise safety hazards; and
9. monitoring changes in the patterns and levels of visitor use, and predicted trends, and altering recreation and tourism management as required.

Key Performance Indicator applies (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
28.1 Visitor satisfaction levels of nature-based experiences.	28.1 Visitor satisfaction levels of nature-based experiences are maintained or increased from 2011 levels.	Every five years.

28.1 Overnight Stays

Overnight stays in Dryandra are provided in built accommodation at the village and at Congelin Campground. Management of accommodation and camping is guided by Policy Statement No. 18 *Recreation, tourism and visitor services* (DEC 2006).

In 2009-10 there were over 49,000 visitors to Dryandra Woodland, which includes about 12,000 visitors camping at Congelin Campground and about 5000 visitor nights were spent at Dryandra Village.

Built Accommodation

Built accommodation on lands and waters managed by the Department is generally provided by way of a commercial concession and gives due consideration to cooperating with the private sector in the provision of a range of accommodation. Within Dryandra, built accommodation is provided for at Dryandra Woodland Village. The buildings and immediate surrounds of the village are leased to the Lions Club to manage as low-cost accommodation for visitors (see below).

The village was established in the late 1920s as a Forests Department settlement for the harvesting of mallet bark for the tanning industry. Today it offers basic low-cost accommodation for overnight visitors in the midst of Dryandra's unique flora and fauna. The village has eight self contained cottages sleeping between two and 12 people. There is also the Currawong complex, which caters for large groups of up to 56 people and is ideal for school and other groups. Use of the accommodation tends to be seasonal, with the village heavily booked on weekends from May to November.

Other built facilities on the site include a study centre, a workshop, and a government employee's house: these are managed by the Department and are excluded from the Lions Club lease area.

Lease

The village accommodation was initially leased to the Lions Club of WA between 1972 and 2003 for a nominal annual rental fee. In return the Lions were to restore, alter and develop the lease area as a camp for underprivileged children, youth organisations, scientific bodies and other groups. A condition of the lease was that all revenue was to be spent on the development, management, care and maintenance of the leased premises and environment. In 2003 a new 10 year lease was entered into with Lions Club Dryandra Village. This lease

has more up to date conditions, including providing for further development of the leasehold area, but only with the consent of the Director General of the Department.

At the expiry of this lease, it will be reviewed in accordance with standard Departmental procedures. It is expected that a new agreement will be subsequently issued to allow for the continued occupation of the lease area.

Camping

Camping can be broadly categorised into vehicle-based camping at designated locations, and that associated with backpacking, or "walk-in" camping. Vehicle-based camp sites are usually established at selected locations and site-hardened to sustain the increased level of use. Walk-in camping is associated with walk tracks and routes, and usually only involves an overnight stay in any one area. Such camping is not allowed within the vicinity of designated recreation areas or major roads within Dryandra, and fires are not permitted.

Some visitors to Dryandra Woodland seek an overnight outdoor experience that is not catered for at the village accommodation complex (CALM 1992c). The Department manages one vehicle-based camping area within Dryandra, the Congelin campground. Facilities have been designed and sited to minimise environmental and aesthetic impacts. Use of the campground is increasing, and at certain times of the year, in particular the autumn and spring school holidays (including Easter) and the June long weekend, it is filled to capacity, and additional visitors camp in between designated sites and in other areas throughout the woodland (T. Sprigg, *pers. comm*.).

To address this issue, two options may be considered over the life of the plan:

- developing an overflow campground adjoining the existing one, which will only be opened as required during peak times. This would mean a large campground would not have to be maintained for the whole of the year and the over flow area could have only minimal facilities and cater for self sufficient campers and 4WD groups.
- developing a new or additional camping area, if demand increases. This would take into consideration development of alternate sites, possibly in association with other day use sites within Dryandra.

No specific camp sites will be provided along walk routes; however, short-stay backpack camping will be allowed.

Other Accommodation

The Dryandra area is well serviced by a range of accommodation options. Motel/hotel accommodation is available in the three townships and at Cuballing, Williams, Pingelly and Narrogin. There are several farm-stay operators in the immediate vicinity of Dryandra, including both the Highbury area and the main blocks north of Narrogin.

Caravan facilities are available at Popanyinning, about 15 kilometres north of Cuballing, and in the townships of Williams, Pingelly and Narrogin. However, it is becoming evident that there is increasing demand for visitors with caravans to be able to stay overnight in the planning area. About 34 per cent of international visitors and 23 per cent of domestic visitors stay in caravans in the wheatbelt, and 23 per cent of international visitors drive a motor-home or campervan on their travels (Tourism WA 2007c).

Therefore, it is proposed to permit the establishment of caravan bays within the Lions Club lease area. Any proposal to provide powered caravan bays within Dryandra would be subject to standard Departmental procedures for environmental assessment, and must adequately address:

- environmental and economic sustainability;
- maintenance of the historical character of the Dryandra Village;
- visual impacts; and
- impacts on the experiences of other visitors.

28.1 Overnight Stays

Key Points

- Alternative accommodation options, such as farm-stays, motels/hotels and caravan parks, are provided by private enterprise in the surrounding area. However, staying overnight in caravans in a natural

setting is not catered for.
- Camping is permitted within Dryandra at Congelin campground where basic facilities are provided.
- Camp fires are an integral part of many visitors' camping experience, but increase the risk of wildfire and cause damage to vegetation and fauna habitat through uncontrolled collecting of wood.
- Camp sites require regular maintenance by Department staff, particularly at peak period times. It is Departmental policy to recover the costs of providing facilities and services to the public from users.

The objective is to provide opportunities for visitors to stay overnight in appropriately designed built accommodation and camp sites, and to facilitate visitor enjoyment, appreciation and understanding of the key values whilst minimising impacts.

This will be achieved by:
1. maintaining the vehicle-based camp sites at Congelin campground, where camp sites cater for a range of group sizes, and for the effective separation of groups where practicable;
2. seeking to recover the costs of providing facilities and services to the public from the users by charging camping fees at Congelin campground;
3. developing a voluntary campground host scheme to assist with the management of camp sites during peak periods;
4. informing visitors of the location of the designated camping area, its facilities and the fees charged, through publications, information boards and sign posting;
5. allowing camping associated with backpacking on walk tracks and routes, except on designated walk tracks, but restricting walk-in camping to a single overnight stay by individuals and small groups and not allowing it within the vicinity of designated recreation areas or major roads;
6. restricting fires by walk-in campers to portable fuel stoves;
7. regulating the use of generators by campers;
8. monitoring changes in the patterns and level of campground use, vegetation cover, and predicted trends and altering recreation management accordingly;
9. if demand increases, providing for the development of a new or additional camping area, or an overflow area adjacent to the existing site at Congelin;
10. ensuring all buildings, improvements, fixtures or fittings erected or installed during the term of the lease are in harmony with the historical style and character of the Dryandra Woodland Village (see Section 29 *Visual Landscape*);
11. ensuring, where appropriate, that any new buildings or constructions are in accordance with Australian standards for access for the disabled;
12. promoting the theme that 'biodiversity is essential to sustain each individual's quality of life' by encouraging Lions Dryandra to practice conservation principles through their daily management;
13. permitting the establishment of powered caravan bays within the Lions Club accommodation lease area, subject to appropriate environmental impact assessment; and
14. encouraging the development of alternative accommodation options on private property.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.2 Nature Study and Appreciation

The human desire to explore, experience and study nature first hand is fundamental to the notion of setting aside relatively undisturbed areas in parks and reserves. Dryandra, as a remnant of the wheatbelt landscape, affords many opportunities for a range of nature study and appreciation activities such as bird watching, photography, wildflower viewing and spotlighting nocturnal animals. In particular, Dryandra is a focal point for the study and observation of threatened mammals, such as the numbat and woylie.

Visitor survey results (CALM 2005a) show that of the people interviewed, the most popular activities were bushwalking (69 per cent), sightseeing (46 per cent) and, equally, bird watching and relaxing (both 40 per cent).

28.2 Nature Study and Appreciation

Key Points
- The study of nature is compatible with the visitor use objective for Dryandra as it allows for the appreciation of the woodland in a peaceful, relatively non-impacting manner.
- Dryandra, as a remnant of the wheatbelt landscape, affords many opportunities for a range of nature

study and appreciation activities.

The objective is to encourage visitors to appreciate and understand the key values of Dryandra Woodland.

This will be achieved by:
1. providing opportunities for viewing wildlife in their natural environment, so long as this can be done safely and without undue disturbance to the species being observed or their habitats;
2. maintaining drive trails and nature walks to provide controlled access through interesting or sensitive environments (see Sections 28.3 *Scenic driving and sightseeing* and 28.5 *Bushwalking*);
3. obtaining necessary Department and external approvals before identifying and interpreting sensitive features, such as threatened flora and fauna, or Aboriginal sites; and
4. implementing those strategies in Section 37 *Information, Interpretation and Education* that relate to nature study and appreciation.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.3 Scenic Driving and Sightseeing

In the 2005 visitor survey (CALM 2005a) sightseeing was the second most popular activity in Dryandra. Many of the roads and tracks provide either open views across a wide, sweeping landscape of forested hills and farmland, or enclosed views within the wandoo woodlands. Look-outs, such as Contine Hill, provide an important opportunity to facilitate sightseeing with minimal impact on the environment.

In recognition of the popularity of sightseeing and scenic driving, the Department was able to secure funding under the auspices of the Forest Ecotourism Program to develop a radio interpretive drive trail in the southern part of Dryandra block. The 25-kilometre "Sounds of Dryandra Woodland" audio drive trail was the first of its kind to be constructed in Western Australia. Short-range, solar-powered transmitters, hidden from view in nearby treetops, are used to broadcast commentaries as you move from site to site along the trail. The commentaries help visitors to discover the relationships between people and Dryandra Woodland through the years. The sounds of the past come to life with tales of the local Nyoongar people, early forestry days, bush railways and some of Dryandra's unique wildlife. At each of the six signposted sites, drivers can stop their cars and tune their radios to 100 MHz FM to hear the different stories.

Another drive trail, Darwinia Drive, has been developed in the northern part of the Dryandra block. This 23-kilometre trail includes five pull-over bays where interpretive information is provided on panels about the complexity and interdependence of natural systems at Dryandra.

28.3 Scenic driving and sightseeing

Key Points
- Dryandra's two drive trails provide a vehicle-based experience for visitors to enjoy the values and historic features of the woodland.
- Vehicles are responsible for an increasing number of native animal deaths.

The objective is to provide opportunities for scenic and recreational driving and sightseeing that do not cause damage to the environment, are safe and minimise conflicts with other users.

This will be achieved by:
1. maintaining the two interpretive drive trails in Dryandra Woodland that incorporate the interpretive theme 'biodiversity is essential to sustain each individual's quality of life' (see Section 37 *Information, Interpretation and Education*);
2. promoting responsible driving practices throughout the woodland to minimise native animal road kills and installing advisory signs as appropriate;
3. ensuring roads promoted for scenic driving are maintained to a suitable standard and are sign posted appropriately;
4. providing appropriate facilities, such as roadside pullover bays, for drivers to stop and enjoy the

environment; and
5. ensuring all works associated with roads and their viewsheds (for example, verge clearing, fuel reduction burning and timber harvesting) are in accordance with visual resource management (see Section 29 *Visual Landscape*) and ecological management principles.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.4 Picnicking and Barbecuing

The bush picnic or barbecue is an opportunity to relax and enjoy the bush with family or friends, whilst also providing the central focus for other nature-based leisure activities, such as sightseeing, bushwalking and scenic driving.

Within Dryandra, picnic and barbecue facilities currently exist at Old Mill Dam, Dryandra Woodland Village, Lol Gray, the Arboretum, Congelin Dam and Contine Hill. Future proposals for these areas are outlined in Table 7. In addition, the Shire of Cuballing has re-established a recreation area at Yornaning Dam (east of Dryandra), and the Department has developed a recreation area at Williams Nature Reserve.

It is envisaged that Old Mill Dam day use site will become the primary orientation point for visitors, due to its proximity to the entrance and being the first site visitors come too after entering the woodland. The site has no toilets or gas BBQs, and is therefore in need of an upgrade.

28.4 Picnicking and Barbecuing

Key Points
- It is intended that Old Mill Dam will become the primary day use and orientation site for visitors.
- Picnic and barbecue areas require regular maintenance by Department staff, particularly at peak times.
- Facilities and recreation experiences are provided at a range of sites within the woodland.
- Fire escapes from open barbecues can cause wildfires.
- Uncontrolled collecting of wood for barbecues impacts on fauna habitat.

The objective is to provide a range of high quality day-use sites that facilitate visitor enjoyment, appreciation and understanding of the key values whilst minimising environmental and other impacts.

This will be achieved by:
1. redesigning, modifying and managing picnic and barbecue areas as outlined in Table 7;
2. upgrading Old Mill Dam day-use site to include facilities such as toilets, gas BBQs and picnic facilities;
3. upgrading and maintaining day use sites according to established planning procedures, design standards and site environmental capability;
4. improving the quality of current sites so as to meet current Departmental standards (including safety requirements), site capability and increased/changing visitor expectations;
5. designing all facilities to have minimum impact and low maintenance requirements;
6. encouraging users to help reduce maintenance costs (e.g. take home rubbish);
7. providing facilities for disabled access at key picnic and barbecue areas according to Departmental policy; and
8. progressively phasing in gas barbecues, but providing firewood at barbecue sites in the interim period.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.5 Bushwalking

Walktrails can enhance visitors' experiences of parks and reserves and bushwalking is an activity that is enjoyed by people of varying ages, interests and levels of physical fitness and mobility. In its various forms, bushwalking can encompass everything from a short, leisurely stroll to a major trek lasting days or even weeks. A range of walktrails of varying distance and duration is required to meet the needs and enhance the experience of visitors.

Walktrails are important to guide visitors to features which are sometimes not apparent or are difficult to access by vehicle. Quite often walktrails are located in areas of high recreation demand and use. They provide a variety of recreation opportunities in areas where it is desirable to manage the impacts on the natural environment by confining visitor use to a single trail.

The impact of bushwalking on the physical environment, while generally low compared to other recreation activities, can vary depending on soil conditions, landform, vegetation type and intensity of use. Where levels of use are high, bushwalking has the potential to lead to the loss of vegetation, introduction and spread of weeds and diseases, localised soil compaction and erosion problems, fauna disturbance and fire risk. Usually these problems can be effectively minimised through appropriate design and construction of trails and through visitor information.

In the 2005 visitor survey (CALM 2005a) bushwalking was the most popular activity undertaken in Dryandra, with 69 per cent of respondents partaking in it. Dryandra, with its diversity of landform and vegetation, provides a number of opportunities to explore the woodland on foot. Bushwalking is compatible with the visitor use goal for Dryandra as it allows for the appreciation of the woodland in a peaceful, low-impact manner.

A number of trails have been developed incorporating a range of experiences, landscapes and length of walks (see Table 8). Some of the trails link with others, thus providing options for longer walks. Major starting points are at the Old Mill Dam picnic area, the village, and Lol Gray picnic area.

A brochure has been developed showing the walktrails in the main Dryandra block.

Table 8. Walktrails within the Planning Area

Walk	Comment
Ochre Trail	This 5 kilometre trail describes some of the modern and ancient Nyoongar culture of the Dryandra area and features an ochre pit used by Aboriginal people for decoration. Scarred trees and stone arrangements provide further clues about traditional Aboriginal lifestyles. Signs along the way help explain the special relationship between the Nyoongar people and the natural environment.
Woylie Walk	This 5.5 kilometre trail meanders through a number of different vegetation types, including woodlands of powderbark and jarrah, kwongan heathlands and mallet plantations. One of the highlights is a thick stand of rock sheoak, featuring a lush fern understorey in winter where diggings and scratchings of woylies can often be seen.
Wandoo Walk	Dryandra's bird life is best illustrated on this short 1 kilometre walk through wandoo woodland, starting at the Old Mill Dam picnic area. Reflector tape marks this walk for night users.
Kawana Walk	This easy grade 3.3 kilometre walk is ideal for families and provides great opportunities for bird watching, echidna spotting or just looking at the beautiful banksia.
Lol Gray Trail	This 12.5 kilometre trail takes you from the village to the Lol Gray picnic area and back. The main features of the trail are the diversity of the vegetation types (including a magnificent stand of rock sheoak), the old Lol Gray fire tower, and the great views over Dryandra from near the tower. Kangaroos are often seen immediately east of the Wandering Road.
Lol Gray Loop	This 3.2 kilometre trail begins following the old telegraph line down the hill from the Lol Gray picnic area. The walk features coppiced powderbarks on the south side of the track, and the large dead trees that were ringbarked during the establishment of the mallet plantations, as well as a patch of kwongan which small possums and honeyeaters find irresistible.
Congelin Siding Walk	This 1.6 kilometre easy grade walk follows the old Pinjarra to Narrogin railway line, which was constructed in 1925. Signs interpret many of the remaining features still visible along the line.

