



Tuart Forest National Park

draft management plan

2011



Department of
Environment and Conservation



 Conservation
Commission
WESTERN AUSTRALIA

Tuart Forest National Park

draft management plan

2011

Department of Environment and Conservation
Conservation Commission of Western Australia

Acknowledgments

This draft management plan was prepared by the Tuart Forest National Park planning team: Sophie Bishop, Robert Chandler, Greg Mair, Kim Williams, Peter Hanly, John Carter, Peter Henderson and Brad Commins. Former planning team members include Nick Detchon, Michelle Anderson and Denam Bennetts. Figures and maps were developed by Aaron Rivers.

Comment and advice during the development of this draft plan was provided by:

- DEC staff – in particular Paul McCluskey, Ken Ninnette, John Tillman, Roger Armstrong, Jason Foster, Chris Bishop, Dave Hampton, Bronwen Keighery, Greg Keighery, Andrew Webb, Gil Field and Blackwood District staff
- specialist branches within the department
- the department's Parks and Conservation Executive
- the Tuart Health Research Group – in particular Katinka Ruthrof
- the Department of Water
- members of the Conservation Commission.

Many groups, individuals and agency representatives made valuable contributions to the development of this document. The assistance of the Tuart Forest National Park Community Advisory Committee is especially acknowledged: Bernie Masters (Chairman), Martin Pritchard, Bethwyn Hastie, Michael Cassanet, Hal Scott, Des Donnelly, Robert Breeden, Jack Bradshaw, Barbara Councillor-Corbett Stammner, Ken Carratti, Will Oldfield and Graeme Rundle (Conservation Commission observer).

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

Images

Main cover photo: Aerial view of Tuart Forest National Park. Photo – Martin Pritchard

Other cover photos: Tuart trees (*Eucalyptus gomphocephala*). Photo – Ken Ninnette
Western ringtail possum (*Pseudocheirus occidentalis*). Photo – Adrian Wayne

Header photo: A view of the Vasse-Wonnerup wetlands with tuart woodlands in the background.
Photo – DEC

Invitation to comment

This draft management plan is an opportunity for the community to provide information, express opinion or suggest alternatives on how Tuart Forest National Park will be managed during the next 10 years.

Make your comments count

What to consider

This plan includes issues which may have a number of management options over the life of the plan or where the department has developed a proposal and wants to gauge public opinion. In making a submission, it is important to understand that legislation and policy clearly stipulate the responsibilities and obligations of the department and in some instances this may predetermine how some issues are addressed (for example, in relation to visitor safety). Nevertheless, it is important to hear from the public about the management of these issues.

The department and Conservation Commission would particularly like to seek feedback on:

- the proposed key performance indicators mentioned throughout various sections of the plan
- the size, structure and overall readability of the plan
- the proposed ecosystem management zones, which have a strong emphasis on tuart restoration
- the suggested change of name for the national park
- future management of Ludlow settlement
- management of horseriding and commercial horse training
- management of kangaroos.

How to make effective comments

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

To ensure your submission is as effective as possible:

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

Where to send your comments

Submissions are welcome for two months after the release date of the draft management plan and can be made online at www.dec.wa.gov.au/haveyoursay or by writing to:

Planning Coordinator
Tuart Forest National Park draft management plan
Department of Environment and Conservation
Locked Bag 104
BENTLEY DELIVERY CENTRE WA 6983

Alternatively submissions can be emailed to planning@dec.wa.gov.au.

How your comments will be considered

The management plan will be reviewed in light of submissions, according to established criteria (see below). A summary of submissions will be prepared along with the final management plan.

1. The draft management plan *will* be amended if a submission:

- (a) provides additional information of direct relevance to management
- (b) provides additional information on affected user groups of direct relevance to management
- (c) indicates a change in (or clarifies) government legislation, management commitment or management policy
- (d) proposes strategies that would better achieve targets and desired outcomes
- (e) indicates omissions, inaccuracies or a lack of clarity.

2. The draft management plan *will not* be amended if a submission:

- (a) clearly supports proposals in the plan
- (b) makes general statements and no change is sought
- (c) makes statements already in the plan or were considered during the plan preparation
- (d) addresses issues beyond the scope of the plan
- (e) is one among several widely divergent viewpoints received on the topic but the text/strategies in the plan are still considered the preferred option
- (f) contributes options that are not feasible
- (g) is based on unclear, factually incorrect information
- (h) provides details that are not appropriate or necessary for inclusion in a document aimed at providing management direction over the long term.

Contents

Introduction	1
1. Management plan area	1
2. Key values and threats	1
3. Management directions	2
Management purpose	3
4. Legislative and policy framework	3
5. Performance assessment	4
6. Administration	4
7. Term of the plan	4
8. Land tenure and boundaries	4
Managing the natural environment	8
9. Physical environment	8
10. Biological environment	11
11. Protecting the natural environment	19
Managing cultural heritage	28
12. Aboriginal and other Australian heritage	28
Managing visitor use	31
13. Visitor opportunities and planning	31
14. Access	33
15. Visitor activities and use	34
16. Tourism and commercial operations	40
Managing resource use	41
17. Mineral and petroleum exploration and development	41
18. Other resource use	42
Involving the community	44
19. Community involvement and off-reserve management	44
Research and monitoring	46
References	47
Maps	52
Map 1. Tenure	52
Map 2. Management zones	53
Map 3. Visitor use and access	54
Map 4. Mining tenements and utilities	55

Tables

Table 1. Existing reserves of the planning area5

Table 2. Proposed additions to the planning area.....6

Table 3. Ecosystem management zones13

Table 4. Conservation significant ecological communities.....18

Table 5. Asset protection areas.....25

Table 6. Existing and proposed day-use sites34

Table 7. Existing and proposed walk trails36

Table 8. Primary interpretive themes38

Appendices

Appendix 1. Rare, priority and other significant flora56

Appendix 2. Rare, priority and other significant fauna.....57

Appendix 3. Assessment of beekeeping sites within the planning area.....59

Introduction

1. Management plan area



Tuart Forest National Park.
Photo – Ken Ninyette/DEC

This draft management plan has been prepared by the Department of Environment and Conservation (the department) on behalf of the Conservation Commission of Western Australia (Conservation Commission). It covers Tuart Forest National Park, State Forest No. 2, Reserve 868 and a number of other proposed additions (a total area of 3,040 hectares) collectively referred to as the planning area.

The planning area is located 200 kilometres south of Perth and 15 kilometres north-east of Busselton within the shires of Busselton and Capel. It is elongated and fragmented in shape, running parallel to the coast and extending 25 kilometres from Minninup in the north-east to its south-western boundary near the Sabina River (see Map 1). This is the first management plan for the planning area.

2. Key values and threats

Key values

The most significant values for the planning area are listed below.