28.5 Bushwalking

Key Points

- The village and Old Mill Dam are a major focus for visitors. A variety of bushwalking opportunities have been provided from these points, including a walking trail that provides access for disabled and elderly persons.
- Walktrails require regular maintenance, particularly in steep terrain, and resources are required to maintain the number of trails provided.
- Bushwalking can aid in the spread of weeds and plant diseases.

The objective is to provide a range of bushwalking opportunities that do not adversely impact on the key values of the planning area.

This will be achieved by:

1. maintaining walking trails to Department standards and developing a walking trail maintenance program;
2. monitoring levels of use and, where conflict arises, consider closing some vehicle tracks to favour bushwalking;
3. maintaining self-guiding interpretive walks which help enrich visitor appreciation and understanding of Dryandra;
4. promoting minimum impact bushwalking;
5. providing comprehensive information on bushwalking opportunities available in the area (see Section 37 *Information, Interpretation and Education*). Information on walking trails should include:
   - distance;
   - level of fitness required;
   - completion time; and
   - special features.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

28.6 Cycling

Cycling, in particular mountain biking, has dramatically increased in popularity in recent years, both in Australia and internationally, with cycling in natural areas becoming an increasingly popular activity with the advent of mountain bikes.

Given this, while there is some use of Dryandra Woodland for cycling at present, it is envisaged that demand for this activity is likely to increase. The potential exists to provide cycle trails in the planning area, particularly in the western section. Cycling trails will be designated, and shared or linked with walktrails providing there is no conflict between users. The longer Lol Gray trail has the potential to be dual use.

Any new cycling trails are to be developed using the standards detailed on the Department's Mountain Bike Management Guidelines (draft) (CALM 2006) based on the International Mountain Bicycling Association (IMBA) Standards, and guidelines provided in Policy Statement 18. New trails may also have a similar program to the four-wheel drive 'adopt a track' program where clubs are encouraged to make a formal commitment in maintaining and ensuring the tracks' sustainability.

28.6 Cycling

Key Points

- There is potential to provide cycling trails in the planning area, particularly in the western section.
- Cycling trails require regular maintenance, particularly in steep terrain, and resources are required to maintain any such trails that are provided.
- Areas suitable for cycling need to be identified and promoted as demand increases. Conflict between cyclists, pedestrians and motorists could occur in some areas.
- Cycling can spread weeds and plant diseases.

The objective is to provide a range of cycling opportunities that do not adversely impact on the key values of the planning area.

This will be achieved by:

1. designating, in consultation with the community, suitable cycling trails, incorporating:
   - management tracks;
   - a variety of landscapes; and
   - a variety of lengths and difficulty of routes;
2. maintaining cycling trails to Department standards and developing a trail maintenance program;
3. monitoring levels of use and, where conflict arises, consider closing some vehicle tracks to favour cycling;
4. promoting minimum impact cycling;
5. providing comprehensive information on cycling opportunities available in the area (see Section 36 *Education, Information and Interpretation*). Information on cycling trails should include distance, level of fitness required, completion time and special features; and
6. prohibiting cycling on roads and pedestrian walks where there is a clear conflict between users.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

28.7 Swimming

The Congelin and Old Mill dams have historically been used for swimming during the hotter months of the year. However, as there is no practical way of treating the water it is not possible to guarantee the safety of the dams for swimming. Old Mill Dam provides the water supply for the village and hence no swimming is permitted.

28.7 Swimming

Key Points

- There are concerns about:
  - water quality, particularly the risk to health from amoebic meningitis;
  - the condition and safety of water access points;
  - submerged obstacles within the dams; and
  - the legal liability if somebody is injured whilst swimming.
- Pathogen levels can fluctuate rapidly, rendering periodic monitoring by chemical analysis ineffective.
- A ban on swimming in the dams in Dryandra would be extremely difficult to enforce.

The objective is to discourage visitors from swimming in Dryandra through appropriate education and signage.

This will be achieved by:

1. maintaining information at the dams informing the public of the potential safety and health problems associated with swimming, and discouraging such activities;
2. maintaining a visual monitoring system for blue-green algae, and, if blue-green algae is apparent, temporarily closing dams to swimming;
3. assessing the condition and safety of water access points in the dams, and, in conjunction with the lessees of Dryandra Village maintaining, replacing or removing facilities as required and recording all inspections and management action;
4. inspecting the dams regularly for surface obstacles and recording all inspections and management actions;
5. ensuring that any site redevelopments at Congelin or Old Mill dams specifically address the issue of visitor safety, particularly with respect to children; and
6. maintaining the fence surrounding the small dam adjacent to the Irabina Study Centre.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

28.8 Orienteering and Rogaining

Orienteering is an organised activity which requires participants on foot to visit a set number of control points in the bush, in a given sequence and in the shortest time. Orienteering events were first held in Dryandra in 1976. In 1979, an orienteering map of the main Dryandra block was produced. This map has been used annually in past years and has become a favourite of many members of the Orienteering Association of Western Australia (OAWA). The map is in need of an update, in conjunction with OAWA and Rogaining WA. The combination of available accommodation, good access, complex gully systems and an established network of tracks makes Dryandra ideally suited for all levels of skill, fitness and enthusiasm.

Rogaining is a long distance cross country navigation event which generally involves greater use of roads and tracks than orienteering. Periods of several years may lapse between successive uses of the same area. Events, organised by the Western Australian Rogaining Association, were first held in Dryandra Woodland and surrounding farmland in 1985.

In general, orienteering and rogaining are an acceptable use of conservation estate, provided they:

- are sensitively located to maintain values;
- are properly planned and managed;
- do not interfere with other forms of recreation; and
- are not resource-demanding on the Department.

These events must be consistent with the Department's *Policy Statement No. 18 – Recreation, tourism and visitor services* (DEC 2006) and will be assessed on a case-by-case basis against the following general criteria:

- protection of natural and cultural values;
- susceptibility of soils to erosion and disturbance;
- safety and enjoyment of all visitors to the planning area as well as those who partake in the event;
- the availability of suitable facilities such as car parking areas, toilets and barbeque areas;
- potential to spread disease - strict hygiene controls must be enforced to eliminate the risk of disease spreading further in the planning area;
- the overuse of sensitive areas;
- past history of use and compatibility with Department operations; and
- potential conflict with other visitors.

Orienteering and rogaining groups are required to seek approval from the Department's District Manager to stage events in Dryandra. Any such events need to be in accordance with the aforementioned criteria. Applications, including the event status (club, State or national), timing and the number of competitors and observers expected, should be of sufficient detail to enable thorough evaluation of potential environmental and social issues.

28.8 Orienteering and Rogaining

Key Points

- The Orienteering Association of WA has identified several other areas in Dryandra that have the potential to provide future venues for orienteering. Each area is about 1500 hectares in size.
- Limited studies on the impacts of orienteering on lichen-covered granite rocks and on wandoo woodlands indicate that physical damage to vegetation is minimal and recovery is expected to be rapid (CALM and OAWA 1986). However, depending upon the number of participants, and the frequency and timing of events, orienteering and rogaining have the potential to impact on the environment and disturb other visitors.

The objective is to provide opportunities for orienteering and rogaining in the planning area whilst minimising the environmental impacts.

This will be achieved by:

1. permitting orienteering and rogaining in areas of State forest and proposed national park within Dryandra Woodland;
2. ensuring orienteering and rogaining groups seek approval from the District Manager to stage events in Dryandra, and run any such events in accordance with the application guidelines;

3. ensuring people involved with orienteering and rogaining monitor the impacts of events in Dryandra; and
4. updating the orienteering map of Dryandra, in conjunction with OAWA and Rogaining WA.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.9 Horse-riding

The use of horses in natural areas is part of the cultural heritage of Australia, and is a source of pleasure and enjoyment for many people. It is accepted as an appropriate means of appreciating and enjoying some areas of Department-managed land, provided that environmental and social impacts can be kept to acceptable limits and are considered manageable (DEC 2006).

Horse-riding on dedicated public roads within lands managed by the Department must comply with the *Road Traffic Act 1974*, but horse-riding on tracks and roads that are within national parks, nature reserves or State forest are subject to the guidelines of the Department's Policy Statement No. 18 – *Recreation, Tourism and Visitor Services* (DEC 2006) and the *Conservation and Land Management Regulations 2002*. Under the Regulations, areas where horse-riding is allowed need to be designated and published in the Government Gazette.

In the past, horse-riding activities have occurred in Dryandra, ranging from casual rides along defined tracks to organised trail and endurance events. Applications for other activities, including cross country riding and hunting from horseback, have been rejected in the past as they have the potential to cause significant environmental impacts. Gymkhanas have occasionally been held in the village paddock. However, the attraction of Dryandra for this event was more the availability of accommodation than the inherent natural values of this area. At the time of publication, the demand for horse-riding in Dryandra appeared to be very low (T. Sprigg *pers. comm.*).

Potential impacts from horse-riding include:

- soil erosion;
- trampling and grazing of vegetation;
- introduction and spread of weeds and dieback disease;
- silting and fouling of watercourses; and
- the potential for conflict with other users.

Consequently, horse-riding is inappropriate in areas of Dryandra with high conservation value, or that are highly susceptible to the spread of weeds or plant fungal diseases (see Table 2). It is best suited to the Darling Range, or areas within Dryandra that are proposed to remain as State forest, where it can be directed to less sensitive areas.

It is proposed to adopt a flexible approach to horse-riding. While demand for horse-riding in Dryandra is very low, recreational horse-riding (including carts) will be limited to gazetted public roads that traverse Dryandra. These include:

- York - Williams Road;
- Contine Siding Road;
- Dryandra Road;
- Rosedale Road; and
- Shepherds Road.

Demand for horse-riding will continue to be reassessed during the term of the plan.

28.9 Horse-riding

Key Points
- Horses can have a number of environmental and social impacts. However, many of these impacts can be minimised and effectively managed by confining horses to existing access tracks.
- Dryandra is predominantly open woodland allowing for easy off-track access into bush areas, potentially leading to the impacts listed above, as well as increasing the likelihood of horses grazing

on poisonous plants (e.g. *Gastrolobium microcarpum*).
- There are no other Department-managed lands in the Wheatbelt Region where horse-riding is permitted. However, there are many alternative sites on private and other lands. Farmstays adjacent to Dryandra offer horse-riding activities.

The objective is to provide horse-riders with an opportunity to experience Dryandra's varied landscapes whilst minimising the environmental and social impacts of horse-riding.

This will be achieved by:
1. limiting recreational horse-riding (including carts) in Dryandra to gazetted public roads;
2. reassessing demand for horse-riding during the life of the plan; and
3. excluding competitive horse-riding events from Dryandra (e.g. gymkhanas and cross country riding).

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.10 Special Events

Car and motorbike events may vary from casual, social outings to highly competitive events requiring expert driving and navigational skills and the use of specially equipped vehicles. Competitive motorbike trail-riding and car rallies will not be permitted in the planning area. However, social car rallies will be allowed providing they are consistent with the Department's *Policy Statement No. 18 – Recreation, tourism and visitor services* (DEC 2006). Applications for such events will be assessed on a case-by-case basis against the following general criteria:

- protection of natural and cultural values;
- susceptibility of soils to erosion and disturbance;
- safety and enjoyment of all visitors to the planning area as well as those who partake in the event;
- the availability of suitable facilities such as car parking areas, toilets and barbeque areas;
- potential to spread disease - strict hygiene controls must be enforced to eliminate the risk of disease spreading further in the planning area;
- the overuse of sensitive areas;
- past history of use and compatibility with Department operations; and
- potential conflict with other visitors.

Groups or persons wishing to hold such events in Dryandra are required to seek approval from the District Manager. Any such events need to be in accordance with the aforementioned criteria. Applications, including the event status, timing and the number of competitors and observers expected, should be of sufficient detail to enable thorough evaluation of potential environmental and social issues. The strategies outlined in this plan are subject to the development of an appropriate policy regarding management of special events and therefore review.

28.10 Car and Motorbike Events

Key Points
- Competitive events can damage roads, disturb other visitors, cause road deaths of wildlife, and lead to the deterioration of vegetation affected by dust along the roadsides. These impacts are inconsistent with the primary purpose of protecting Dryandra's natural values.
- There are no other areas on Department-managed lands in the Wheatbelt Region where these activities are permitted. However, there are alternative sites on private and other lands.

The objective is to exclude competitive special events from the planning area.

This will be achieved by:
1. prohibiting commercial competitive events such as car rallies and other motor sport from Dryandra Woodland;
2. requiring that groups wishing to conduct social car rallies contact the Department for approval and planning of the event; and
3. directing social rallies away from areas of high conservation value, or popular recreation sites where

there is a possibility of a nuisance being created to other visitors.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

28.11 Fishing

Recreational fishing is managed throughout the State by the Department of Fisheries in accordance with the *Fish Resources Management Act 1994*. Recreational fishing is generally controlled through orders and regulations made under the fisheries legislation in respect to size and bag limits, gear controls, closed seasons and licensing. These controls vary around the State and are amended from time to time. Fishing is permitted in State forests, national parks, nature reserves and other parts of the terrestrial conservation estate in accordance with the *Fish Resources Management Act 1994*, any CALM Act management plan and the *Conservation and Land Management Regulations 2002*. Access to fishing sites is managed by the Department.

Within Dryandra, fishing for redfin perch (*Perca fluviatilis*) and yabbies (*Cherax albidus*) is undertaken at both Old Mill Dam and Congelin Dam during the warmer months.

There are no size or bag limits on redfin perch, although a recreational fishing licence is required. Redfin perch are major predators of juvenile marron and, if caught, should not be returned to the water (Department of Fisheries WA 2007a). Likewise, there are no size or bag limits on yabbies, and a licence is not required. Yabbies are a threat to the marron fishery, as they breed faster and may carry diseases which affect other freshwater crayfish. If caught, yabbies should never be returned to the water (Department of Fisheries WA 2007b).

28.11 Fishing

Key Points
- Recreational fishing and marroning activities are managed by the Department of Fisheries.
- Fishing for redfin and yabbies is undertaken in Old Mill Dam and Congelin Dam.
- If caught, neither of these species should be returned to the water.

The objective is to manage recreational fishing in the planning area in accordance with relevant regulations.

This will be achieved by:
1. allowing recreational fishing for redfin and yabbies at Old Mill Dam and Congelin Dam in accordance with the relevant Acts and Department of Fisheries WA regulations.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

29. VISUAL LANDSCAPE

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.

29.1 Landscape Character Types

Every landscape[14] 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

[14] The term landscape in this context refers to the scenery or visual expression of the environment, Other non-visual components of the landscape, such as smell and sound, have not been assessed.

1994b). The Dryandra Woodland is within the Dryandra Uplands, which is a component of the Wheatbelt Plateau Landscape Character Type.

Within each Landscape Character Type, the scenic quality has been classed as high, moderate or low. This is typically based on diversity, uniqueness, prominence and naturalism of landform, vegetation and waterform within each type (CALM 1994b).

Dryandra's landscape is characterised by its diversity in vegetation (open woodland to closed heath) and landform (gentle valley slopes to abrupt breakaway areas), and its historic built components (the village and homestead sites). The visual quality of this landscape is a resource in its own right and should be considered concurrently with other values when management decisions are made.

29.2 Landscape Management

Landscape management is concerned with the management of land, vegetation and water resources so as to maintain or improve their visual quality. 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.

Table 9. Visual Management Guidelines.

VISUAL MANAGEMENT GUIDELINES
❖ Alterations to the natural landscape should be subtle, remaining subordinate to natural elements by borrowing extensively from form, line, colour, texture and scale found commonly in the surrounding landscape. ❖ Site-specific visual resource factors should be carefully identified and evaluated before any management activities are undertaken. ❖ Facilities and activities that utilise and yet disturb little of the natural environment should be encouraged, for example, walking tracks and small picnic sites. ❖ Degraded landscapes, e.g. gravel pits, should be rehabilitated after use. ❖ 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 utilised. ❖ Prescribed burning operations should incorporate prescriptions and techniques that minimise the visual impact.

Changes to the landscape continually occur. Whether visual changes are perceived as positive or negative depends on numerous factors, including the viewer's perception and position, view duration, view distance, landform, soils, aspect and type of landscape alteration. The ability of landscapes to absorb change without loss of scenic value also varies and depends on slope, soils and vegetation cover. Landscape management thus involves extensive broad scale and on-site analysis of these factors, project impact evaluation, and sensitive site planning, design and construction methods.

29. Visual Landscape

Key Points

- ❖ Sites or management activities currently requiring improved visual management include:
  - existing gravel pits;
  - recreation sites where there is undefined car parking and damage to vegetation from site associated use;
  - timber production operations in visually sensitive areas, such as along some roadsides;
  - additions to the village buildings where the scale, form, colours, materials and patterns do not effectively borrow or blend with the historical characteristics of the site;
  - the exotic plant species along Tomingley Road;
  - groups of unrelated signs which create visual clutter; and
  - clearing for line-of-sight from survey trig points.
- ❖ Alterations to natural landscapes often have an undesirable visual impact that can be avoided or minimised. Management operations within Dryandra should conform to the desired visual quality standards outlined in the Department's *Policy Statement No. 34 - Visual Resource Management on*

Lands and Waters Managed by CALM.

The objective is to ensure that all uses and management activities are planned and implemented to complement rather than detract from the visual qualities of Dryandra's landscapes.

This will be achieved by:

1. assessing and mapping the visual resource values of the Dryandra Woodland as time and resources permit;
2. ensuring sites or activities currently requiring visual management (see Key Points) are managed according to the guidelines outlined in Table 9;
3. ensuring government agencies, statutory authorities, lessees and Departmental contractors recognise the importance of visual resource management;
4. encouraging sensitive siting of facilities and signs, selection of site compatible materials and colours, revegetation with local native species, and careful planning and siting of utilities;
5. developing all signs in accordance with the Department's Sign Manual and encouraging the sensitive use of signs in areas adjacent to the planning area; and
6. utilising interpretive and explanatory signs before and during operations that alter the visual landscape.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

30. TOURISM AND COMMERCIAL OPERATIONS

Tourism

Dryandra Woodland is one of the central wheatbelt's key tourist attractions. In 2009-10 there were over 49,000 visitors to Dryandra Woodland, of which about 5000 visitor nights were spent at the village (see Section 28.1 *Overnight Stays*). This compares with estimated annual visitor numbers of 117,000 at Wave Rock (Hibbs *et al.* 1994), and just under 6,700 at Lake Dumbleyung in 2009/10 and 4,400 at Boyagin Rock in the same period, all of which are located in the central wheatbelt.

Although the structure of the vegetation in Dryandra lacks the dimensions of the typical forest tourist attractions in the south-west of the State, the planning area is still the key bushland resource in the central wheatbelt, and as such, provides the area with a substantial tourism product. The name 'Dryandra Woodland' gives this product a unique identity, distinguishing it from other forest tourist attractions, as does the Barna Mia facility which is also unique to the whole south-west of the State.

Visitors to the central wheatbelt may be classified into three principal groups:

- the fully accommodated tour market, characterised by both domestic and overseas visitors, who are visiting Dryandra as part of a total tour package;
- the independent, self-drive market, characterised by both domestic and overseas visitors, who either visit Dryandra as part of an overall itinerary or as an end-destination; and
- day trippers, principally from the central wheatbelt and Perth metropolitan area, who consist of both coach and self-drive travellers, who do not stay overnight at Dryandra.

The largest potential markets for Dryandra are day trippers from the central wheatbelt and short-stay visitors from Perth. Anecdotal information suggests that the future trends in tourism in Dryandra will be towards soft adventure (e.g. bushwalking) and nature-based tourism. Although these are quite different market segments, Dryandra should aim to cater for both audiences.

Commercial Operations

Commercial concessions can help meet the rising demand for high quality recreation and tourism opportunities, facilities and services, whilst ensuring that financial contributions help meet the costs of managing the resource. A commercial concession is a right granted by way of a lease or licence for occupation or use under appropriate conditions, of an area of land or water managed by the Department. The Department's Policy Statement No. 18 *Recreation, tourism and visitor services* (DEC 2006) governs conditions for commercial concessions. All commercial concessions require approval by the Minister for Environment.

Concessions must be consistent with the purposes of Dryandra Woodland and this management plan.

Lease or licence arrangements can be mutually beneficial to the Department, the commercial operator and the public. The Department can assist operators by helping to develop information and on-site experiences for their clients. Conversely, commercial operators may be able to assist the Department with management tasks, enabling staff to then perform additional tasks (e.g. guided tours). However, the Department may be directly involved in those commercial activities which are environmentally or socially sensitive, or are of important educative or interpretive value to visitors.

Commercial visitor services within Dryandra currently include the Dryandra Village accommodation (see Section 28.1 *Overnight Stays*) and numerous wildlife tours.

The Department's role in tourism will be to complement private enterprise by managing and presenting natural assets, providing access and information, and interpreting the natural environment. Private enterprise has the role of marketing tour opportunities, and catering for the transportation, accommodation and comfort needs of visitors (Shea and Sharp 1992).

30. Tourism and Commercial Operations

Key Points

- Dryandra Woodland has considerable potential for future tourism growth and commercial operators provided the following issues are addressed:
  - better access to Dryandra's natural environment and development of additional tourist attractions and activities. These factors are of prime importance to the area's potential to attract and retain visitors;
  - the provision of essential facilities and infrastructure, both public and private, which are required to adequately service existing tourists and sustain tourism growth; and
  - achievement of a balance between the provision of adequate access and preservation of Dryandra's natural environment, through implementation of appropriate management controls.
- It is Department policy to recover the costs of providing facilities and services to the public from users.
- The proposed central theme of Dryandra's interpretive and educational programs - 'biodiversity is essential to sustain each individual's quality of life' - could be incorporated into commercial tour operators' programs.

The objective is to provide a range of nature-based tourism opportunities in the planning area whilst minimising the environmental impacts.

This will be achieved by:

1. improving access for tourists to Dryandra's natural and cultural environment (see Section 27 *Visitor Access* and 28.3 *Scenic Driving and Sightseeing*);
2. developing a range of recreation opportunities to enhance tourists' experience of Dryandra (see Section 26 *Visitor Opportunities*);
3. upgrading the village area, including Old Mill Dam, and encouraging 'farm stay' type accommodation adjacent to Dryandra to better service the needs of tourists;
4. marketing Dryandra to attract a clientele that is appreciative of the natural environment. The main target audiences will include local communities, schools and universities, naturalists and nature-based tourists and others seeking passive recreation in a natural setting;
5. liaising with Tourism WA, particularly Australia's Golden Outback Region and the Central South Tourism Association to ensure Dryandra is viewed and promoted as an integral part of regional tourism;
6. designing and implementing educational programs and activities that promote the theme that 'biodiversity is essential to sustain each individual's quality of life', in consultation with the local community and tour operators;
7. developing guidelines, in consultation with operators, for groups and commercial tours, including:
   - maximum numbers of participants;
   - activities carried out in areas able to sustain such use; and
   - safety and environmental standards.
8. approving only those commercial concessions that rely on the special environmental qualities of the woodland;

9. issuing concessions (through leases and licences) to tour operators to supply appropriate visitor services. Where it is necessary to limit licences/leases, offer opportunities to operators according to criteria including experience, knowledge, willingness to contribute to management;
10. ensuring the Department is directly involved in those commercial activities which:
    - ❖ are of particular environmental or social sensitivity;
    - ❖ are of important educative or interpretative value to visitors; and
    - ❖ are likely to cause an overall financial loss to the department if conducted by concession;
11. ensuring that fees and charges for the provision of these services to users at least cover costs; and
12. monitoring the impact of commercial tours on the woodland environment, and taking appropriate action, such as limiting the number of tours, if Dryandra's values are found to be adversely affected.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART F. MANAGING RESOURCE USE

31. FOREST PRODUCTS

The Timber Industry

In the past, plantation mallet harvested from Dryandra supported the mallet bark industry and a number of local industries, including a tool handle manufacturer who produced about 100,000 handles each year, a small industry for the treatment and supply of fencing materials and licensed operators who cut both firewood and fencing materials.

Since the previous management plan the tool handle industry has ceased and other timber markets have declined. There is now just one licensed operator who cuts firewood and fencing material and two licensed operators who cut only firewood. Hence, the current timber industry at Dryandra is greatly reduced from what it has been in the past. It is still based on plantation brown mallet, although there has been interest shown in a range of wheatbelt species.

The decline of mallet as a tool handle and fencing product has restricted mallet timber to predominantly the local firewood market, and current trends (such as global warming and the future use of wood as a heating resource) indicate that production of mallet is likely to decline to a small volume firewood market based around Narrogin and surrounding towns (Conservation Commission 2007). There are possibilities for the production of other timber products, for example flooring, small saw logs and other species, and research and development into such products will continue.

Whilst the Dryandra timber industry is small in the State-wide context, it makes some contribution to the local economy and, potentially, has a role to play in the future development of commercial tree crops on cleared farmland.

In a future context, if demand for timber supply goes beyond the sustainable yield of Dryandra then use of private property will become all the more important. A demonstration integrated wood processing plant has been trialed at Narrogin to determine whether or not a commercially driven plant would be viable. Should such a plant go ahead it would be based on supply from mallee crops grown on farmland, but could possibly utilise any available residue timber from Dryandra.

Given the current limited demand for timber supply, the immediate aim for mallet production at Dryandra is to provide a resource to the existing firewood market, and to establish new markets. Over time, the aim is to progressively regenerate good mallet stands back to mallet and return poorer areas of mallet to natural vegetation communities. If new markets for mallet are established, the intent is to complement the existing mallet resource with the development of plantations on private land.

Timber Production

This management plan provides for the harvesting of plantation mallet from the woodland by a number of contractors.

Under the Forest Products Act the Forests Products Commission (FPC) is responsible for establishing, maintaining and managing plantations of forest products on public land. Section 58 of the Forest Products Act provides that production contracts can only be entered into by the FPC when the quantities and kinds of forest products and the location of the forest products proposed to be managed, harvested or sold under the contract are in accordance with the provisions of the relevant management plan. An FPC production contract cannot be entered into after the relevant management plan has ‘expired’, even though all other aspects of the plan remain valid. Consequently, once this management plan has been gazetted, FPC will be able to issue 10 year production contracts under the Forest Products Act for the commercial harvesting of plantation mallet.

This management plan complements the *Forest Management Plan 2004-2013* (FMP) (Conservation Commission 2004) where it relates to Dryandra. Should there be a conflict between this plan and the FMP, this management plan will take priority.

Mallet

In the first part of this century the bark of brown mallet (a valuable source of tannins) was a major export commodity. Naturally occurring brown mallet was heavily exploited, until there was concern for both the future of the species and the industry. Consequently, Crown reserves were set aside to protect natural stands of the species, and to provide a secure resource for future industry needs.

Plantations of brown mallet were established in Dryandra between 1926 and 1962 and now cover 8316 hectares (about 30 per cent of Dryandra). Of this area, 3430 hectares contains good quality mallet stands, 2812 hectares are more open mallet stands with a limited range of understorey species, and mallet establishment failed over the remaining 2074 hectares.

The failed areas now carry mixed vegetation including areas of wandoo, powderbark wandoo, rock sheoak, heath, and communities associated with rocky outcrops.

In Dryandra, natural mallet stands predominantly occur on the break-away slopes. The plantations were established on these sites and also on the broad valley slopes and floors. In the latter areas the original vegetation - generally wandoo and powderbark wandoo woodlands - has mostly been displaced.

Brown mallet is a major honey and pollen producer (see Section 35 *Beekeeping).*

Wandoo and Powderbark Wandoo

Over two-thirds of Dryandra is natural bushland consisting primarily of wandoo and powderbark wandoo woodlands. Since the early part of this century most woodland areas have been cut over for sawlogs, fencing material and firewood. Broadscale cutting of wandoo initially declined in 1967 with the closing of the sawmill in Dryandra, and later ceased in 1977 when most areas of Dryandra were no longer able to sustain wandoo timber production (Forests Department 1981). Since 1977 the wandoo woodlands have been managed primarily for flora, fauna and retention of landscape values, although about 20 tonnes per year of wandoo and powderbark wandoo were removed under licence between 1983 and 1989.

Currently, most local companies requiring wandoo obtain supplies from State forest in the Perth Hills district, where the larger areas of forest can sustain the supply.

Under this plan it is proposed that all future supplies of wandoo for companies near Dryandra will come from State forest in the Perth Hills district.

Minor Timber Species

There are a number of minor timber species in Dryandra that are likely to have been cut in the past, including sandalwood (*Santalum spicatum*), rock sheoak (*Allocasuarina huegeliana*), jarrah, marri, flooded gum (*Eucalyptus rudis*), York gum (*E. loxophleba*) and jam (*Acacia acuminata*). Commercial interest remains in some of these species.

Since 1931, 15 sandalwood experimental plots have been established in Dryandra Woodland. Many plants within these plots are still surviving and are a potential source of seed for future plantings. The Department has land in the Highbury area for the demonstration of the commercial and land conservation benefits of establishing sandalwood on cleared farm land.

The eventual transfer of the mallet resource on to private agricultural land is considered desirable in the long term given the extremely high conservation and recreation value of Dryandra, and the fact that its size and fragmentation make it difficult to manage because of the need to protect significant areas from disturbance, while at the same time maintaining a range of regeneration stages. Revegetation with woody perennial vegetation is critical to the long term sustainability of agriculture in the wheatbelt: the synergistic relationship between agriculture and deep-rooted commercial tree crops make the establishment of a commercial timber resource on freehold land within the next seventy years both desirable and economically feasible (see Table 10). If this is not so, then the sustainability of both the timber industry and large areas of agricultural land would have to be questioned.

In this context it may seem practical to phase out timber harvesting from Dryandra more rapidly. However, the industry is an important means of removing plantation mallet to make way for revegetation with natural species. Furthermore, the current plantations are essential for researching the commercial viability of mallet on agricultural land, an integral factor if the sustainable agriculture and nature conservation objectives previously discussed are to be achieved.

Table 10. Vision for Mallet Plantation Management

1st Rotation	2nd Rotation	3rd Rotation
'Poor quality' mallet (about 3500 ha) Harvest stands for mallet products then convert to natural vegetation (2100 ha). If regeneration consists of dense mallet stands, commercially thin or use prescribed fire to determine community composition. Re-establish 1400 ha of 'poor quality' mallet for second rotation.	Harvest stands for mallet products then convert to natural vegetation or third rotation if second rotation re-establishment was successful (1400 ha).	
'Good quality' mallet (about 4800 ha) Commercially harvest 'good quality' mallet and re-establish plantations. Research during first rotation: • silvicultural requirements of mallet to maximise yields; • properties and uses of mallet; • techniques for commercial mallet (and other species) establishment and silviculture on private property.	Commercially harvest and convert about 1300 ha to natural vegetation. If regeneration consists of dense mallet stands, commercially thin or use prescribed fire to determine forest composition.	
	Commercially harvest 2000 ha and re-establish mallet for third rotation.	Commercially harvest 2000 ha and review the need to regenerate to natural vegetation. If regeneration consists of dense mallet, commercially thin.
	Commercially harvest and re-establish a 200 ha mallet plantation to demonstrate silvicultural management necessary to produce range of products and benefits.	Maintain demonstration plantation.
	Assist with broad-scale establishment of mallet or other species on private land.	Increasing proportion of mallet on private land.

Note: Whether stands require third or more rotations to be determined on the success or otherwise of the proposed rotations stated above.

Firewood

Public firewood collection is an established use at Dryandra and there is still a small local firewood market. The removal of firewood can have detrimental environmental impacts including the reduction in habitat integrity, loss of vegetation cover, spread of disease, changes to nutrient balance of ecosystems and disturbance of soils by people collecting firewood. Off-road driving associated with public firewood collection can increase the risk of spreading plant diseases, lead to soil compaction, and damage understorey vegetation.

Firewood can be taken from public firewood areas on State forest and timber reserves declared under Part 15 of the *Forest Management Regulations 1993* and section 128(1)(d) of the CALM Act. The Forest Products Commission is responsible for administering commercial firewood collection.

31. Forest Products

Key Points

- Contractors operating in the south-west forests were issued with ten year licences in 1995 to coincide with the term of the Forest Management Plan. However, those in Dryandra currently operate under contracts with a five year tenure, most of which terminated during 2005. Greater resource security, improved industry management and integration with conservation objectives could be achieved by issuing licences for up to ten years to about coincide with the duration of this management plan.
- This management plan provides the broad framework for the future direction of the timber industry at Dryandra. However, operational and technical details need to be developed.
- Trends have continued to emerge that indicate there may be opportunities to establish local woody species on cleared farmland. These trends include:
  - an increasing awareness that woody perennial vegetation can ameliorate land degradation;
  - the need to diversify sources of farm income;
  - the increasing interest in using woody vegetation as a substitute for non-renewable or environmentally damaging substances; and
  - the increasing concern over the introduction of exotic, woody weeds.
- There is broad agreement that ecologically sustainable land-use is crucial to the long term viability of agriculture in the wheatbelt. To achieve this goal it is vital that extensive revegetation occur on cleared farmland to counteract land degradation. At the same time, it is clearly more attractive to property owners if revegetated areas can produce a direct cash return, e.g. sandalwood and oil mallees.
- The use of mallet plantations by native vertebrate animals is influenced by the age of the plantation, the amount of regrowth other than mallet and the inclusion of natural vegetation isolates or rocky outcrops (Ninox 1991). Older mallet stands with a relatively large number of regrowth wandoo and powderbark wandoo, support a greater diversity than young, uniform stands.
- There is a need for extensive research into the conversion from mallet back to natural vegetation stands.