- Tuart (*Eucalyptus gomphocephala*), which is endemic to the Swan Coastal Plain, characterises the vegetation types and landscapes of the planning area.
- It represents the most southern occurrence of tuart and the largest area of remnant tuart within a formal conservation reserve. Of the 30,316 hectares of tuart remaining on the Swan Coastal Plain, 2,460 hectares or eight per cent is contained within the planning area.
- It contains 142 hectares of conservation category wetlands, including part of the internationally significant Ramsar-listed Vasse-Wonnerup wetlands (around 309 hectares of wetland and tuart woodland fall within the boundary of the Ramsar site).
- A mosaic of upland and wetland plant communities provides important habitat for endangered species such as western ringtail possum (*Pseudocheirus occidentalis*), Carnaby's cockatoo (*Calyptorhynchus latirostris*), Baudin's cockatoo (*Calyptorhynchus baudinii*) and wambenger or southern brush-tailed phascogale (*Phascogale tapoatafa*).
- It contains Aboriginal sites of mythological, archaeological, cultural and spiritual significance.
- There are buildings and structures of heritage significance such as former forestry houses, lime kilns, timber mills and railways.
- The range of recreational opportunities provided including scenic driving, bushwalking, birdwatching and horseriding.

Key threats

Major threats affecting the planning area's key values include the following:

- more than 190 weed species that occur throughout the planning area
- excessive grazing of native vegetation by rabbits (*Oryctolagus cuniculus*) and western grey kangaroos (*Macropus fuliginosus*)
- clearing of the surrounding landscape, resulting in habitat fragmentation and a high boundary to area ratio
- limited variation in the age-class structure of tuart, which is exacerbated by the large proportion of aging trees and a lack of natural recruitment of seedlings
- altered fire regimes, intensified by a drying and warming climatic trend
- threats to tuart health from insect attack and pathogens such as *Armillaria luteobubalina* and *Phytophthora multivora*
- altered hydrology (altered surface water flow regimes affecting riparian vegetation) and water stress associated with declining rainfall
- pollution and eutrophication of water bodies
- impacts on natural and aesthetic values caused by unrestricted recreational activities
- predation and competition from non-native fauna species such as foxes (*Vulpes vulpes*), cats (*Felis catus*) and feral honeybees (*Apis* sp.).

3. Management directions

Vision

Tuart Forest National Park, the largest of Western Australia's tall tuart communities, will continue to provide valuable habitat for the western ringtail possum and other native fauna. Bordering the Ramsar-listed Vasse-Wonnerup wetlands, the national park will be valued by the community for its aesthetic beauty, natural values, significance to Noongar people and its historical significance as a centre of the early forestry industry in WA. In partnership with key stakeholders and the wider community, rehabilitation will continue to return Tuart Forest National Park to a functioning tuart ecosystem. Natural, cultural and recreational values will be maintained and will continue to be further enhanced for future generations.

This vision is derived from community input and will be achieved through the department's management goals¹ of (i) conserving biodiversity, (ii) managing natural resources and promoting environmentally sustainable practices, (iii) leading climate change actions, (iv) creating a world-class parks system, (v) maintaining community involvement and support, and (vi) improving the way we do business.

Key directions of this management plan include:

- protecting and re-establishing the high conservation value ecosystems within the planning area, particularly the tall tuart woodlands and eastern wetlands
- managing species of conservation significance to maintain long-term viability of populations
- fostering and improving community understanding of, and support for, the management strategies contained in this plan.

¹ See the department's Corporate Plan 2007–2009 at www.dec.wa.gov.au/about-us/about-dec/corporate-plan.html

Management purpose

4. Legislative and policy framework

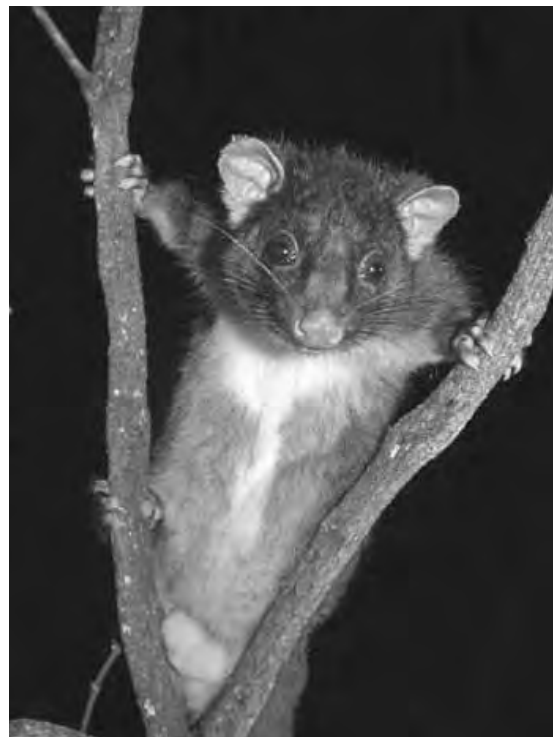
The department administers *inter alia* the *Conservation and Land Management Act 1984* (CALM Act) which provides for the management of lands and waters vested in the Conservation Commission, and the *Wildlife Conservation Act 1950* (Wildlife Conservation Act) which provides for the protection of native flora and fauna within this state. This management plan also conforms to other policies of the department.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), administered by the Australian Government, relates to the protection of nationally listed threatened species and ecological communities, heritage (including Ramsar sites) and key threatening processes. Other state and Australian Government legislation may be referred to throughout this plan.

Australia is a signatory to a number of important international conservation agreements, such as the *Convention on Wetlands of International Importance* (Ramsar Convention) and several migratory bird agreements, which affect management of the planning area. The Vasse-Wonnerup wetlands were listed under the Ramsar Convention in 1990, with an additional area (incorporating parts of the planning area) included in 2000. About 309 hectares of the Vasse-Wonnerup system² falls within the planning area (see Map 2).

The Conservation Commission and the department acknowledge the aspirations of Aboriginal people to obtain native title over their traditional lands and waters under the provisions of the *Native Title Act 1993* (Native Title Act). The South West Aboriginal Land and Sea Council (SWALSC) is the representative Aboriginal body appointed under the Native Title Act, which represents native title claimants and other Aboriginal people in the south-west. There are three native title claims registered over the area: Gnaala Karla Booja, South West Boojarah and the Harris Family. The Native Title Act requires native title claimants and representative bodies to be advised when major public works are undertaken and when a management plan is being prepared.

A memorandum of understanding (MOU) exists between the department and SWALSC that sets out both the principles and guidelines under which access and cooperative management agreements between the department and Aboriginal people may be established within the existing provisions of the CALM Act. During the preparation of this management plan SWALSC and native title claimants were notified of the management planning process. The department recognises the interests of Aboriginal people and their desire to continue cultural activities and customs in the planning area.



Tuart Forest National Park provides valuable habitat for the threatened western ringtail possum. Photo – DEC

²For further information, see <http://www.environment.gov.au/water/topics/wetlands/database/ramsar.html>



Aerial photograph of the planning area. Photo – Martin Pritchard

5. Performance assessment

The Conservation Commission will measure the success of this plan in accordance with section 19(1) (g)(iii) of the CALM Act by using selected key performance indicators (KPIs) and other mechanisms as appropriate. The department must report to the Conservation Commission within the timeframes stipulated for each KPI.