The objective is to provide a timber resource with the long term aim of converting some areas of mallet to original woodlands, whilst promoting the value of local native species in sustainable farming.

This will be achieved by:

1. permitting FPC to enter into production contracts for mallet harvesting from the plantations within Dryandra Woodland for up to ten years to coincide with the life of this management plan;
2. producing a plan, in conjunction with the FPC, for the experimental production and conversion of mallet plantation areas;
3. liaising with the FPC regarding the development of other timber products;
4. demonstrating how the establishment of commercial plantations of suitable native perennial trees can be integrated with surrounding agricultural land uses to benefit landowners, the timber industry and the environment;
5. ensuring that timber harvesting operations are conducted in accordance with the Department's Visual Resource Management guidelines to reduce aesthetic impacts;
6. continuing to follow, in all operations, the hygiene practices outlined in the Department's Dieback Hygiene Manual (CALM 2000);
7. supporting research with the aims of increasing the yield and quality of mallet, and determining the properties and uses of mallet; and
8. promoting and supporting the future development of plantations on private land.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

32. MINERAL EXPLORATION AND DEVELOPMENT

Legislative Framework and Government Policy

Mining[15] on land and waters managed by the Department is subject to the Mining Act, the Petroleum and Geothermal Energy Resources Act, the Environmental Protection Act, the Wildlife Conservation Act and various State Agreement Acts. The Environmental Protection Act takes precedence over most other acts.

The Department of Mines and Petroleum (DMP) administers the Mining Act and the exploration for and subsequent development of minerals in Western Australia is undertaken through the granting of various tenements including prospecting licences, exploration licences, general purpose leases and mining leases. DMP also administers the Petroleum and Geothermal Energy Resources Act and the exploration for and subsequent extraction of petroleum resources is undertaken through the granting of exploration permits and production licences. The holders of such tenements, permits and licenses are required to meet conditions to retain the right to explore and develop. The consent of the Minister responsible for the Mining Act or Petroleum and Geothermal Energy Resources Act is required for issuing various tenements, permits or licences.

Under the Mining Act the specific processes for approval of mining proposals on land managed under the CALM Act are dependent on the classification of the reserves under the Land Administration Act. Sections 24, 24A and 25 of the Mining Act define Ministerial responsibilities for approving mineral exploration and development on various lands and waters of the State. Relevant to the planning area, the granting of a mining tenement or petroleum permit or licence is:

1. subject to the concurrence of the Minister for Environment and approval of both Houses of Parliament for:
   - class A reserves (conservation parks or section 5(1)(g) and 5(1)(h) reserves) within the South West Land Division or the local government districts of Esperance or Ravensthorpe;
   - national parks across the State;
   - class A nature reserves across the State;

2. subject to the Minister for Environment being consulted for:
   - non class A land (nature reserve, conservation park and 5(1)(h) and 5(1)(g) reserves) across the State.

3. subject to the concurrence of the Minister for Environment for:
   - State forest and timber reserves within the South West Mineral Field.

As of 8 July 2004, the Environmental Protection Act now provides for the protection of native vegetation and control of clearing. Any clearing of native vegetation will require a permit under Part V of the Act except where exemptions are granted under Schedule 6 of the Act or prescribed by regulation in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. For the mineral and petroleum industries, applications for any clearing associated with their exploration, production or development activities will require a permit in all cases except where granted an exemption.

The Conservation Commission provides advice to the Minister for Environment with regards to all mining tenement applications for all reserves.

The document, *Guidelines for Mineral Exploration and Mining within Conservation Reserves and other Environmentally Sensitive Areas* (DME 1998), outlines the procedures and conditions to be applied to applications for mining tenements. Under a 2004 MOU between the former DoIR and the EPA, all development type mining proposals within two kilometres of a national park, marine park, State forest or proposed conservation reserve will be automatically referred to the EPA for assessment.

In 2006 the EPA released Position Statement No. 9 *Environmental Offsets* (EPA 2006). Should mining or petroleum tenements be approved in proposed conservation estate, these should be subject to the principle of environmental offsets. Under the Mining Act there is an expectation that areas disturbed by mining should be rehabilitated and the costs borne by the organisation(s) responsible for the activity.

[15] Mining includes exploration, fossicking, prospecting and mining operations.

Mineral Prospectivity

DMP have assessed the northern part of Dryandra Woodland and report that the area potentially containns bauxite resources. DMP have assessed the southern part of Dryandra Woodland and report that the area contains no mineral occurrences or resources although the westernmost area is subject to an exploration licence application and has potential for gold, nickel and base metals. Any future proposals to explore or mine in Dryandra will be assessed in accordance with the Mining Act, the Environmental Protection Act and government policy, including the *Guidelines for the Application of Environmental Conditions for Exploration and Mining on Conservation Reserves and Other Environmentally Sensitive Land* (DOME 1994).

32. Mineral Exploration and Development

Key Points

- Applications to mine in the planning area are subject to the Mining Act, the Petroleum Act, the Wildlife Conservation Act, Environmental Protection Act and approval of relevant Ministers.
- Generally, national parks are not available for new mining or petroleum development.
- Mining is not permitted in national parks or class A reserves unless approved by both Houses of Parliament.
- Mineral and petroleum exploration and development within or adjacent to the planning area can potentially have a significant impact on nature conservation, recreation and tourism, and cultural values.
- The potential for mining in Dryandra is a key constraint in the conversion of parts of the State forest to national park and nature reserve status (as identified on Maps 2a and 2b).

The objective is to protect the values of the planning area whilst minimising the environmental impacts from mineral exploration and development.

This will be achieved by:

1. continuing to implement government policy on mining, including the *'Guidelines for the Application of Environmental Conditions for Exploration on Conservation Reserves and Other Environmentally Sensitive Land*' (DOME 1994);
2. ensuring that if exploration or mining is approved, it is subject to conditions that will minimise impacts on the biological, physical, cultural, and landscape values of the woodland, and that rehabilitation is to Department and DMP specifications and at the proponent's expense; and
3. continuing to liaise with DMP to achieve changes to the tenure of areas of Dryandra Woodland (as outlined on Maps 2a and 2b).

Key Performance Indicators:

There are no Key Performance Indicators for this section.

33. BASIC RAW MATERIALS

Gravel, sand and rock aggregate are needed for road construction and maintenance, and recreation site development. Supplies of these materials have been obtained from within Dryandra in the past by the department, local shires and other government departments. All gravel pits no longer required have been rehabilitated by the Department.

Traffic volumes in Dryandra are insufficient to warrant sealing of any roads, and hence there will be an ongoing requirement for gravel for road surfacing and maintenance.

Access to basic raw materials within the planning area will be subject to the Department's Policy Statement No. 2 *Local Government Authority Access to Basic Raw Materials from State Forest and Timber Reserves* (under review) and the Conservation Commission's Policy Statement 3 *Basic Raw Materials: Government and Local Government Access to Conservation Estate (National Parks, Nature Reserves and Conservation Parks)* (Conservation Commission of WA 2006). Extraction will be permitted where the use of material assists in the protection and management of the area, a more environmentally acceptable alternative is not available and where material is used within the boundaries of the planning area. To minimise disturbance to conservation areas, alternative sources of basic raw materials, located outside the planning area, are preferred. Where extraction of basic raw materials does occur, natural values of the planning area can be maintained by:

- siting pits only in vegetation communities that are adequately represented and with the lowest conservation values;
- siting pits in areas that are protectable from dieback disease introduction and spread;
- applying best practice management in accordance with the Department's dieback disease hygiene manual;
- applying best practice rehabilitation following extraction (see Section 33 *Rehabilitation*); and
- restricting access to pit sites by unauthorised users.

Extraction by Shires is regulated under the *Local Government Act 1995* and the Mining Act for individuals. Under the Mining Act, consent from two Houses of Parliament and assessment by the Environmental Protection Authority may be required before extraction of basic raw materials can take place in Class A reserves (which include national parks and conservation parks).

33. Basic Raw Materials

Key Points

- Raw material extraction and movement can be a major source of plant fungal disease and it is, therefore, important that dieback hygiene procedures are used.
- The major roads in Dryandra will require maintenance over the life of this management plan. The continuing redevelopment and maintenance of these roads will become an increasing financial burden for the Department.

The objective is to protect the values of the planning area whilst minimising the environmental impacts from basic raw material extraction and development activities.

This will be achieved by:

1. ensuring requests for gravel, sand and stone from State forest areas of Dryandra are in accordance with Department Policy Statement No. 2 *Local Government Authority Access to Basic Raw Materials from State Forest and Timber Reserves* (under review);
2. in accordance with Conservation Commission policy, permitting access to basic raw materials from nature reserve or national park areas where the road or facility is within the boundaries or road reserve enclave of the reserve or national park;
3. ensuring that where the material is for use on areas or easements not managed by the Department, all biological survey and dieback assessment and related costs are borne by the authority accessing the material;
4. using, wherever practicable, materials for road construction and maintenance that visually blend with the surrounding soils;
5. ensuring an up-to-date hygiene map is available before raw materials are extracted. Materials infected with plant fungal disease will not be used on disease-free-sites and all quarries will have strictly controlled access;
6. ensuring that conservation values, particularly threatened plants or Aboriginal sites, are not disturbed by extraction of materials; and
7. rehabilitating all pits according to Department guidelines as soon as extraction of materials is complete.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

34. REHABILITATION

The Department's Policy Statement No. 10 *Rehabilitation of disturbed land* (CALM 1986) 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 unnecessary disturbance;
- disturbance followed by 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 (including landscape values) and help to enhance all potential uses provided the priority uses are not adversely affected.

In cases where other agencies/organisations have been responsible for disturbance within the planning area, it is the Department's policy that those agencies are responsible for rehabilitation to a suitable standard, and at their own expense.

Disturbance is defined as any activity or process producing, or likely to produce, long-term degradation of habitats and ecosystems. Rehabilitation includes the processes necessary to return disturbed land to a predetermined landform and vegetation condition, land use or productivity.

Rehabilitation may be required for mined gravel pits, species trial plots, road works, previous silviculture activities, track closure, recreation site closure or redevelopment, or activities associated with fire suppression. To ensure that rehabilitation works have the greatest degree of success as well as limiting the introduction of exotic plants, local native species should be used.

Rehabilitation that has been undertaken in Dryandra over the past few years includes that of:

- failed mallet plantations and areas of non-local plants (which have been converted to communities of original species);
- gravel pits and some tracks that were no longer required; and
- parts of the village field not required for recreation purposes.

34. Rehabilitation

Key Points

- The methodology for converting mallet plantations to woodland consisting of original species has not been developed and the impact of the process on the threatened fauna has not been assessed (see Section 31 *Forest Products*).

The objective is to rehabilitate disturbed ecosystems to a stable condition that resembles as close as possible the natural ecosystem structure, function and/or processes, thereby improving resilience to future disturbances.

This will be achieved by:

1. managing Dryandra, as far as practicable, to avoid unnecessary disturbance, with rehabilitation being the last option in a series of management decisions designed to protect Dryandra's values;
2. minimising the area and degree of disturbances associated with planned activities (e.g. recreation site development - see Table 7), and specifying rehabilitation requirements;
3. preparing and implementing rehabilitation prescriptions for all disturbed areas as resources permit. Natural regeneration is the preferred method of rehabilitation and, where necessary, steps should be taken to encourage it. Where natural regeneration is not possible, species of local provenance should be planted, with restoration as far as practicable of the original species diversity and composition;
4. ensuring that, whenever possible, the cost of rehabilitation is borne by the agency responsible for the disturbance;
5. liaising with mining companies, government departments and other land users to ensure an exchange of ideas on the latest techniques and standards in rehabilitation;
6. investigating techniques for converting the selected areas of mallet plantation to communities of original species, and monitor the effects on fauna; and
7. monitoring rehabilitation programs to ensure that the aims are being achieved, and to ensure that improvements are incorporated.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

35. BEEKEEPING

The honey bee was introduced into Australia midway through the nineteenth century (see Section 19 Introduced and Other Problem Animals). Commercial beekeeping has since developed into a small but significant industry in WA, with an average total income of $9.3 million annually for honey production, and a total worth (including pollination of agricultural and horticultural crops) of about $120 million per annum (Manning 1992). The WA Department of Agriculture and Food has calculated the value of apiculture dependent on Dryandra to be in excess of $125 000 in an average year (CALM 1995).

Commercial beekeeping involves the short term placement of managed populations of the introduced honeybee (*Apis mellifera*) into areas of land to take advantage of the availability of nectar or pollen. Beekeepers have traditionally relied on large areas of native vegetation for honey production and are increasingly dependent on lands managed by the Department.

All apiary sites on Crown land in WA (including land not managed by the Department) require a permit from the Department. Beekeepers are also required under the *Beekeepers Act 1963* to register with the Department of Agriculture and Food.

At the time of publication there are 51 apiary sites in Dryandra, managed by 20 registered beekeepers. There are also an additional 20 sites in the surrounding area that are dependent on the woodland. Each apiarist usually has a network of sites between Geraldton and Albany and moves the hives according to nectar flow cycles of between two and eight years. Hence many apiary sites in Dryandra are used only infrequently. Within Dryandra, brown mallet is an important producer of honey and pollen.

There has been considerable debate over the possible environmental effects of honeybees on the Australian biota, especially in relation to managed apiary operations in national parks and nature reserves. Environmental concerns have focused on:

- the effects of competition for nectar and pollen between honeybees and native pollinators;
- the efficiency of pollination by honeybees; and
- the displacement of native birds and mammals from nesting hollows by feral colonies.

While it is recognised that feral honeybees are more of a threat to the values of conservation reserves than managed honeybees, there is little knowledge about the range of conditions under which honeybees leave the hive and become feral.

Beekeepers argue that commercially managed hives are only placed where there are abundant nectar resources: there is little point placing them elsewhere. Certainly, nectar flows in some eucalypt species can be so heavy that nectar drips from the blooms in excess (Anderson 1989). As such, any competition with native species is reduced. However, research by Paton (1990) and Pyke and Balzer (1985) has shown that honeybees do compete for nectar when floral resources are low. Paton found that feral bees could remove up to 90 per cent of the nectar and pollen produced by several native plants, and stated that interactions between honeybees, native pollinators and native plants are likely to be deleterious to the native species. Paton (1993) also states that forage behaviour can lead to the inefficient pollination of some native plants. Honeybees forage over smaller areas and transport pollen over shorter distances than native pollinators, thus decreasing the potential gene flow between plants. However, it is also possible that honeybees have a positive effect on native flora, particularly on small reserves where native pollinators have largely disappeared (Paton 1993).

Department Policy

The management of apiculture on Crown land is guided by the Department's draft (revised) Policy Statement No. 41 – *Beekeeping on public land*. 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[16], at least until a management plan has been prepared. In this instance, the Department and the Conservation Commission, 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 ecological and management criteria (see Appendix 5).

The Department recognises the value of the beekeeping industry to the State's economy and seeks to continue its relationship with the apiarists within the planning area in a sustainable manner. The Department will take a precautionary and pragmatic approach with regards to allowing beekeeping in conservation reserves.

When allowing an introduced pollinator to persist within a conservation reserve, the dynamics between the native pollinators (which include mammals, birds and insects) and the native flora need to be considered. The planning area has been assessed using environmental and management criteria, adapted from the draft policy, in terms of the values that may be impacted by honeybees (see Appendix 5). Predicted interaction between apiary sites and threatened flora and significant habitats and communities within Dryandra Woodland, and on Crown

[16] Lands reserved primarily for nature conservation includes national parks, conservation parks, nature reserves and section 5(1)(g) and (h) reserves.

land within two kilometres of the planning area boundary, has been made by the Department and based on the best available knowledge.

The suitability for apiary sites and the predicted impact between honeybees and values is classified into three classes, which are:

- 'suitable' for apiary sites;
- 'suitable but conditional'; or
- 'highly constrained'.

The Department's management approach for each category is shown in Appendix 5. The assessment has shown that there are no highly constrained sites within Dryandra, and that 29 sites are suitable and 22 are suitable but with conditions imposed. None of the sites located within the two kilometre buffer impact on values of the planning area.

Of the sites assessed as 'suitable but conditional', several are located in proximity to recreation areas. A site by site assessment is needed to determine if they need to be relocated.

If there are any changes to the allocation of apiary sites in the planning area, or to the methodology applied above, the Department will re-assess the classification and take action accordingly.

35. Beekeeping

Key Points

- Beekeeping is a significant industry in the south-west and throughout WA.
- Commercial beekeepers have always relied heavily on large areas of native vegetation, and are increasingly dependent on lands managed by the Department.
- There are 51 apiary sites in the planning area and a two kilometres surrounding area.
- The planning area has been assessed as being either suitable or suitable but conditional for apiary sites based on environmental and management criteria.
- There are no highly constrained apiary sites within Dryandra.

The objective is to minimise the impacts of commercial honeybees on key values while supporting the beekeeping industry.

This will be achieved by:

1. managing apiary sites according to relevant Departmental policies, thus:
   - maintaining existing apiary sites within Dryandra; and
   - managing apiculture by designating access routes, supervising field activities (including applying dieback hygiene principles) and reviewing site management.
2. reviewing the apiary analysis for the planning area as required and/or if there are any changes to sites, to determine whether access for beekeeping is either retained at the current level, increased, decreased or phased out based on environmental and management criteria (see Appendix 5);
3. renewing apiary permits, with additional conditions as required, and considering alternative sites, transfer of sites, cancellation or relocation of sites in accordance with the assessment criteria;
4. not permitting any new sites within the planning area;
5. requiring industry to control feral bees within the planning area where possible (see Section 20 *Introduced and Other Problem Animals*);
6. liaising with beekeepers (including through the Beekeepers Consultative Committee) and the Department of Agriculture and Food to ensure the most efficient and sustainable use of sites;
7. supporting research on the impact of beekeeping on biodiversity and adapting management to incorporate new knowledge; and
8. monitoring apiary use within the planning area and any corresponding impacts within the areas identified as suitable but conditional.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

36. PUBLIC UTILITIES AND SERVICES

Public utilities and services within the planning area are significant to local and regional communities. Utility corridors often link various electricity, gas, telecommunication and water service networks to private property that may be surrounded by the planning area, or traverse Crown lands to shorten the route for these services to other nearby towns.

The many utility and service easements in the area impinge on Dryandra Woodland. These include the Wandering - Narrogin and York - Williams roads, and communications cables, water supply pipes and powerlines servicing the Dryandra Village.

The construction and subsequent maintenance of utility and service infrastructure and all associated access routes within or around conservation reserves can result in a number of significant management problems depending on their location and type. Consequently, the location of structures should preferably be directed outside the planning area. The use of already degraded areas, pre-existing utility corridors and co-location with existing infrastructure (i.e.. clustering facilities) are also considerations that will be encouraged by the Department.

This management plan provides for continuation of existing utility and service arrangements. The Department's and Conservation Commission's preference is that utility infrastructure not servicing the planning area itself is accommodated outside of the planning area. In instances where accommodating utility service developments within or adjacent to the planning area is acceptable, or undesirable but nonetheless unavoidable, the Department will generally seek to ensure the utility or service provider has considered, and implemented where possible, mitigation measures for the following impacts:

- physical (e.g. soil erosion and landform degradation);
- biological (e.g. introduction and spread of weeds and pathogens as well as disturbance to native flora, fauna, significant habitats and ecological communities);
- visual (e.g. loss of visual amenity through clearing of native vegetation);
- operational (e.g. additional access routes requiring management); and
- social (e.g. potential to impact on recreation and cultural heritage).

The Department will continue to identify, assess and monitor any future developments/ proposals that may impact on the values of the planning area. However, where proposals are likely to have a significant adverse impact on the environment, they will be referred to the Environmental Protection Authority for formal environmental impact assessment (and the imposition and monitoring of environmental conditions) under the Environmental Protection Act.

36. Public Utilities and Services

Key Points

- The provision of service and utility corridors and the associated clearing of land has had a direct impact on Dryandra's environment and landscape values. There is also a risk that disease and weeds will be spread, while cleared areas improve access for feral animals.
- Native fauna, in particular the numbat and woylie, are at risk from traffic along major roads.

The objective is to minimise the impacts of public utilities and services on the key values.

This will be achieved by:

1. encouraging the placement of any new utility corridors outside of Dryandra or along existing access routes, and encouraging alternative, low impact methods of providing services, for example underground cables;
2. ensuring that strict dieback disease hygiene conditions apply when maintenance of utilities and corridors is undertaken; and
3. referring any new proposal for utility corridors through the woodland to the Environmental Protection Authority.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART G. INVOLVING THE COMMUNITY

37. INFORMATION, INTERPRETATION AND EDUCATION

An effective information, interpretation and education program is an essential component of management. It informs the public of the values, facilities and recreational opportunities available and provides an avenue for greater understanding of the natural environment and its management.

Information

Information on the planning area's facilities, attractions, activities, access, regulations, code of care and costs is provided by the Department through signage, printed materials (e.g. books, brochures), the Department's internet website (*NatureBase)*, Department staff and volunteers. Information is also widely available from other external sources including tour operators and the tourism industry. The delivery of consistent and accurate information by both internal and external providers is important in protecting the key values of the planning area and achieving effective communication.

Interpretation

Interpretation is the craft of enriching visitor experience and fostering appreciation of a place's values. It is an interactive process involving the visitor, the interpretive medium and the setting. Interpretation is a means of communicating ideas, feelings and information and an opportunity for translating stories of places, the biota and people in terms that motivate and inspire visitors to greater understanding and care. Interpretation planning is an integral component of planning for visitor use.

Interpretive Themes

Dryandra Woodland, with its conservation and recreation values, and agricultural setting, has a diversity of natural and cultural values and land uses. These factors, and steady growth in visitor numbers, have increased opportunities to promote the principle that 'the maintenance of natural biodiversity is essential to sustain each individual's quality of life' - that is, if humans conserve and respect the richness, integrity and stability of their biological and physical environment, ecosystems will remain healthy and sustain the activities of humans and other life forms. This basic tenet has been adopted as the theme for current and future education, interpretation and information programs within Dryandra. Components of this theme include nature conservation, visitor use, Aboriginal culture, sustainable timber production (including agroforestry) and agriculture.

Relevant subjects for such programs include sustainable land use, maintenance of biodiversity and ecological processes, minimal impact recreation and cultural heritage issues.

The most recent visitor surveys indicate that Barna Mia is the most visited recreation area in Dryandra (CALM 2005a), making it an important and valuable resource for informing and educating visitors about Dryandra's key values. Barna Mia is home to some of WA's threatened fauna, including the bilby, boodie (burrowing bettong) and Western barred bandicoot. It provides visitors with the opportunity to view a number of rare native mammals in a natural setting, and learn about 'Western Shield', the Department's wildlife conservation program. Visitors to Barna Mia participate in a media presentation followed by a guided night walk spotlighting for these small animals and observing them as they feed.

Education

Education is a series of linked learning programs developed with defined outcomes in mind. Education programs including presentations and organised field activities are targeted at specific user groups to facilitate learning and foster greater appreciation and understanding of the area's key values. The planning area provides a base for a range of opportunities for education programs for schools in the region, and the Department often liaises and is involved with local schools.

The Department runs a number of education programs, specifically for schools, including fauna monitoring and radio tracking and a presentation on flora and fauna conservation and land management. Dryandra's educational program aims to promote the principle that the maintenance of biodiversity can sustain our quality of life.

Programs at Dryandra will complement related themes to be developed in the Department's Great Southern, Yilgarn and Avon-Mortlock Districts.

37. Information, Interpretation and Education

Key Points

- Without an effective communication program that includes information, interpretation and education, achieving management objectives for Dryandra becomes increasingly difficult.
- An effective communication program provides enriching visitor experiences and fosters appreciation of an area's values and the need for their protection.
- Information about Dryandra needs to be integrated with other Wheatbelt Region conservation reserves, to avoid unnecessary repetition.

The objective is to promote community awareness, understanding and appreciation of the values of the planning area to engender support for their protection and effective management.

This will be achieved by:

1. providing information to visitors on the key values and management issues within the planning area such as wildlife interactions, visitor safety and appropriate visitor activities and behaviour;
2. ensuring that external providers such as volunteers, commercial operators and the tourism industry, have relevant and factual information and interpretive material about the planning area;
3. providing for visitor interpretation of the primary themes of the planning area;
4. maintaining existing information at Dryandra and further developing information at Old Mill Dam and Congelin day use sites and Congelin campground;
5. ensuring all signs, including those erected by the Lions Club, meet the standards of the Department's Signs Manual;
6. continuing to design and implement educational programs and activities that promote the themes identified previously, by:
   - providing teaching kits and resource information that can be used for environmental education programs;
   - maintaining the Irabina Study Centre as a venue for education programs; and
   - providing instructional courses on recreational activities and ecology.
7. focussing interpretation and education programs at Barna Mia, Dryandra Village, the Old Mill Dam, Congelin campground and the Irabina Study Centre;
8. providing interpretation of the main themes at designated sites, such as look-outs and drive and walktrails, which includes nearby attractions, vegetation, landforms and fauna;
9. liaising with the relevant groups, e.g. tour operators, when preparing audience-specific programs;
10. maintaining a 'user-pays' system for seasonal interpretative activities programs;
11. training staff and, where appropriate, volunteers in the principles and procedures of public communication, and the planning and effective presentation of nature interpretation programs;
12. seeking funds and resources for educational programs and activities from federal and State Government, the corporate community (e.g. sponsorship) and the private, non-profit sector (e.g. volunteers); and
13. developing communication plans for major management issues which identify objectives, target audiences and channels of communication.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

38. COMMUNITY INVOLVEMENT AND VOLUNTEERS

Community involvement is action-oriented opportunities for people to participate in Departmental programs developed to maintain ongoing community support and participation. Community involvement is an integral part of the Department's operations and the implementation of this management plan. A key objective for the Department is to develop community awareness and appreciation of the State's natural environment and

biodiversity and promote community involvement in and support for its protection and conservation. The community, as groups or individuals, is encouraged to be involved in both the planning and management of many of Department's activities, including volunteer programs.

The involvement and support of Aboriginal people, adjacent landowners and managers, visitors, tour operators and interest groups is important to the conservation of Dryandra's key values and in providing more effective and integrated management of issues that are influenced by activities beyond the boundaries of the reserve (e.g. fire, weeds and introduced animals). Working together with Aboriginal people to 'care for country' will assist heritage preservation and conservation of the environment, as well as enrich cross-cultural awareness.

Dryandra's Neighbours

Ongoing support for the management of the planning area from Dryandra's neighbours, and their understanding of the associated issues, is a key aspect in the implementation of this management plan. A greater understanding of the management issues will enhance integrated land management, which is particularly important where such issues go beyond the boundaries of both Dryandra and its neighbouring private properties.

Dryandra has a high boundary-to-area ratio and hence, with such a large amount of adjacent land, there is greater potential for conflicting management issues on both sides of the fence. Principles for effective neighbour relations, outlined in the Department's *Good Neighbour Policy* (DEC 2007a), are important for developing partnerships with the community, and in particular neighbouring land holders. The Policy addresses issues such as fences line construction and maintenance, management of vegetation along fence lines, fire management, control of weeds and introduced pest animals, stock on Department-managed lands, kangaroo management and access to Department-managed lands.

Changes in land use on adjoining properties, particularly proposed sub-divisions, need to be carefully considered with regards to potential impacts on Dryandra's values and the implications on future management, for example the resultant changes to fox baiting regimes.

Volunteers

The Department has traditionally welcomed support from volunteers. Not only does the Department benefit from these activities, but the volunteers also gain meaningful and enjoyable experiences in an area of interest. The community benefits from volunteer programs through the added level of environmental management, and an improved level of services in the form of information and education.

The Department's *Policy Statement No. 15 – Community Involvement (Public Participation and Volunteers)* (CALM 1991) outlines initiatives to provide more volunteer opportunities and training to both volunteers and Departmental staff in the management of volunteers.

Community members are encouraged to take part in volunteer activities in the planning area such as conducting visitor surveys, clean up days, campground hosting, weed removal, and research and monitoring programs. Volunteer activities not only increase the Department's work capabilities and skills base, but also foster communication links and understanding with the community.

38. Community Involvement and Volunteers

Key Points

- Community involvement and support is an integral part of the Department's operations and critical to the successful implementation of this management plan.
- There are several land management activities of mutual concern to the Department and its neighbours which require effective neighbour relations.
- The Department supports voluntary activities, which, in turn, contribute to the protection of key values of the planning area, building community awareness, understanding, appreciation and commitment, and the achievement of management objectives
- Government agencies whose influence extends up to the boundaries of, or into, Dryandra must recognise they can play an important role in the protection of Dryandra's environment.
- Rationalisation of the woodland boundaries is an important step towards alleviating problems caused by Dryandra's high boundary-to-area ratio (see Section 9 *Existing and Proposed Tenure*).
- On-going liaison between the Department and local communities is essential.

The objective is to facilitate effective community involvement in the management of the planning area.

This will be achieved by:

1. liaising with adjoining landowners, Land Conservation District Committees, local authorities and government departments to ensure that, as far as possible, land management is integrated across the landscape;
2. promoting on-going bush fire liaison with FESA, shires, local Bush Fire Control Officers and brigades;
3. encouraging Shires and the local community to take responsibility for weed control, feral animal control and visual resource management on adjoining lands;
4. continuing to inform the community about the values of bush corridors and roadside reserve initiatives, and of fox baiting programs;
5. promoting and providing advisory services to local communities on issues impacting on Dryandra;
6. continuing to provide and promote opportunities for involvement of interested community members in the management of the planning area including local Aboriginal people, neighbours, local government authorities, relevant government agencies, various advisory committees and other stakeholders; and
7. continuing to support volunteer involvement in Department programs, e.g. department Bush Rangers, 4WD clubs.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART H. RESEARCH AND MONITORING

39. 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 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 Division, principally through Visitor Satisfaction Surveys, the Visitor Statistics Program and the Nature-based Tourism Research Reference Group.

Fauna monitoring is undertaken in Dryandra in accordance with the guidelines of the Western Shield Fauna Recovery Program, which is designed to provide a consistent approach across the south-west. Monitoring of fauna is also undertaken by the District, collaboratively with the Department's Science Division, as part of the Return to Dryandra program.

Research Requirements

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.

Dryandra Woodland offers many opportunities for research, both to enable better management of its biological, cultural, recreational and economic resources, and to provide information about the natural environments in the central western wheatbelt of which it forms an important remnant.

Monitoring is necessary to measure changes over time. At Dryandra, the effect of management actions, timber harvesting and climate change should be monitored in order to provide early warning of significant changes and allow management response.

The woodland has already provided the location for a significant body of research. This has been carried out in Dryandra for a number of reasons. These include:

- the fact that Dryandra is the largest remnant of native vegetation in the central western wheatbelt, and provides the best example of the natural environment in that region. Several studies have been based there (Serventy 1970 - woodland ecology; Mc Arthur *et al.* 1977 - soil and landforms; and P. Brown pers comm. - Wandoo dieback);
- Dryandra possesses significant populations of several species of rare fauna. Research has included studies on the numbat (Calaby 1960, Friend 1990a and 1990b) and woylie (Kinnear 1992 and DEC 2008);
- research required to provide information to assist in the management of Dryandra itself (Butler 1965, Burbidge 1977, Christensen 1978, CALM 1985, and Ninox Wildlife Consulting 1991); and

- the proximity of the woodland to Perth, availability of accommodation, and the pre-existing body of knowledge have made Dryandra an ideal location for student field studies (Majer 1985, L. Thomas pers comm.).

Inventory, research and monitoring projects should give priority to those values identified as being most at risk (sensitive to disturbance) and to management practices most likely to have adverse social and ecological impacts. Such projects should involve volunteers and educational institutions, as well as Department staff, thus helping to provide information to the broader community and reducing costs.

39. Research and Monitoring

Key Points

- Research and monitoring are important components of management, and are required to effectively implement and measure the success of this management plan.
- 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.
- Dryandra Woodland offers many opportunities for research as part of the Department's Western Shield program and the Return to Dryandra fauna recovery program, as well as social research as part of the department's Visitor Survey Program.
- Departmental research and monitoring activities in Dryandra are subject to a prioritisation process for research across the entire State.
- There is no known bibliography of the published literature for Dryandra Woodland.