6. Administration

The implementation of this management plan is the responsibility of the District Manager, who coordinates operational management of the planning area. The planning area is situated within the department's Blackwood District of the South West Region.

7. Term of the plan

The management plan will guide management of the planning area for a period of 10 years from the date it is gazetted. During this time, amendments to the management plan may be made under section 61 of the CALM Act. If an amendment is necessary, proposed changes will be released for public comment. At the end of the 10-year period, the management plan may be reviewed and a new plan prepared. In the event that the plan is not reviewed and replaced, this plan will remain in force.

8. Land tenure and boundaries

The reserves that make up the planning area are outlined in tables 1 and 2 and shown on Map 1. All reserves listed in Table 1 are vested in the Conservation Commission with the exception of Reserve 868 which is unvested but managed by the department.

The planning area lies within the Swan Coastal Plain IBRA³ region, and more specifically the Perth IBRA subregion. About 10.5 per cent of the pre-European extent of remnant vegetation in the Swan Coastal Plain IBRA region is protected within formal conservation reserves. The planning area contains 1.9 per cent of remnant vegetation that is protected within formal conservation reserves. Similarly, 11.6 per cent of the Perth IBRA subregion is protected within formal conservation reserves, of which 2.6 per cent is within the planning area. Of the 30,316 hectares of tuart remaining on the Swan Coastal Plain, 2,460 hectares, or eight per cent, is contained within the planning area.

Table 1. Existing reserves of the planning area

Reserve name/type	Reserve number	Purpose	Class	Area (ha)	Created (year)	Proposed change
Tuart Forest National Park ¹	40251	National park	A	1,101	1987	
Tuart Forest National Park ¹	40250	National park	A	683	1987	Consolidate into Reserve 40251
Tuart Forest National Park ¹	43059	National park	A	265	1994	Consolidate into Reserve 40251
Ludlow State Forest ²	Part State Forest No. 2	State forest	A	90	1919	Consolidate into Reserve 40251
Unvested reserve	868	Housing; Public recreation	Other	2	1949	Future tenure to be determined
Total area				2,141		

¹The name has not been gazetted

²As proposed in the *Forest Management Plan 2004–2013* (Conservation Commission) (proposals 111 and 112)

Ludlow settlement is situated partly within State Forest No. 2 and Reserve 868. It is likely that a separate reserve will be created over the settlement, however the boundary, vesting and purpose of the reserve will be dependent on future management arrangements and subject to usual government consideration.

Proposed additions to the planning area

Creation of a conservation reserve system that is comprehensive, adequate and representative⁴ helps meet obligations under the international Convention on Biological Diversity⁵ and *Australia's Strategy for the National Reserve System 2009–2030* (National Reserve System Task Group 2009). Proposed additions to the existing reserves of the planning area are listed in Table 2 and shown on Map 1. As proposed additions become vested with the Conservation Commission they will be managed in accordance with this management plan. Any reserve additions will be subject to usual government consideration and determination.

³IBRA Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell 1995).

⁴The terms *comprehensive, adequate and representative* are defined in the Australian and New Zealand Environment and Conservation Council's Guidelines for Establishing the National Reserve System (1999) as: *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 communities; and *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.

⁵Australia signed the 'Convention on Biological Diversity' (Rio Convention) at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992.

Table 2. Proposed additions to the planning area

Tenure	Vesting	Class	Area (ha)	Proposed change
Lot 17 on Plan 40604	Freehold	N/A ¹	35	Incorporate into Reserve 40251 ²
Lot 2 on Plan 3280	Freehold	N/A ¹	40	Incorporate into Reserve 40251 ²
Lot 100 on Plan 301596	Freehold	N/A ¹	9	Incorporate into Reserve 40251 ²
Lot 101 on Plan 301596	Freehold	N/A ¹	7	Incorporate into Reserve 40251 ²
Lot 94 on Plan 39525	Freehold	N/A ¹	0.1	Incorporate into Reserve 40251 ³
Undeveloped road reserves	Local government	Other	10	Incorporate into Reserve 40251
Unallocated Crown Land	Unvested	Other	1	Incorporate into Reserve 40251
Part State Forest No. 2	Conservation Commission	A	797 ⁴	Incorporate into Reserve 40251

¹ Freehold lots do not have a listed class until tenure proposals are completed.

² These tenure additions are a Ministerial requirement following approval for Bemax to mine part of State Forest No. 2.

³ Land ceded to the state following a rural subdivision.

⁴ This figure excludes 90 hectares listed in Table 1 and shown in Map 1 but includes the Bemax mining lease (216 hectares).

State Forest No. 2

Those parts of State Forest No. 2 shown on Table 1 and Map 1 as proposed additions to Tuart Forest National Park reflect tenure recommendations in the *Forest Management Plan 2004–2013* (Conservation Commission). The long-term intention is to transfer all of State Forest No. 2 to Tuart Forest National Park and rehabilitate with tuart following harvesting of plantation timber. Given the large areas involved, costs associated with rehabilitation and other constraints, this will be an ongoing program during the life of this management plan and beyond.

The Bemax mining lease covers 216 hectares of State Forest No. 2. Mining has now finished and following completion of rehabilitation, the lease area will be incorporated into Tuart Forest National Park (EPA 2003).

Road and rail reserves

Several undeveloped road reserves traverse or lie adjacent to the planning area. The department will liaise with the shires of Busselton and Capel and Main Roads WA to investigate the possibility of adding these road reserves to Tuart Forest National Park. If added, any tracks located within these reserves will be closed and rehabilitated unless they are required for management access.

Two easements traverse the planning area that are associated with an underground gas pipeline that runs along three unvested rail reserves managed by the Public Transport Authority (reserves 41074, 11091 and 13136). The land covered by the easements contains some vegetation of conservation value. However, due to the existence of the gas pipeline, it will not be rehabilitated or included in the planning area.

Nomenclature

The name Tuart Forest National Park has not been gazetted. It is proposed that alternative names, such as Ludlow Tuart Forest National Park, be considered depending on feedback from the community during the public consultation phase for this draft management plan.

Throughout this management plan, specific locations within the planning area are often referred to using paddock or forest block names which reflect the historical land use of the planning area. A diagram showing the location of the paddock and forest block names is at Figure 1.