The objective is to increase knowledge and understanding of the values of Dryandra Woodland and threats to these so as to provide for better management and allow assessment of this management plan

This will be achieved by:

1. conducting integrated research and monitoring programs that facilitate management of Dryandra, with a focus on key issues and values identified in this management plan, the establishment of baseline information for future auditing, and other Departmental research priorities;
2. developing a bibliography for Dryandra Woodland and ensuring relevant information gained through broader Departmental research, monitoring and experience is also stored in regional and district office libraries/databases, updated when required, and used, where necessary, to modify management practices;
3. developing and maintaining a database of historical, current and required research on the planning area;
4. incorporating research and monitoring findings into interpretive and educational material where appropriate;
5. encouraging and supporting, wherever possible, external agencies and individuals where their research contributes directly to Departmental strategies or the implementation and auditing of this management plan;
6. ensuring that research and monitoring activities do not adversely impact on the values of the planning area;
7. pursuing external funding sources to assist in achieving research and monitoring objectives;
8. continuing to require all researchers to make their findings readily available to the Department and the public;
9. encouraging the use of the village and the Irabina Study Centre for research and educational purposes; and
10. monitoring the use of plantation corridors by native fauna.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

GLOSSARY

1080	A naturally occurring toxin (sodium fluoroacetate) found in many native south-west Western Australian plants known as 'poison peas' (*Gastrolobium* sp.).
Adaptive management	A process of responding positively to change. The term adaptive management is used to describe an approach to managing complex natural systems that builds on common sense and learning from experience, experimenting, monitoring and adjusting practices based on what was learnt.
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.
Avifauna	The birds or the kinds of birds of a region, period or environment.
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.
Bioregion	A land and water territory whose limits are defined not by political boundaries, but by geographical limits of human communities and ecological systems.
Biotic	Of, or relating to living things; caused or produced by living organisms.
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 5.5 kilos.
Declared rare flora/fauna	Threatened flora or fauna gazetted under the *Wildlife Conservation Act 1950*.
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*.
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.
Ecotourism	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.
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 a fire and the area to be protected.
Fire regime	The combination of season, intensity, interval, extent and patchiness of fire in a given area over time.
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.
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.
Geography	The science of the Earth's form, physical features, climate and population.
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.
Heritage	Something inherited from past generations that is valued.
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).
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	A mosaic where the mix of local ecosystems and landforms is repeated in a similar form over a kilometres-wide area. Several attributes, including geology, soil types, vegetation types, local faunas, climate and natural disturbance regimes tend to be similar and repeated across the whole area (Forman 1995).
Landscape Character Type	A broad scale area of land with common visual characteristics based on landscape.
Mesic	Of, or adapted to, a temperate, moderately moist habitat.
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.
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.
Pathogen	Any organism (bacterium or virus) or factor that causes disease within a host.
Potable	Suitable for drinking.
Precipitation	Any form of water, such as rain, snow, sleet or hail that falls to the Earth's surface.
Prescribed burning	The planned application of fire under selected fuel and weather conditions to a defined area to achieve specific management objectives.
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.
Rehabilitation	The process necessary to return disturbed land to a predetermined state, in terms of surface, vegetational cover, land-use and/or productivity.
Recovery plan	A plan that describes the actions required to achieve the recovery of threatened species or ecological communities from the current threat of extinction or destruction.
Recreation	Those leisure time activities or experiences participated in through choice, which bring enjoyment or satisfaction to the participants.
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.
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.
Species richness	The number of different species in a community or other defined unit.
Statutory	Enacted or required by law.
Taxa	A defined unit (for example, species or genus) in the classification of plants and animals.
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.
Tourism	Generally considered in this management plan to be visitors from outside the area staying overnight in or adjacent to the planning area.
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.
Vertebrate	Animals that have a spinal column which includes fish, amphibians, reptiles, birds and mammals.

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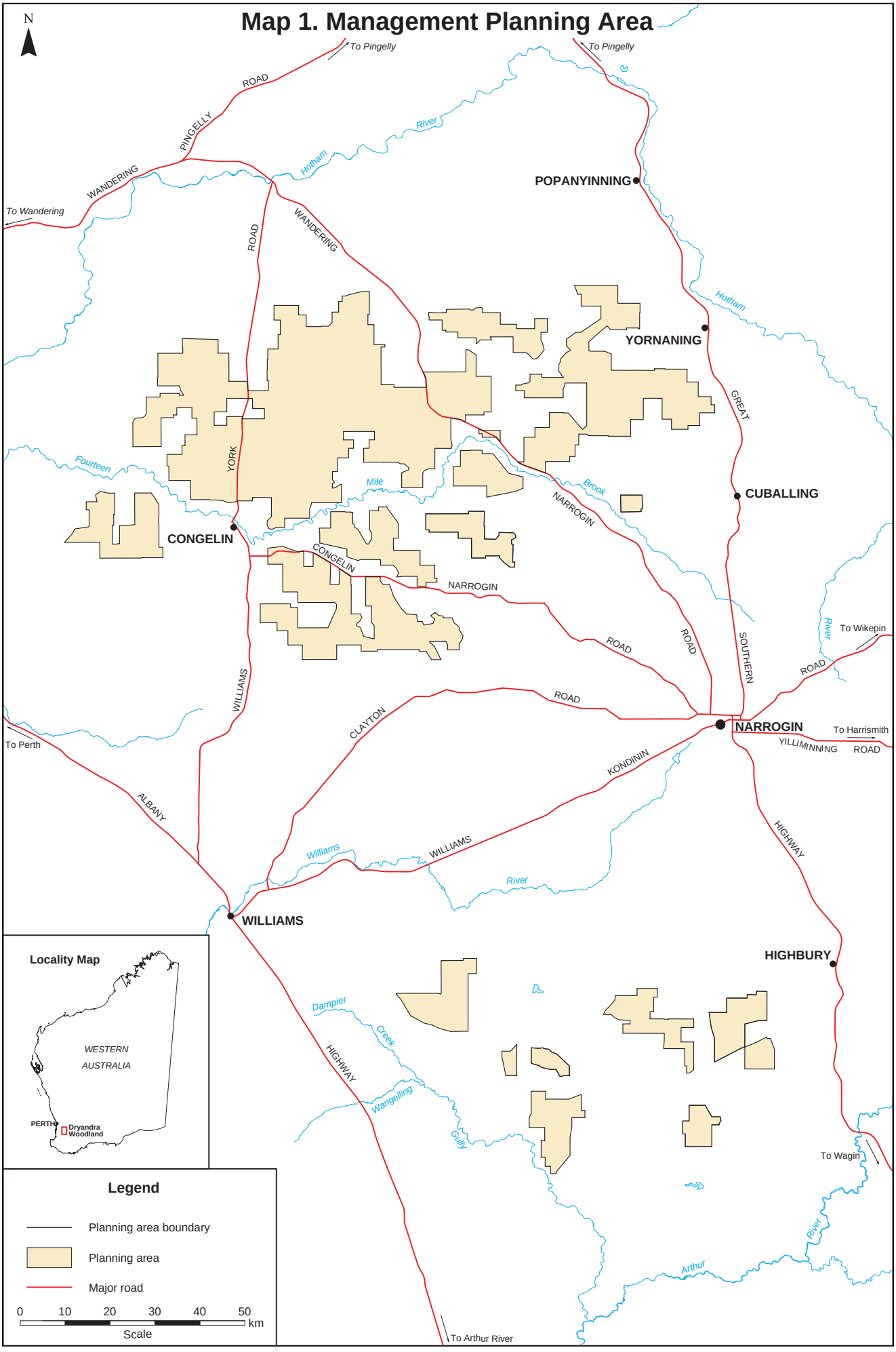
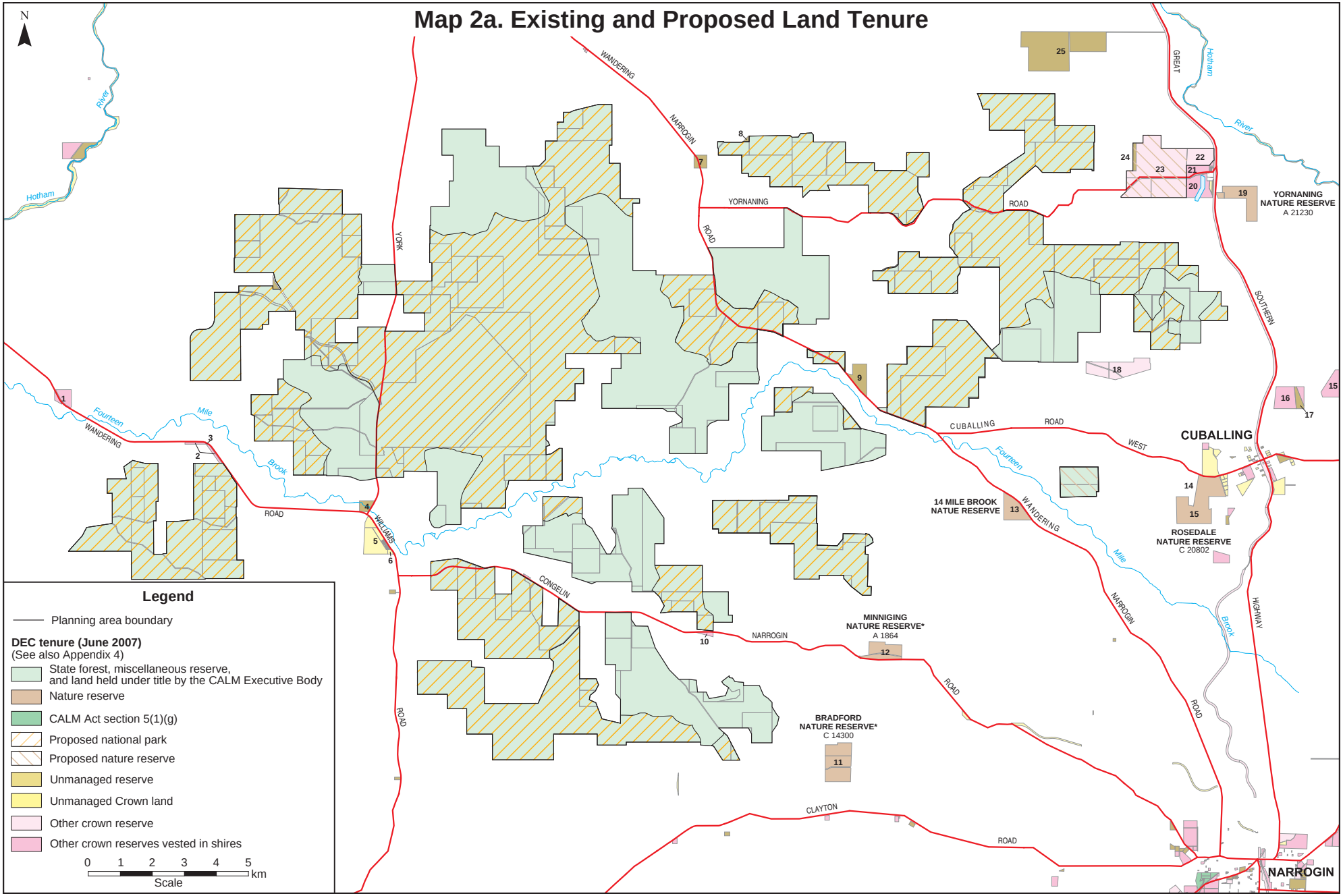
PERSONAL COMMUNICATIONS

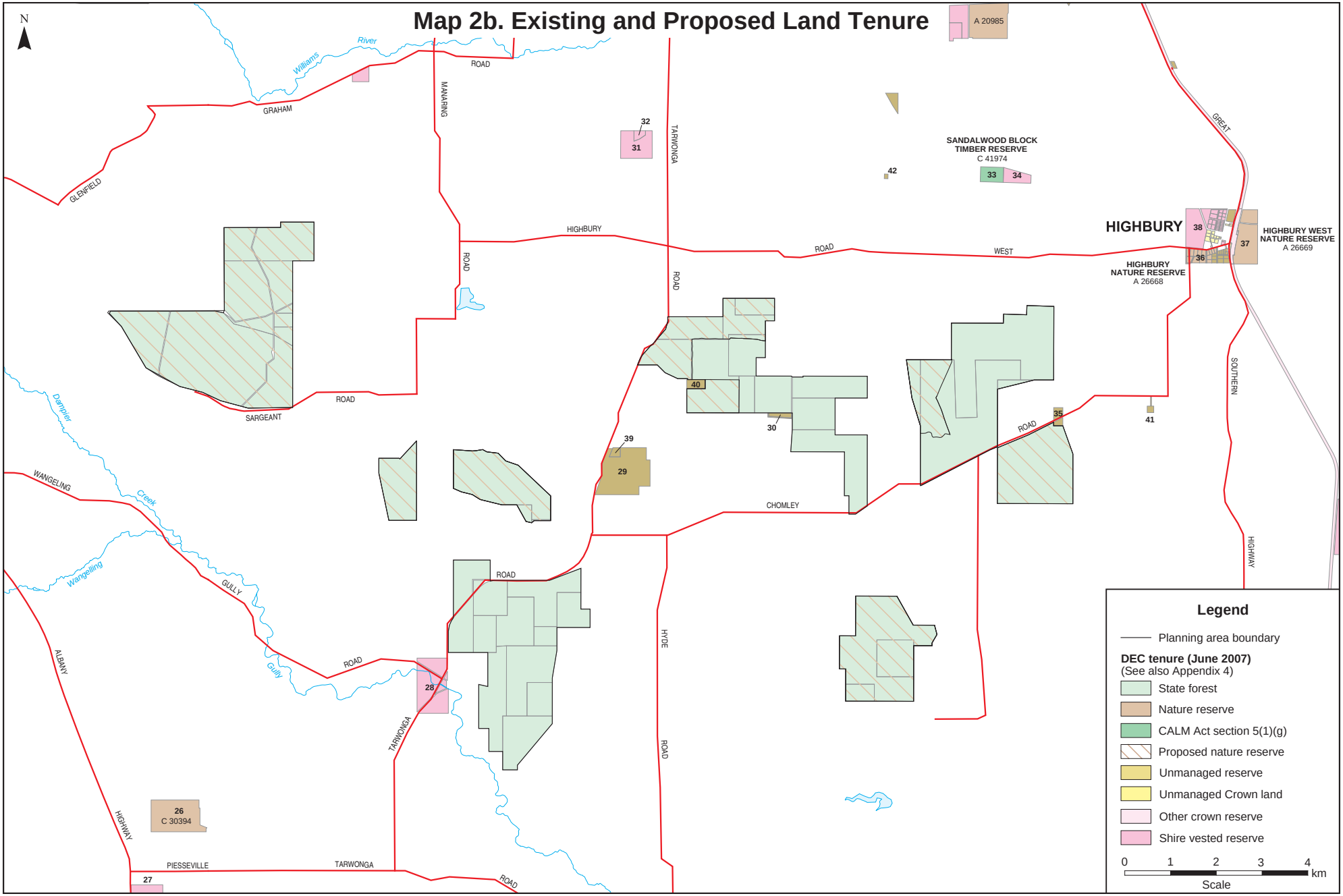
Brown, Paul	Former Program Leader - Nature Conservation, Swan Region, DEC
Davis, Dr Jenny	Lecturer, Environmental Studies, Murdoch University.
Friend, Dr J. A. (Tony)	Senior Research Scientist, Science Division, DEC.
Gorton, Steve	Senior Operations Officer, Great Southern District, DEC.
Handcock, Brian	former Regional Manager, Wheatbelt Region, Western Australian Tourism Commission.
Hopkins, Angas	former Principal Research Scientist, Science Division, DEC.
Morris, Keith	Section Manager, Science Division, DEC.
Nyoongar TAFE Students	Aboriginal Studies, Narrogin TAFE.
Shearer, Dr Bryan	Principal Research Scientist, Science Division, DEC.
Smurthwaite, Tony	Department of Minerals and Energy.
Sprigg, Tricia	Former District Parks and Visitor Services leader, Great Southern District, DEC.
Thomas, Leslie	Tutor, External Studies, Murdoch University.

Map 1. Management Planning Area

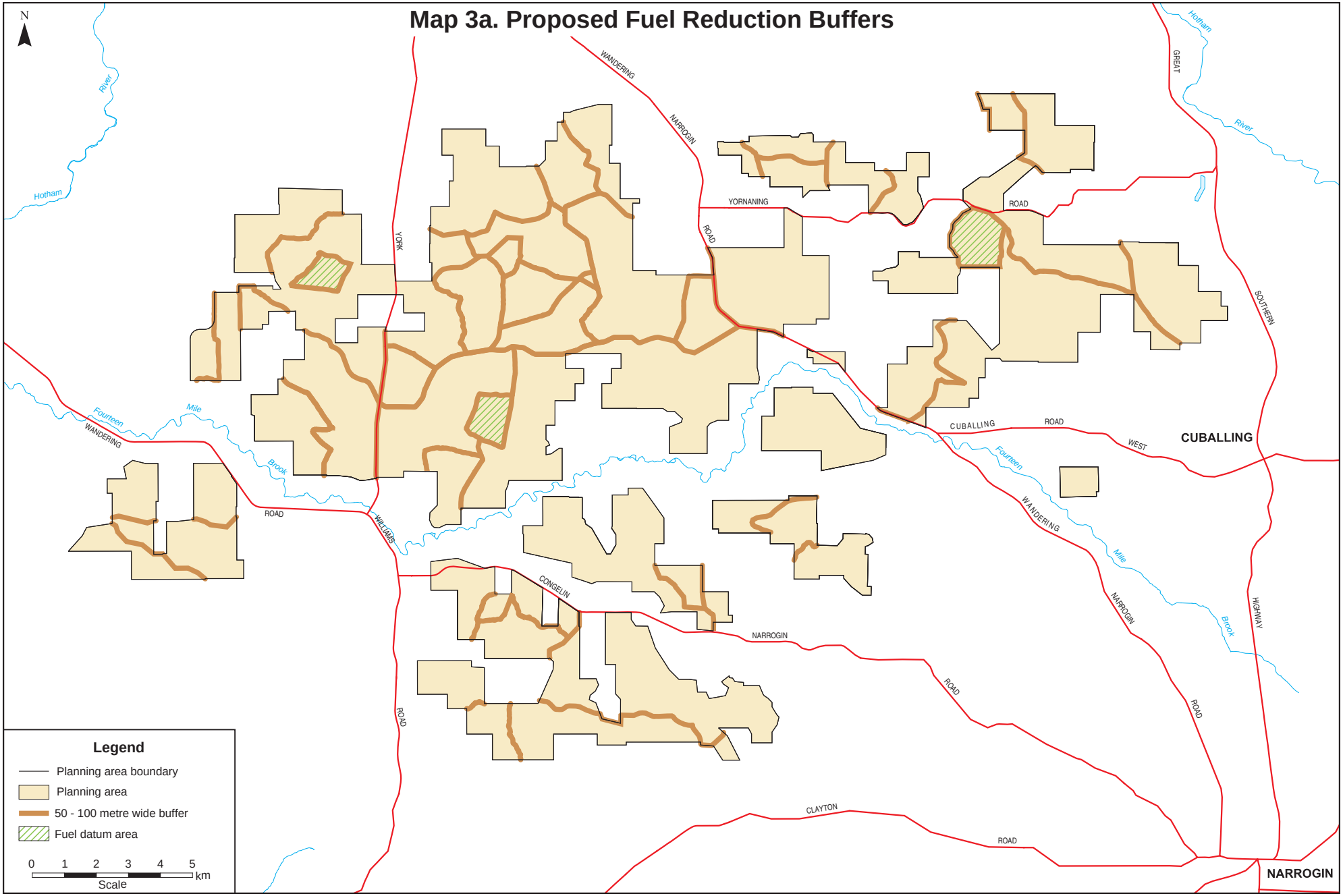


Map 2a. Existing and Proposed Land Tenure

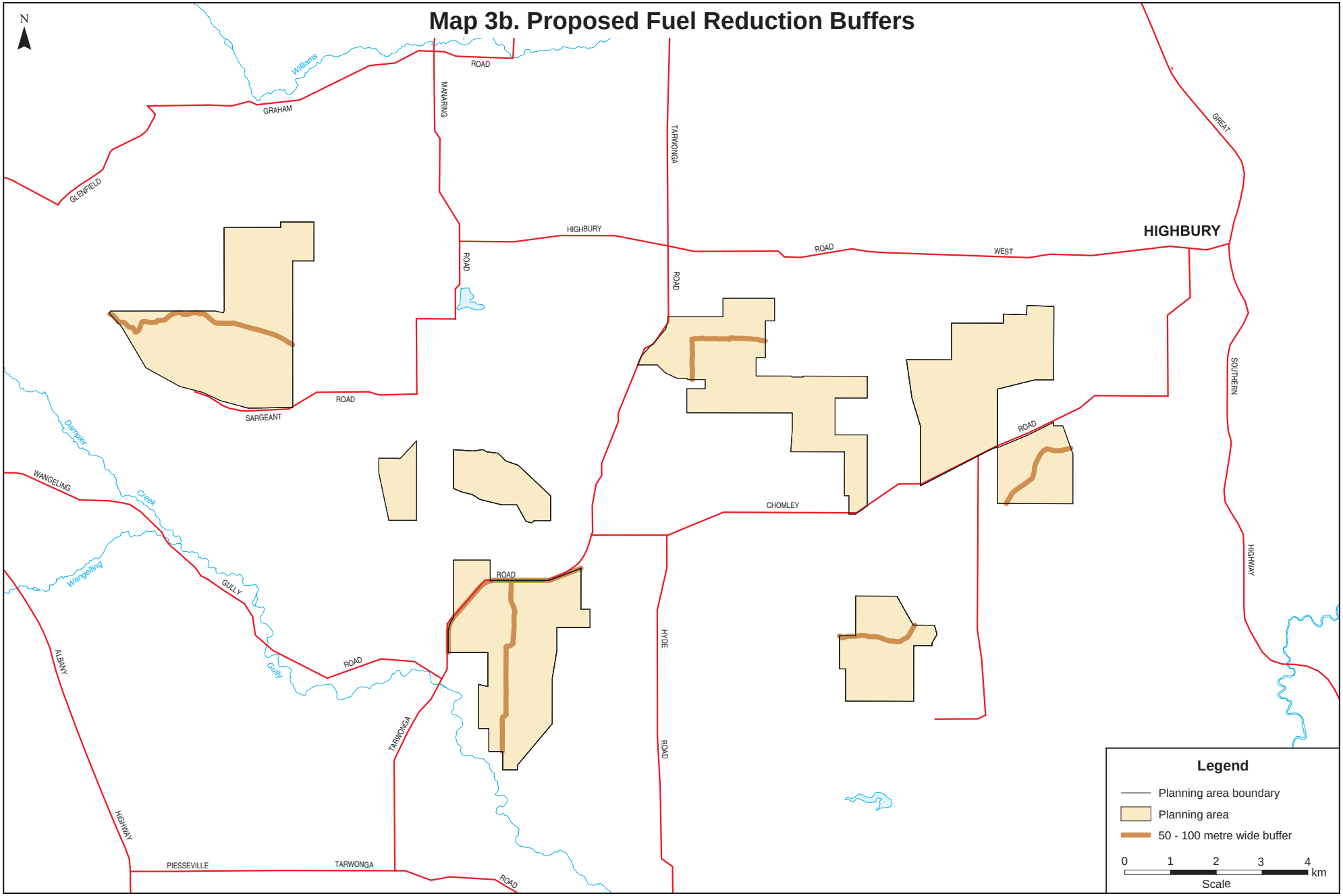


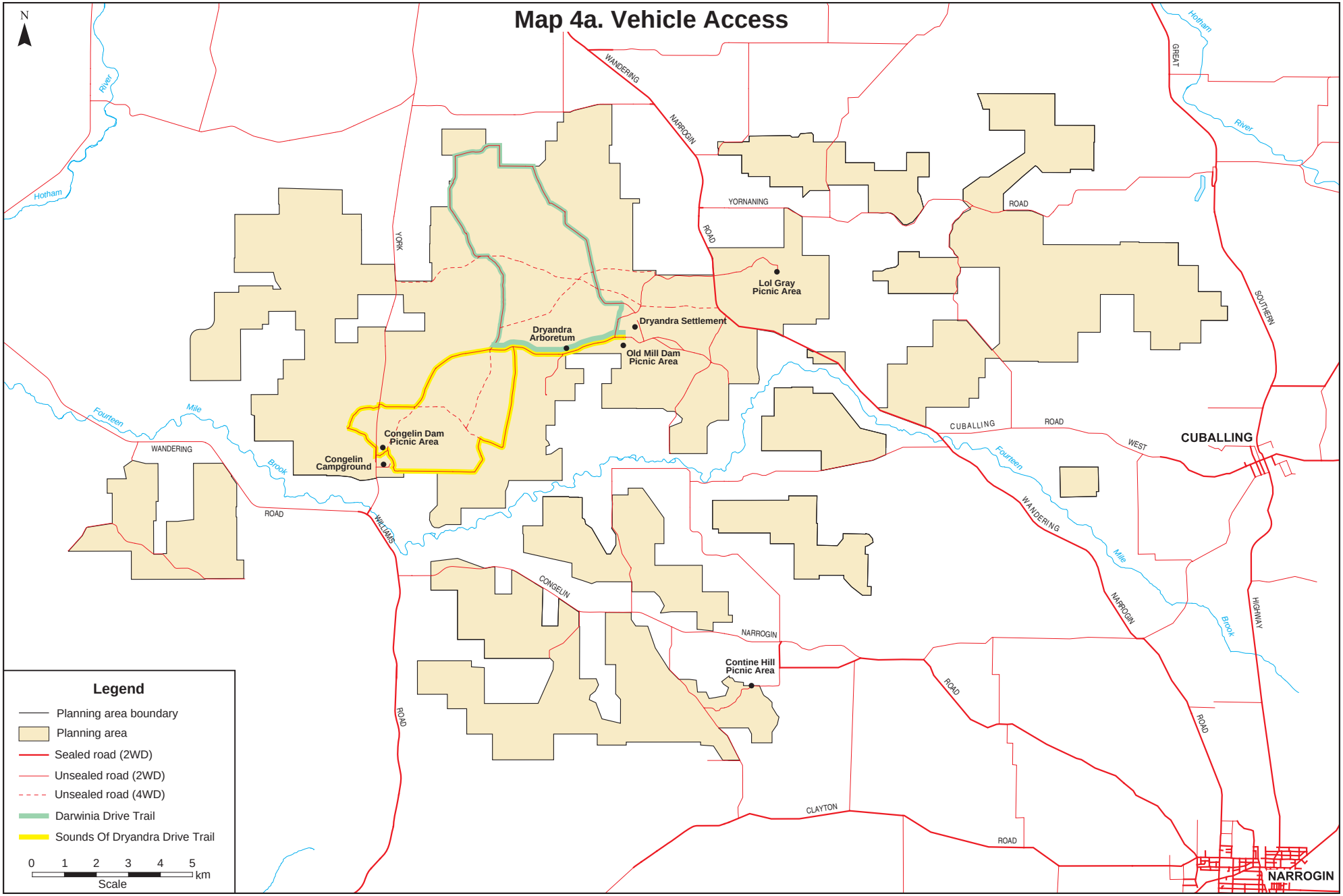

Map 2b. Existing and Proposed Land Tenure
N
A 20985
Williams River
ROAD
GRAHAM
MANARING
GLENFIELD
32
31
TARWONGA
SANDALWOOD BLOCK
TIMBER RESERVE
C 41974
42
33
34
GREAT
HIGHBURY
38
37
36
HIGHBURY WEST
NATURE RESERVE
A 26669
HIGHBURY
ROAD
WEST
HIGHBURY
NATURE RESERVE
A 26668
SOUTHERN
HIGHWAY
SARGEANT
ROAD
40
30
41
35
39
29
Dampier
WANGELING
Creek
CHOMLEY
Wangelling
GULLY
ROAD
HYDE
ALBANY
Gully
28
TARWONGA
26
C 30394
HIGHWAY
PIESSEVILLE
TARWONGA
27
ROAD
Legend
Planning area boundary
DEC tenure (June 2007)
(See also Appendix 4)
State forest
Nature reserve
CALM Act section 5(1)(g)
Proposed nature reserve
Unmanaged reserve
Unmanaged Crown land
Other crown reserve
Shire vested reserve
0 1 2 3 4 km
Scale