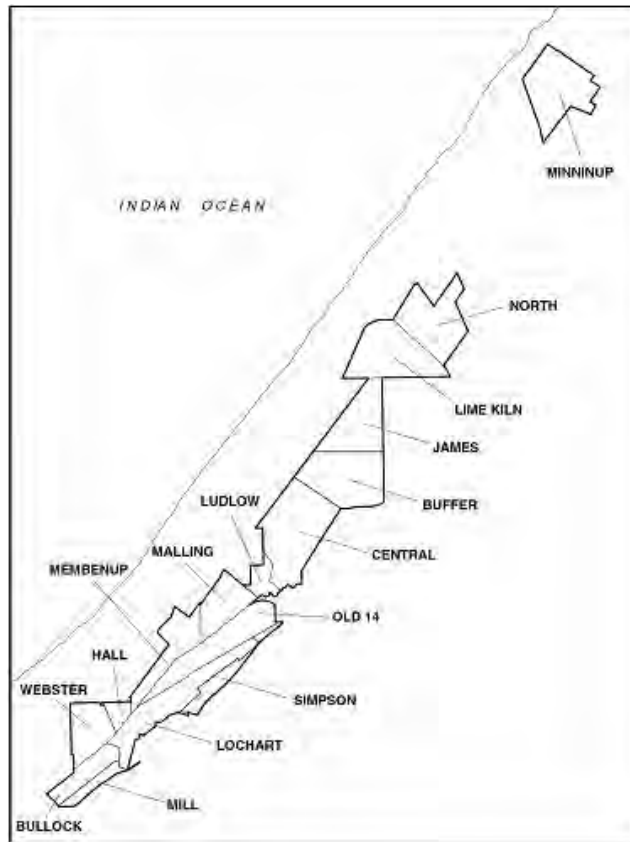


Figure 1. Paddock and forest block names

Desired outcome

The planning area is protected by providing the most appropriate tenure, class and purpose available.

Strategies

1. Manage any proposed reserve additions that are vested with the Conservation Commission in accordance with this management plan.
2. Implement all tenure recommendations in this management plan and relevant recommendations in the *Forest Management Plan 2004–2013*, subject to usual government consideration and determination.
3. Depending on feedback from the community during the public consultation phase to this draft management plan, consider officially changing the name of the national park.
4. Where appropriate, acquire and incorporate other adjacent properties, if identified as having high conservation value or management benefits.

Key performance indicator

Performance measure	Target	Reporting requirement
8.1 Incorporation of proposed tenure additions into Tuart Forest National Park.	8.1 Tenure additions listed in Table 2 have been incorporated into Tuart Forest National Park.	Every five years

Managing the natural environment

This chapter describes the natural values of Tuart Forest National Park and its proposed additions, the threats to these values, and strategies proposed by the department to mitigate these threats. The targets, strategies and actions are consistent with and complement the department's *Nature Conservation Service South West Region Plan 2009–2014*. In turn, future versions of the regional nature conservation plan will be consistent with this management plan.

9. Physical environment

Climate

The planning area experiences a Mediterranean climate with mild, warm summers and cool, wet winters. The mean maximum temperature is 29.2 degrees Celsius in summer and 17.1 degrees Celsius in winter (BoM 2010). Long-term average annual rainfall (recorded over 128 years) is 811 millimetres; however, over the past 30 years this has declined to 749 millimetres (BoM 2010).

The south-west of WA is experiencing a trend of increasing temperatures and declining rainfall, which is predicted to continue (CSIRO 2007). Major impacts of a warming and drying climate relevant to the planning area include:

- a possible increase in the incidence and intensity of bushfires
- altered hydrological regimes, particularly a reduced amount of time that wetlands hold water, which in turn impacts waterbird habitat
- reduced soil moisture, which has been identified as a potential threat to tuart health as trees subject to water stress are also more susceptible to insect attack (TRG 2002).

Being able to accurately determine that a key value has been adversely and directly affected by climate change is difficult and unlikely during the life of this plan. Climate change will be taken into consideration when assessing KPIs, and if monitoring indicates that climate change could be influencing key values, the department will consider further management options.



The common donkey orchid (*Diuris longifolia*) is one of a number of orchid species found in the planning area. Photo – DEC

Geology, landform and soils

The planning area is characterised by gently undulating relief, ranging from five to 10 metres above sea level. It is located at the southern end of the Swan Coastal Plain, where it overlies the southern Perth Basin, and is predominantly within the Spearwood Dune landform system, which is one of three coastal aeolian dune belts of the Swan Coastal Plain. The wetlands of the planning area fall within the Abba soil system to the east and Vasse soil system along parts of the western boundary.

For those parts situated in the Spearwood Dune system, the geology consists of Tamala limestone, overlain by brown and yellow sands of varying depths (McArthur 1991, Forests Department 1979). Toward the west, the soils are predominantly brown soils overlying fossiliferous beach-

deposited limestone at shallow depth (Forests Department of WA 1979), transitioning to dark calcareous sands and estuarine deposits of the Vasse-Wonnerup wetlands (Tille and Lantzke 1990). The soils towards the east are podsollic and more leached, varying from greyish brown at the surface to bright yellow at 1.5 metres depth (Forests Department of WA 1979).

The eastern parts of the planning area situated in the Abba soil system contain wetland clay soils which are poorly drained, wet and semi-wet sandy grey-brown gradational and duplex soils (Tille and Lantzke 1990) that are susceptible to mixing following disturbance (for example pine harvesting and off-road vehicle use).

Operational and recreational activities have the potential to adversely affect the geology, landforms and soils of the planning area. Particularly in the eastern wetlands, surface soils and vegetation are easily disturbed by activities which deplete vegetation cover, damage soil structure, erode soils and cause the loss of soil microbes. Wetland soils are particularly susceptible to erosion when disturbed.

Hydrology

The planning area falls across the Vasse-Wonnerup Estuary and Capel River sub-catchments which together make up part of the larger Geographe Bay catchment area. The Geographe Bay catchment is in turn within the greater Busselton Coast drainage basin.

The heavily modified Abba and Ludlow rivers pass through Tuart Forest National Park and State Forest No. 2. The Vasse-Wonnerup wetland system, Simpson Block wetlands and Buffer Block wetlands occur within and immediately adjacent to the planning area (see Figure 1 and Map 2), and all are classified as conservation category wetlands⁶ in recognition of the high level of ecological attributes and functions they provide (WRC 2001). In total, there are 146 hectares of conservation category wetlands within the planning area.



A view of the Vasse-Wonnerup wetlands with tuart woodlands in the background. Photo – DEC

⁶Conservation category wetland' refers to a category of wetland defined under the Water and Rivers Commission Position Statement: *Wetlands* (2001).

An ecological character description⁷ has been prepared for the Vasse-Wonnerup Ramsar site that documents baseline condition in order to guide management actions and monitoring in the future (WRM 2007). The ecological character description outlines several key management recommendations and this management plan is consistent with these recommendations.

Floodgates on the exit channels of the Vasse and Wonnerup estuaries (outside the planning area) are managed by the Water Corporation, however the department has delegated responsibility for their operation during summer and autumn to maintain minimum water levels and water quality (WRM 2007). The floodgates have a major influence on the hydrology and ecology of the wetlands within and adjacent to the planning area, which contain a significant food and nesting resource for large numbers of waterbirds, including internationally significant migratory species (WAPC 2005).

Groundwater in the planning area is part of the Busselton-Capel groundwater area (WAPC 2005), which incorporates an unconfined superficial aquifer as well as the underlying Leederville and Yarragadee aquifers (DoW 2008). There has been a general trend of declining summer minimum groundwater levels over the past 20 years, although maximum levels in winter remain steady (DoW 2008).

Nutrient levels are high in the Vasse-Wonnerup wetland system because of agricultural fertiliser run-off, stock wastes and unsewered areas in the Busselton township (WRM 2007). Although a substantial portion of these nutrients is either taken up by fringing vegetation or retained in the bed of the estuaries bound to sediments, the Vasse-Wonnerup system is still one of the most nutrient-enriched wetland systems in the south-west of WA (Weaving 1998, WAPC 2005). Salinity levels in the Vasse-Wonnerup wetlands range from fresh to brackish in winter but approach seawater levels in summer and can become hypersaline in places (WRM 2007, Bernie Masters *pers. comm.* 2008). This large seasonal range in salinity is harsh for many biota, particularly salt-sensitive fauna species, but also creates a variety of sub-habitats allowing a wide range of freshwater, estuarine and marine communities to co-exist (WRM 2007).

Desired outcome

The geological features, soils and hydrological values of the planning area are protected and conserved.

Strategies

1. Identify and protect valuable or important geomorphic features and soils that are vulnerable to environmental disturbance, such as soils around wetlands.
2. Protect wetlands and hydrological processes from damage or disturbance that may affect water quality or quantity.
3. Assess all development proposals for potential adverse impacts on geological or hydrological features such as soils, surface water movement and groundwater quality and quantity, and refer proposals that may impact on these values to the Environmental Protection Authority for further assessment and evaluation.
4. Control access to and restrict activities in areas identified as vulnerable to disturbance.
5. Assess soil quality in areas to be rehabilitated and restore soil conditions in order to assist with ecosystem rehabilitation.
6. Refer to information maintained by the Department of Water on surface and groundwater hydrological regimes as a base for future investigations and monitoring of water quality and quantity.

⁷The Ecological Character Description Vasse-Wonnerup Wetlands Ramsar Site South-west Western Australia (WRM 2007) can be downloaded from <http://portal.water.wa.gov.au/portal/page/portal/WaterQuality/Publications/Content/Appendix%20D%20ECD%20report2.pdf>

10. Biological environment

Native plants and plant communities

The planning area has a high level of flora diversity, with 96 families that are made up of 596 native species⁸ including 34 subspecies. The planning area lies within the internationally recognised biodiversity hot spot known as the South West Botanical Province and is also within the Busselton-Augusta national biodiversity hot spot.

Plant species and communities of conservation significance are listed at Appendix 1, and include:

- *Verticordia plumosa* var. *vassensis* which is listed under the Wildlife Conservation Act as ‘declared rare flora’ (DRF) and under the EPBC Act as ‘endangered’
- 25 Priority species (four Priority 2, 13 Priority 3 and eight Priority 4 species)
- seven species endemic to the Swan Coastal Plain
- four relictual⁹ species
- one species with a disjunct distribution, *Isolepis oldfieldiana* (a member of the Cyperaceae family)
- tuart (*Eucalyptus gomphocephala*) and yate (*E. cornuta*) occurring at the southern and northern extent of their ranges respectively.

The majority of plant communities consist of tall tuart woodland with an overstorey dominated by tuart, with some marri (*Corymbia calophylla*) and jarrah (*Eucalyptus marginata*) found in the northern parts. Peppermint (*Agonis flexuosa*) is dominant as a secondary overstorey species in some parts of the planning area. Based on canopy density, some parts of the planning area classify as tuart open forest (areas with greater than 50 per cent canopy cover) (DAFF 2008). It is likely that there was a greater proportion of open forest in pre-European times (Jack Bradshaw *pers. comm.* 2010).



The Priority 3 species *Verticordia attenuata* is found in State Forest No. 2. Photo – DEC



The planning area contains a number of native tuart trees that provide valuable habitat. Photo – DEC

⁸Records obtained from the Western Australian Herbarium (2007) and the department’s Species and Communities Branch (2008).

⁹Pertaining to an archaic form in an otherwise extinct taxon.

Five principal plant communities have been identified and described by Keighery and Keighery (2002):

- tuart tall woodland over pasture grasses
- tuart tall woodland over candlestick banksia (*Banksia attenuata*) woodland
- tuart tall woodland over peppermint open forest
- flat and basin wetlands
- pine plantations with relict tuart.

Two other plant communities have been identified (yate woodland and riverine communities associated with drainage channel edges), but because they are both relatively small in area and highly disturbed, they have not been mapped. Many of the plant communities lack structural diversity due to a lack of natural regeneration of tuart and understorey species.

Tuart occurrence within the planning area is of particular conservation significance, as not only is the species restricted to the Swan Coastal Plain, but only 35 per cent of its original extent remains. The presence of mature tuart is necessary to maintain biodiversity values, especially in sustaining viable populations of fauna that rely on large tree hollows. There has been a reduction in the availability of suitable tree hollows through the loss of older trees with no younger tuarts to replace them, and competition for hollows from fauna species not local to the area. Sudden death of individual tuarts has been observed in the planning area and the cause is yet to be determined. An additional threat to mature tuart is the high risk of being lost in a single event such as bushfire. Where possible, mature tuart trees will be protected by limiting threats that reduce the resilience of tuart ecosystems. The monitoring of tuart health will also be ongoing, and management will be adapted over the life of the plan in light of new research.

There are a number of tuart plots throughout the planning area (see Map 2) that were planted in the 1960s and 1970s in areas once cleared for forestry purposes (Des Donnelly *pers. comm.* 2010). The plots represent a valuable resource as they contain trees of known age and thus are a useful reference in planning for future restoration. A small number of tuart plots will be selected and used as age-class reference sites to determine the most suitable age variation and density of tuart in an effort toward restoring ecosystem function in the tuart communities of the planning area.

A decline in flooded gum (*Eucalyptus rudis*) has been observed both within and adjacent to the planning area, particularly along the Abba River. Although the causes are unclear, it is thought that a number of factors are leading to the weakening of the trees and weakened trees suffer physiological changes that make them more susceptible to insect attack.

There is limited knowledge about peppermint (*Agonis flexuosa*) biology and its role in the tall tuart woodland ecosystem; however, it has become dominant in some parts of the planning area and competes with tuart, preventing the establishment of tuart seedlings. In other parts of the planning area, peppermint decline has been observed since 2005 (Bernie Masters *pers. comm.* 2010) for reasons that are unknown. As peppermint is the primary food source for the threatened western ringtail possum, peppermint density and age-class representation should not fall to a level where food resources are unable to sustain the current possum population, at least until knowledge of peppermint biology and its role in the tall tuart woodland ecosystem can be further understood.