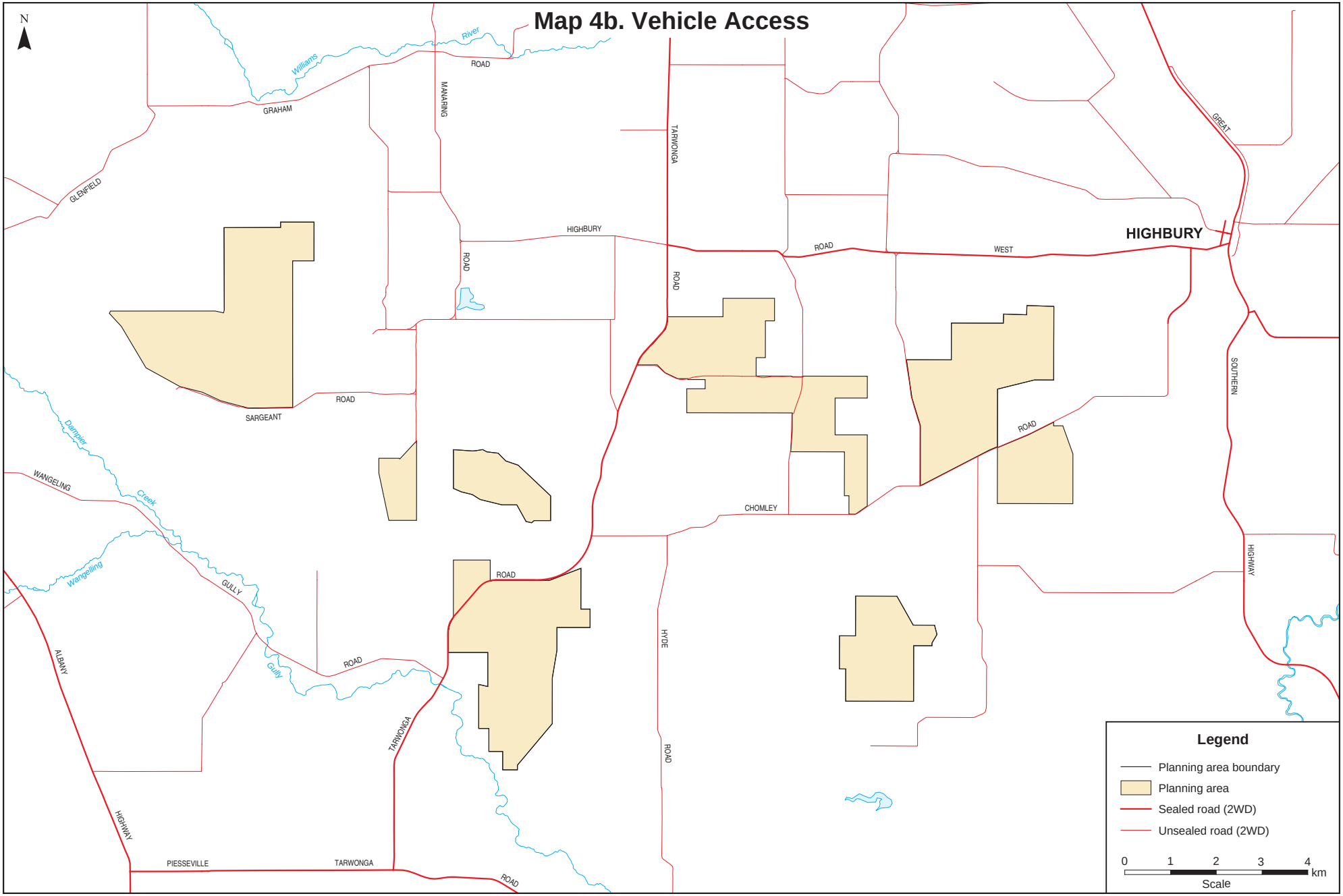
Map 3a. Proposed Fuel Reduction Buffers

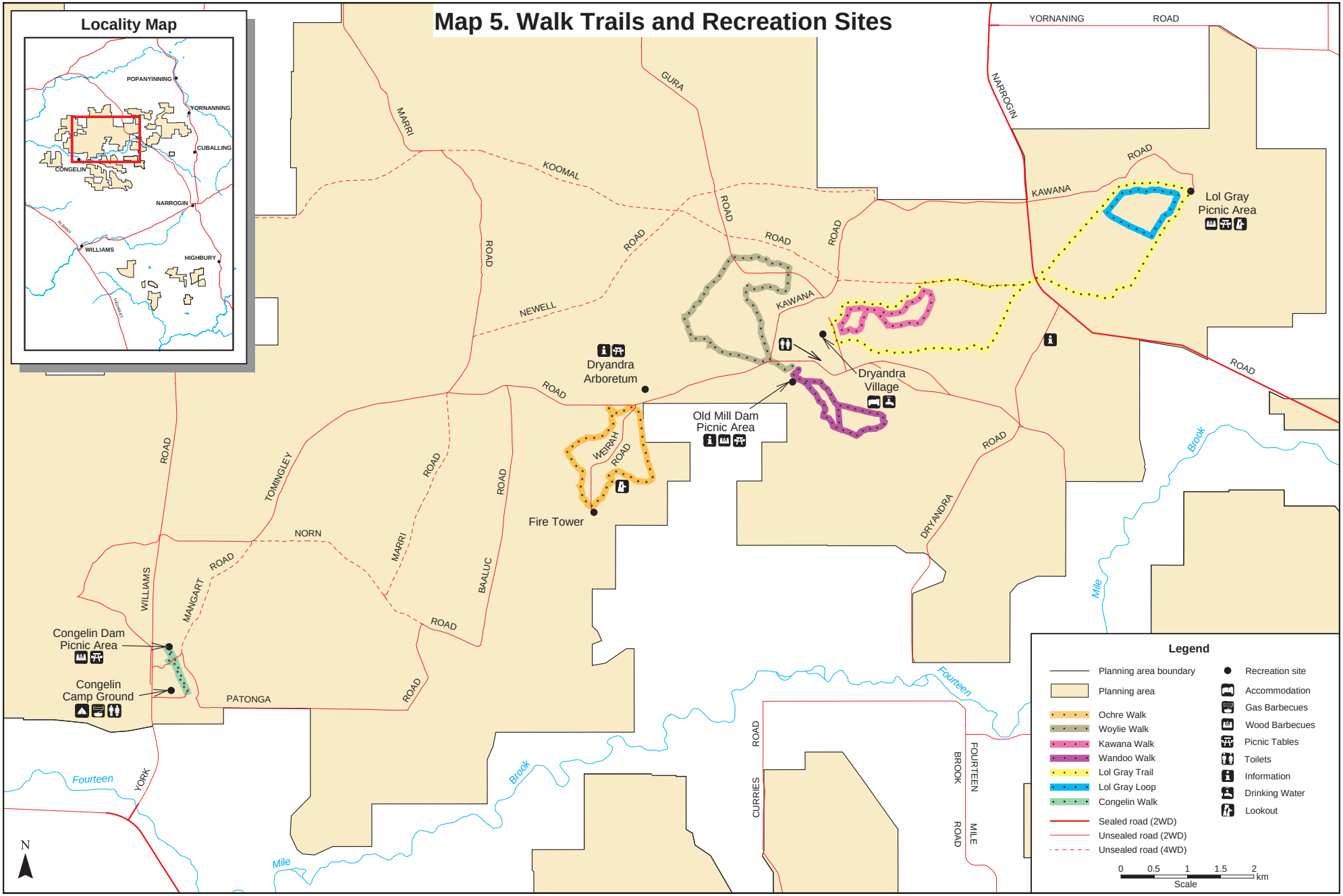


Map 3b. Proposed Fuel Reduction Buffers




Map 4a. Vehicle Access
N
Legend
Planning area boundary
Planning area
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
Darwinia Drive Trail
Sounds Of Dryandra Drive Trail
0 1 2 3 4 5
km
Scale
Lol Gray Picnic Area
Dryandra Settlement
Dryandra Arboretum
Old Mill Dam Picnic Area
Congelin Dam Picnic Area
Congelin Campground
Contine Hill Picnic Area
CUBALLING
NARROGIN
WANDERING NARROGIN ROAD
YORK ROAD
YORNANING ROAD
GREAT SOUTHERN ROAD
CUBALLING WEST ROAD
WANDERING NARROGIN ROAD
WILLIAMS ROAD
CONGELIN NARROGIN ROAD
CLAYTON ROAD
HIGHWAY
Hotham River
Fourteen Mile Brook


Map 4b. Vehicle Access
N
Williams River
ROAD
GRAHAM
MANARING
TARWONGA
GREAT
GLENFIELD
HIGHBURY
ROAD
WEST
HIGHBURY
ROAD
ROAD
SARGEANT
ROAD
SOUTHERN
Dampier
Creek
WANGELING
ROAD
CHOMLEY
Wangelling
GULLY
ROAD
HIGHWAY
ALBANY
Gully
ROAD
HYDE
TARWONGA
HIGHWAY
PIESSEVILLE
TARWONGA
ROAD
Legend
Planning area boundary
Planning area
Sealed road (2WD)
Unsealed road (2WD)
0 1 2 3 4 km
Scale


Map 5. Walk Trails and Recreation Sites
Locality Map
POPANYINNING
YORNANNING
CUBALLING
CONGELIN
NARROGIN
WILLIAMS
HIGHBURY
ALBANY
KEMMAY
YORNANING ROAD
NARROGIN
GURA
MARRI
KOOMAL
ROAD
NEWELL
KAWANA
Lol Gray Picnic Area
Dryandra Arboretum
Dryandra Village
Old Mill Dam Picnic Area
Fire Tower
WEIRAH
TOMINGLEY
NORN
BAALUC
DRYANDRA
WILLIAMS
MANGART
PATONGA
Congelin Dam Picnic Area
Congelin Camp Ground
YORK
Fourteen Brook
Mile Brook
CURRIES
FOURTEEN BROOK MILE ROAD
Legend
Planning area boundary
Planning area
Ochre Walk
Woylie Walk
Kawana Walk
Wandoo Walk
Lol Gray Trail
Lol Gray Loop
Congelin Walk
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
Recreation site
Accommodation
Gas Barbecues
Wood Barbecues
Picnic Tables
Toilets
Information
Drinking Water
Lookout
0 0.5 1 1.5 2 km
Scale
N

APPENDICES

APPENDIX 1. KEY PERFORMANCE INDICATORS

Key Values	Key Objectives	Key Performance Indicators		
		Performance Measure	Target	Reporting Requirements
Part B: Management Direction and Purpose				
Section 9: Existing and Proposed Tenure				
State forests 51 (Lol Gray), 52 (Highbury) and 53 (Montague), are vested in the Conservation Commission for the purpose of multiple use. Currently, conservation of flora and fauna is the primary use, with recreation and mallet timber production as secondary uses. In order that the tenure better reflect these values, it is proposed that some areas will become nature reserve, some will become national park, and others will remain as State forest.	Ensure land tenure reflects the high conservation value of Dryandra Woodland, and takes into consideration recreation and production values.	9.1 Changes in tenure and purpose.	9.1 To implement all proposed changes to tenure over the life of the management plan.	Every three years.
Part C: Managing the Natural Environment				
Section 17: Native Plants and Plant Communities				
As a result of past clearing of the fertile valley floors for agriculture, some of the original vegetation associations of the central western wheatbelt are absent from or poorly represented in Dryandra. Management will be aimed at ensuring the continued persistence of the existing range of vegetation associations and species within Dryandra.	Develop and implement management strategies that will ensure continued persistence of the full range of plant communities within Dryandra.	17.1 Diversity, cover and condition of native vegetation communities.	17.1 No significant decrease in known level of diversity, cover and condition over the life of the plan.	Every five years.
	Maintain viable populations of all species of plants that occur in Dryandra.	17.2 Cover and condition of threatened, priority or otherwise significant flora species.	17.2 Remain stable or increase over the life of the plan subject to natural variations.	Every five years.
Section 18: Native Animals and Habitats				
The persistence of many species of flora and fauna of high conservation significance is indicative of Dryandra's important role in conserving the	Maintain sustainable populations of all species of native animals currently found	18.1 Maintain viable populations of representative CWR	18.1 No loss of known representative CWR fauna species over the life of the	Every five years.

Key Values	Key Objectives	Key Performance Indicators		
		Performance Measure	Target	Reporting Requirements
biological diversity of the wheatbelt and the state. It is proposed to maintain viable populations of all native species, to re-introduce native animals that were once found in Dryandra, to provide opportunities for Dryandra to be used as a source of native animals for re-introduction into other areas and to maximise the value of Dryandra to mobile elements of the native fauna by increasing vegetated links between remnants.	in Dryandra.	fauna species. 18.2 Population numbers and range of specially protected fauna species or otherwise significant fauna.	plan, subject to natural variations. 18.2 Maintain or increase over the life of the plan, subject to natural variations.	 Every five years.
	Re-introduce native animals that were once found in Dryandra.	18.3 Successful reintroduction of threatened fauna species.	18.3 Reintroduced fauna species established and maintaining sustaining populations.	Every five years.
Section 19: Environmental weeds				
The major weed threats in Dryandra are the two species of cape tulip and soursob. The plan aims to control or eradicate, where possible, these and other weeds that have potential to cause major environmental problems.	Prevent as far as practicable, the introduction of weeds to Dryandra. Control, or if possible, eradicate weeds likely to cause major environmental problems.	19.1 Changes in the abundance and distribution of environmental weeds rated as high or moderate in the *Environmental Weeds Strategy for Western Australia*.	19.1 No increase in the abundance or distribution of high and moderate priority weeds.	Every five years.
Section 20: Introduced and other problem animals				
Introduced animals such as foxes have a detrimental effect on native plants and animals. Dryandra is one of the areas where successful fox control methods were researched and developed. The fox baiting program will continue, as will research on effective and efficient control of foxes and other feral animals.	Prevent, as far as practicable, the introduction of non-native species to Dryandra. Control or, if possible, eradicate animals likely to cause major environmental or social problems.	20.1 Diversity of native fauna species and habitat.	20.1 No loss of known species or habitat diversity over the life of the plan.	Every five years.
Section 21: Diseases				
Plant diseases, caused by *Phytophora* species and *Armillaria luteobalina*, are important concerns for Dryandra. Management will include surveys to identify diseased areas and the application of hygiene practices in all relevant operations.	Prevent, as far as practicable, the introduction of plant diseases into disease-free areas.	21.1 Changes in the occurrence of plant diseases within the planning area.	21.1 No new human-assisted occurrences or spread of plant diseases over the life of the plan.	Every five years.

Key Values	Key Objectives	Key Performance Indicators		
		Performance Measure	Target	Reporting Requirements
Section 22: Fire				
The management of fire in Dryandra needs to achieve multiple objectives. There will be an on-going requirement for the protection of life, property and the brown mallet plantations, and an increasing emphasis upon the maintenance of habitat and species diversity.	Encourage and maintain biodiversity conservation and protect life and community assets within, and adjacent to, the planning area.	22.1 The impact of wildfire on life, property or significant community assets.	22.1 No loss of life, property or significant community assets, or serious injury attributable to the Department's fire management.	Annually.
Part E: Managing Visitor Use				
Section 26: Visitor Opportunities				
Visitation levels are expected to increase once the national park is declared, and the area is increasingly promoted by the tourism industry. Dryandra will be marketed to attract a clientele that is appreciative of the natural environment. A range of access will continue to be provided to meet visitor and management demands.	Provide and maintain a range of visitor opportunities within Dryandra, including scenic driving, bushwalking, cycling and horse-riding, while ensuring that key values are not adversely affected.	26.1 Visitor satisfaction levels of nature-based experiences. 26.2 The perceived level of environmental degradation at high-use sites from visitor impacts as determined by visitor surveys.	26.1 Visitor satisfaction levels of nature-based experiences are maintained or increased from 2011 levels. 26.2 The perceived level of environmental degradation at high-use sites from visitor impacts does not increase over the life of the plan.	Every five years. Every five years.
Section 28: Visitor Activities and Use				
	Provide and maintain a range of recreation areas and facilities within the planning area that do not conflict with other users, damage the environment or cause injury to visitors and their vehicles.	28.1 Visitor satisfaction levels of nature-based experiences.	28.1 Visitor satisfaction levels of nature-based experiences are maintained or increased from 2011 levels.	Every five years.

APPENDIX 2. SPECIALLY PROTECTED AND PRIORITY FAUNA

Species	Common Name	Recovery Plan	Conservation Status in WA	
Specially Protected Fauna			**Schedule / Priority**	**IUCN Category**
Bettongia penicillata ogilbyi	Woylie	Yes*	S1	EN
Calyptorhynchus latirostris	Carnaby's cockatoo	Yes	S1	EN
Perameles bougainville	Western barred bandicoot	No	S1	EN
Phascogale calura	Red-tailed phascogale	No	S1	EN
Bettongia lesueur	Boodie	No	S1	VU
Dasyurus geoffroii	Chuditch	Yes	S1	VU
Leipoa ocellata	Malleefowl	No	S1	VU
Macrotis lagotis	Bilby	No	S1	VU
Myrinecobius fasciatus	Numbat	In preparation	S1	VU
Falcunculus frontatus	Crested shrike-tit	No	P4	
Falco peregrinus	Peregrine falcon	No	S4	
Morelia spilota imbricata	Carpet python	No	S4	
Macropus eugenii derbianus	Tammar wallaby	No	P5	
Isoodon obesulus	Quenda (southern brown bandicoot)	No	P5	

* Recovery plan needs to be rewritten in view of specially protected listing on 23 January 2008.

Conservation Code

Scheduled species

Fauna declared under the Western Australian Wildlife Conservation Act as likely to become extinct or rare, or otherwise in need of special protection:

- Schedule 1 (S1): Fauna that is rare or likely to become extinct.
- Schedule 2 (S2): Fauna presumed extinct but might be rediscovered.
- Schedule 3 (S3): Birds protected under an international agreement.
- Schedule 4 (S4): Other specially protected fauna.

P1-5 = Priority Fauna (see *Appendix 3* for more information).

World Conservation Union (IUCN) Rank

IUCN Red List categories used to rank threatened species in Western Australia.

Extinct (EX):	Taxon that is extinct.
Extinct in the Wild (EW):	Taxon known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range.
Critically endangered (CR):	Taxon facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN):	Taxon facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU):	Taxon facing a high risk of extinction in the wild in the medium-term future.

APPENDIX 3. CONSERVATION CODES

R: Declared Rare Flora - Extant Species
Species that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora - Presumed Extinct Species
Species that have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

Priority 1: Poorly known species.
Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation and under threat of destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority 2 : Poorly known species
Species that are known from one or a few collections or sight records (generally less than 5), some of which are on lands not under immediate threat of destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

Priority 3: Poorly known species
Species that are known from collections or sight records from several localities not under imminent threat, or from few widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

Priority 4: Rare, near threatened and other species in need of monitoring.
a. Rare. Species are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
b. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
c. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: Conservation dependent species
Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years. Note: the need for further survey of poorly known species is prioritised into the three categories depending on the perceived urgency for determining the conservation status of those species, as indicated by the apparent degree of threat to the species based on the current information.

APPENDIX 4a. CROWN LAND OUTSIDE THE DRYANDRA WOODLAND[17]

No. on Map 2a	Reserve No.	Area (ha)	Vesting	Purpose
1	A2059	37.9		Stopping Place
2	28666	7.7	Shire of Williams	Parklands
3	16156	0.2		Gravel
4	Townsite			
5	13243	42.5	Shire of Williams	Recreation
6	9549	2.0		School
7	11207	15.2		Stopping Place and Water Supply
8	15886	1.5		Gravel
9	27141	37.8		Conservation of Timber
10	19747	4.2	Shire of Cuballing	Landscape Protection
11	14300	95.1		Timber State forest
12	1864	52.2	CCWA	Conservation of Flora and Fauna
13	21830	44.8	CCWA	Conservation of Flora and Fauna
14	32463	23.7		Gravel
15	20802	83.5	CCWA	Cons of Flora and Fauna
16	7530	56.7	Shire of Cuballing (WPL 21 yrs)	Recreation
17	24579	9.5		Rifle Range
18	Pt15925		Minister for Water Resources	Water Supply
19	21230	68.8	CCWA	Conservation of Flora and Fauna
20	4698			Water Supply
21	5271	84.3	Shire of Cuballing	Recreation
22	6593	43.3	Minister for Water Resources	Water Supply
23	Pt15925		Minister for Water Resources	Water Supply
24	20474	8.7		Timber Mallet
25	19794	235.9		Timber Mallet

[17] As on Maps 2a and 2b

APPENDIX 4b. CROWN LAND OUTSIDE THE DRYANDRA WOODLAND[18]

No. on Map 2b	Reserve No.	Area (ha)	Vesting	Purpose
26	30394	74.5	CCWA	Cons of Flora and Fauna
27	14486	39.2	Shire of Cuballing (WPL 21 yrs)	Recreation, Camping and Hall
28	8733	79.4	Shire of Narrogin	Stopping Place and Water Supply
29	19107	98.1		Timber Mallet
30	29610	8.1		Gravel
31	1865	36.3		Travellers and Stock
32	12203	4.1	Shire of Narrogin	Recreation
33	41974	16.5	Director General - DEC	Sandalwood Regeneration
34	11593	15.0	Shire of Narrogin	Stopping Place
35	18976	8.1		Quarry
36	26668	17.0	CCWA	Conservation of Flora and Fauna
37	26669	54.1	CCWA	Conservation of Flora and Fauna
38	Townsite			
39	29611	4.0		Gravel
40	29610	8.1		Gravel
41	19153	2.4		Quarry and Access There To
42	14883	0.8		Water Supply

[18] As on Maps 2a and 2b

APPENDIX 5. 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 kilometres 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 kilometres 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 kilometres 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/ camp/day use site present	-	Built accommodation/ camp/day use site present
4. Tracks and trails within a 200 m radius	No walktrail present (Class 1 or 2)	Walktrail present but only used infrequently or proposed walktrail (Class 1 or 2)	Walktrail 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 kilometres radius	No other apiary sites present		Apiary site present
7. Feral honey bee management within 2 kilometres	-	Feral honey bee control program in place[8]	-
8. Weed management within a 2 kilometres 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 two 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.