Keighery and Keighery (2002) rated the condition of vegetation in the planning area, with results ranging from 'very good' to 'completely degraded' in the upland plant communities. At the time of survey, the mixed eucalypt woodland at Minninup Block was considered to be 'very good' to 'good' in the most undisturbed areas. In general, condition declines from north to south. The wetlands are generally in better condition than the uplands, and riverine habitats are considered to be in the worst condition, being rated as 'degraded' to 'very degraded'. The pine plantations contain significant numbers of native plant species and when the pines are removed, those areas will resemble a condition more like the other disturbed areas.

Clearing in the surrounding landscape and past land management practices such as grazing, altered fire regimes and the introduction of softwood plantations have resulted in adverse changes to ecosystems within the planning area (Keighery and Keighery 2002). In particular, the absence of natural recruitment of tuart, which is the dominant species and considered to be of key ecological importance, indicates that the tuart ecosystems are functionally degraded and are not self-sustaining (Jack Bradshaw *pers. comm.* 2010).

If left unaddressed, parts of the planning area are likely to experience further deterioration in vegetation condition and ecosystem function. In response, an ecosystem management program has been developed that identifies seven management zones (see Map 2). The objectives and strategies applicable within each zone are outlined in Table 3.

Table 3. Ecosystem management zones

Management zone	Objectives	Strategies
<p>Zone 1: Vasse-Wonnerup riparian habitat</p> <p>Consists of the western-most sections of the planning area that are part of the Vasse-Wonnerup wetland system. Predominantly riparian vegetation or cleared land with good conditions for rehabilitation. Includes occurrences of the proposed Busselton yate threatened ecological community (TEC).¹⁰</p>	<p>Protect and enhance the Vasse-Wonnerup wetland/tall tuart community transition zone.</p> <p>Protect and enhance the Busselton yate proposed TEC.</p> <p>Protect and increase the area of native vegetation that links the tall tuart communities with the Vasse-Wonnerup wetlands.</p>	<p>Continue to re-establish native vegetation in lots 2, 100 and 101.</p> <p>Increase species diversity in existing rehabilitation areas within this zone.</p>
<p>Zone 2a: Cleared plantations and former freehold land</p> <p>This zone is largely cleared, providing a valuable opportunity to carry out experimental trials in rehabilitation. Includes species from both the tall tuart communities and the eastern wetlands, as well as occurrences of the proposed Busselton yate TEC.</p>	<p>Protect and enhance the eastern wetland/tall tuart community transition zone.</p> <p>Protect and enhance the Busselton yate proposed TEC.</p> <p>Protect and increase habitat for fauna that are highly represented in zones 5 and 6 (for example western ringtail possum and brushtail possum).</p> <p>Enhance resilience of this zone to disturbance and threatening processes.</p>	<p>Undertake experimental trials in rehabilitation of the tall tuart communities to address knowledge deficits.</p> <p>Re-establish native vegetation in cleared areas, adapting management according to results of experimental trials.</p>
<p>Zone 2b: Plantations to be cleared</p> <p>Contains some relict tuarts, as well as pine and karri plantations proposed for harvesting. The southern block also contains some wetland areas.</p>	<p>Following tree harvesting, objectives will be the same as Zone 2a.</p>	<p>Following tree harvesting, strategies will be the same as Zone 2a.</p>

¹⁰There are no TECs listed under the EPBC Act within the planning area, however the Busselton yate TEC has been proposed for listing as a TEC because it is critically endangered.

Management zone	Objectives	Strategies
<p>Zone 3: Eastern wetlands</p> <p>Made up of freshwater wetlands with plant communities unusual for this part of the Swan Coastal Plain.</p> <p>Also contains a transition zone between the wetlands and upland tuart woodland community.</p>	<p>Protect and enhance the eastern wetland/tall tuart community transition zone.</p> <p>Maintain the condition of ecological communities and conserve significant flora.</p>	<p>Develop and implement a weed control program.</p> <p>Investigate ecological fire requirements and if necessary apply fire to enhance regeneration.</p>
<p>Zone 4: Old ashbed tall tuart regeneration</p> <p>Contains tuart that was regenerated 10 to 30 years ago using ash-bed stands. There is little diversity in secondary and understorey species.</p>	<p>Protect and enhance the condition of regenerated tuart, including a variation in the age-class structure.</p> <p>Improve the representation of secondary and understorey species.</p>	<p>At selected sites, evaluate the need to introduce variation in the age-class structure of tuart and implement a regeneration program where required.</p> <p>Where necessary, modify the density of regenerated tuart stands to maintain health of remaining trees.</p> <p>Re-establish secondary and understorey vegetation.</p>
<p>Zone 5: Mature tall tuart woodland</p> <p>This zone is rich in fauna diversity and abundance, supporting species and communities from the Vasse-Wonnerup wetlands and tall tuart woodland. Supports a large proportion of the possum populations in the planning area and contains mature tuart with hollows that provide fauna habitat.</p>	<p>Protect and enhance the condition of the mature tuart woodland.</p> <p>Protect fauna habitat and fauna populations which are highly represented in this zone (for example western ringtail possum and brushtail possum).</p>	<p>At selected sites, evaluate the need to introduce variation in the age-class structure of tuart and implement a regeneration program where required.</p> <p>Protect mature tuarts and tree hollows from threats such as inappropriate fire regimes.</p> <p>Re-establish native vegetation, including tuart, where gaps occur in the canopy due to loss of senescent trees.</p> <p>Monitor tuart health for signs of decline.</p>
<p>Zone 6: Mixed eucalypt woodland</p> <p>Made up of a variety of eucalypts with some natural understorey. This zone contains higher understorey species diversity than the other tuart dominated zones.</p>	<p>Maintain and protect diversity of vegetation occurrences within this zone.</p>	<p>Identify knowledge deficits about ecological structure and function of the mixed eucalypt woodland ecosystem.</p> <p>Monitor for plant diseases such as <i>Phytophthora cinnamomi</i>.</p> <p>Evaluate the impacts of grazing by native and introduced species.</p> <p>Develop and implement a weed control program.</p>

Management zone	Objectives	Strategies
<p>Zone 7: Degraded woodland with infrastructure</p> <p>The Ludlow settlement and Bemax mining lease are included in this zone. Rehabilitation is occurring within the Bemax mining lease.</p>	<p>Maintain and enhance condition and species diversity of unmined sections of the Bemax mining lease.</p>	<p>Monitor Bemax rehabilitation as set out in associated Ministerial conditions.</p> <p>Continue with rehabilitation of the unmined component of Bemax mining lease.</p> <p>Undertake further experimental trials on rehabilitation of tall tuart ecosystems.</p> <p>Re-establish native vegetation in cleared areas, adapting management according to results of experimental trials.</p>

Desired outcomes

- Native plants and plant communities of conservation significance are identified and protected.
- Ecosystems are rehabilitated to maintain or improve ecological integrity in the long term.

Strategies

1. Consistent with the nature conservation plan for the South West Region, identify native plants and plant communities of conservation significance, and implement strategies to minimise impacts from threatening processes, such as:
 - assess and where necessary propose statutory protection
 - develop and implement recovery plans
 - assess all proposed operations and developments for potential impacts.
2. Rehabilitate disturbed areas, and periodically monitor and evaluate vegetation condition to assess rehabilitation efforts.
3. Collect seed from tuart and other plant species within the planning area in seed years, and use for rehabilitation purposes.
4. Conduct age-class structural mapping of tuart in the planning area to determine the current and desirable long-term age-class structure.
5. Based on the results from the structural mapping, select a number of age-class reference sites within the planning area, and undertake the following:
 - introduce variation into the age-class structure of tuart by planting seedlings
 - monitor and, where necessary, modify the distribution and density of flora species (including tuart and peppermint) with a long-term aim of restoring ecological function.
6. Implement the ecosystem management strategies outlined in Table 3, according to the zoning scheme as indicated on Map 2.
7. Minimise grazing impacts by kangaroos on rehabilitated areas by implementing protective measures such as temporary fencing or plant guards.
8. Restrict unauthorised vehicle access to high conservation value areas.

Key performance indicators

Performance measure	Target	Reporting requirement
10.1 Complete structural mapping of tuart in the planning area.	10.1 Map the current age-class structure of tuart in the planning area.	Every five years
10.2 Area of tuart woodland communities meeting specified conditions of structural diversity.	10.2 Overall extent and condition of the tuart woodlands is maintained, and changes are made to the age-class structure of tuart at selected sites to improve diversity and ecosystem function.	Every five years
10.3 Baseline extent and composition of vegetation communities in the eastern wetlands.	10.3 No decrease in the extent or significant change to the species composition of vegetation communities in the eastern wetlands.	Every five years
10.4 Population size and number of populations of threatened flora species.	10.4 Maintain or improve the population size and number of populations of threatened flora species over the life of the plan.	Every five years, or as per recovery plans if applicable
10.5 The existing and desirable floristic composition and age-class structure of the tuart communities.	10.5 Determine the existing and desirable floristic composition and age-class structure of the tuart communities.	Every five years

Native animals and habitats

The planning area is isolated from similar habitats and has low fauna diversity when compared to nearby conservation reserves. However, it does contain a mix of species at the wetland and terrestrial interface and some fauna are restricted entirely to the planning area. A total of 113 species¹¹ have been recorded in the planning area including 14 mammals, 67 birds, 19 reptiles, seven amphibians and six fish. Surveys undertaken on the Bemax mining lease recorded 61 species, including seven previously unrecorded bird species.

Fauna species of conservation significance that are found in the planning area are listed at Appendix 2, and include:

- four fauna species listed as ‘rare or likely to become extinct’ under the Wildlife Conservation Act, being brush-tailed phascogale, western ringtail possum, Carnaby’s cockatoo and Baudin’s cockatoo
- two species listed under the EPBC Act (western ringtail possum and Carnaby’s cockatoo)
- 19 species of trans-equatorial migratory shorebird (WAPC 2005) and 15 migratory bird species listed under the EPBC Act, including great egret (*Ardea alba*) and fork-tailed swift (*Apus pacificus*) which are also protected under international migratory bird treaties
- two Priority species (one Priority 4 and one Priority 5 species)
- more than half of the reptile species of the south-west (Chapman and Dell 1985) and one of the most diverse reptile assemblages of tuart woodlands (Dell *et al.* 2002)
- seven frog species, all endemic to WA (Tyler *et al.* 2000) and representing approximately half the species that occur across the Swan Coastal Plain (Dell *et al.* 2002; How and Dell 1993)

¹¹ Records obtained from the Western Australian Museum (2007), Dell *et al.* (2002), Napier (1982), Cable Sands (2002) and Morgan *et al.* (1998)

- 20 fauna species endemic to the south-west, including three birds (Baudin's cockatoo, Carnaby's cockatoo and the red-capped parrot), a bat (western false pipistrelle), seven amphibians, four fish, four reptiles and one mammal species, the western ringtail possum
- five taxonomic groups of subterranean fauna, none of which have been previously identified and all may be new, undescribed species (Biota Environmental Sciences 2003).

The wetlands of the Vasse-Wonnerup system are of international importance, supporting peak numbers of 25,000 to 35,000 waterbirds consisting of 83 different species (WRM 2007) including a number of migratory species protected under the CAMBA, JAMBA and ROKAMBA¹² migratory bird agreements. The wetlands also support the largest breeding colony of black swan (*Cygnus atratus*) in southern WA (WAPC 2005, DEH 2003).

The Simpson and Buffer block wetlands, also referred to as the eastern wetlands (see Figure 1 and Map 2) are located on the eastern side of the planning area. Both are listed as conservation category wetlands (WRC 2001), and contain species compositions typical of wetlands on the eastern side of the Swan Coastal Plain which has been predominantly cleared (Keighery and Keighery 2002). The eastern wetlands are in close proximity to the nationally significant McCarley's Swamp (May and McKenzie 2003) and are therefore likely to support similar ecological values, making them potentially of national significance (Bronwen Keighery pers. comm. 2007).

There are three important ecological transition zones in the planning area that provide habitat for a mix of wetland and terrestrial fauna species and require careful management to mitigate threatening processes. They are the transition zone between the Vasse-Wonnerup wetlands and mature tall tuart woodland, between the eastern wetlands and mature tall tuart woodland, and between the eastern wetlands and cleared pine plantation.

Mature tuart trees are necessary to sustain viable populations of fauna that rely on large tree hollows for habitat (for example common brush-tail possum (*Trichosurus vulpecular*), western ringtail possum and a range of birds). There has been a reduction of suitable tree hollows due to the loss of older trees with limited recruitment of younger tuarts, the loss of trees in the surrounding areas and competition for hollows from introduced and other problem species such as the honey bee, pink and grey galah (*Cacatua roseicapilla*), eastern long-billed corella (*C. tenuirostris*) and little corella (*C. sanguinea*). The protection of mature tuart is critical for the preservation of fauna habitat. Artificial nesting hollows have been installed in parts of the planning area to counteract the decline in natural hollows.

Desired outcome

Native fauna and habitats of conservation significance are identified and protected.

Strategies

1. Consistent with the nature conservation plan for the South West Region, identify native fauna of conservation significance and implement appropriate strategies to minimise impacts from threatening processes, such as:
 - assess and where necessary propose statutory protection
 - develop and implement recovery plans
 - assess all proposed operations and developments for potential impacts.
2. Maintain or enhance wildlife movement corridors and habitats such as tree canopies to provide for the ecological requirements of native fauna.
3. Consider the habitat requirements of fauna species and, where necessary, use fire to promote biodiversity.

¹² CAMBA China-Australia Migratory Bird Agreement, JAMBA Japan-Australia Migratory Bird Agreement, ROKAMBA Republic of Korea-Australia Migratory Bird Agreement.

4. Ensure that on-ground works such as pine harvesting consider impacts on native fauna species and habitats.
5. Monitor populations of selected threatened fauna species, in accordance with relevant recovery plans if applicable.
6. Monitor activity in artificial nesting hollows in the planning area.

Key performance indicator

Performance measure	Target	Reporting requirement
10.6 Population size of selected threatened fauna species.	10.6 No sustained decrease in the population size of selected threatened fauna species.	Every five years or as per recovery plans if applicable

Ecological communities

May and McKenzie (2003) identified two 'priority' ecological communities in the planning area and occurrences of a third community has since been found (Andrew Webb, *pers. comm.* 2008). A summary of the priority ecological communities is at Table 4. There are no threatened ecological communities (TECs) listed under the EPBC Act within the planning area, however the department has recommended one priority ecological community for listing as a TEC because it is considered to be critically endangered, but this has not yet been endorsed.

Table 4. Conservation significant ecological communities

Community	Status
<i>Eucalyptus cornuta</i> , <i>Agonis flexuosa</i> and <i>E. decipiens</i> forest on deep yellow-brown siliceous sands over limestone (Busselton yate community).	Currently Priority 1 but recommended to be upgraded to critically endangered (Val English <i>pers. comm.</i> 2008)
Quindalup <i>Eucalyptus gomphocephala</i> and/or <i>Agonis flexuosa</i> woodlands (community type 30b).	Priority 3
Southern <i>Eucalyptus gomphocephala</i> – <i>Agonis flexuosa</i> woodlands (community type 25).	Priority 3

Desired outcome

Conservation-significant ecological communities are identified and protected.

Strategies

1. Identify ecological communities of conservation significance that require special protection.
2. Implement appropriate strategies to minimise impacts from threatening processes, such as:
 - assess and, where necessary, propose statutory protection
 - establish and maintain regular monitoring to assess all proposed operations and developments for potential impacts.

Key performance indicator

Performance measure	Target	Reporting requirements
10.7 The floristic composition and size of the proposed Busselton yate TECs.	10.7 No decline in the floristic composition or size of the proposed Busselton yate TECs.	Every five years or as per recovery plan if applicable

11. Protecting the natural environment

Altered hydrological regimes

Changing seasonal patterns and the quantity and quality of water draining into the Geographe Bay catchment impacts both directly and indirectly on wetland values and tuart health. They are often inter-related with other threats such as invasive plants, disease, inappropriate fire regimes and acid sulfate soils. Physical and chemical processes such as salinity, acidification, eutrophication and turbidity can and have caused adverse impacts in aquatic ecosystems. Ongoing water quality monitoring of the Vasse-Wonnerup wetlands is of particular importance and is a requirement of its listing under the Ramsar Convention.



Lasiopetalum membranaceum is a Priority 3 species only found in the south-west of WA. Photo – DEC

Most of the planning area is at low risk of forming acid sulfate soils; however, alluvial sediments that make up the Vasse-Wonnerup floodplain and wetland areas are at high risk if disturbed (WAPC 2003). Any disturbance to these soils (including rehabilitation) requires careful assessment and monitoring to ensure potential impacts are identified. Where a proposed activity or development in the planning area or surrounding catchment may have acid sulfate soil related impacts, it will be referred to the Environmental Protection Authority for assessment.

Water stress associated with groundwater abstraction and reduced rainfall is considered a likely contributing factor to tuart decline within the planning area (TRG 2004).

Desired outcome

Alteration to natural groundwater and surface water hydrological processes and water quality is minimal.

Strategies

1. Protect water sources, wetlands and hydrological processes within the planning area from damage or disturbance that may affect water quality or quantity.
2. Ensure all proposed activities and developments that may modify the current hydrological regime are assessed and any adverse impacts are prevented or mitigated.
3. Undertake rehabilitation actions where the health of fringing riparian vegetation has been adversely affected by build up of excessive nutrient-rich sediments.
4. Work cooperatively with the Department of Water to maintain monitoring of surface and groundwater quality and quantity programs in the planning area.
5. Engage with relevant authorities (for example Department of Water), adjacent landholders and community groups regarding water quality/quantity and provide advice and direction as necessary to ensure key values are protected.

Introduced plants

The planning area has an extensive weed problem, with 193 weed species recorded and very few areas unaffected. Of the 193 weed species, six are 'declared' under sections 39–41 of the *Agriculture and Related Resources Protection Act 1976*¹³ (ARRP Act) and 16 species listed in the *Environmental Weed Strategy for Western Australia 1999* (EWS) as 'high'. A further 75 environmental weed species are rated in the EWS as moderate, 20 rated as mild, 62 rated as low and 20 are unrated. Many weed species are widely distributed and are often associated with riparian and moisture-gaining sites.

Two species of significant concern are arum lily (*Zantedeschia aethiopica*) and bridal creeper (*Asparagus asparagoides*). Both species are rated as 'high' under the EWS and listed as 'declared plants' under the ARRP Act. Bridal creeper is also one of 20 weeds of national significance and a strategic plan has been prepared for its management (DEWHA 2009). Arum lily and bridal creeper occur extensively throughout the planning area, often in dense thickets and have the ability to change the structure and function of ecosystems (CALM 1999).

Bullrush (*Typha orientalis*) and the divided sedge (*Carex divisa*) (rated as 'High' and 'Moderate' by the EWS respectively) currently provide important habitat and act as wildlife corridors for some native fauna species. Their removal should be undertaken in conjunction with a replacement program of native flora species that can provide the same functions.

Introduced pasture grasses are common and effective management can only be achieved when followed by immediate rehabilitation with native species. This will occur as part of the implementation of rehabilitation programs.

Pine plantations and plots in the planning area are intended for rehabilitation with native species following harvesting. The department will liaise with the Forest Products Commission to ensure the removal of pine minimises impacts on biodiversity. A trial plot of karri (*Eucalyptus diversicolor*) exists along the northern edge of Management Zone 2b. Due to its relatively young age, it has no significant fauna habitat value (that is, no hollows have developed) and is therefore proposed to be removed during the life of this plan. Any tree removals will require appropriate hygiene practices to prevent the spread of soil-borne fungus *Armillaria luteobubalina*.

Adjacent to the south-west corner of the Ludlow settlement, some pine is interspersed with tuart. These pines provide habitat for fauna including the western ringtail possum, Carnaby's cockatoo and heron (*Nycticorax caledonicus*). Therefore they will be retained until they senesce, in which case they will be removed and replaced with native species.

Weed control will focus on high conservation value areas, being the eastern wetlands (Management Zone 3) and mixed eucalypt woodlands (Management Zone 6). Ongoing weed control will also be carried out in areas of high community interest such as road verges, along boundaries with private property and around recreation sites. Any weed control undertaken in the planning area will be managed to minimise impacts on non-target flora species, particularly understorey species such as native herbs and grasses.

Desired outcome

The impacts of introduced plants on biodiversity values are minimised.

Strategies

1. Maintain information on declared plants including presence, abundance and distribution, relevant biological information and history of control.
2. Liaise with the Forest Products Commission to ensure pine removal operations do not impact on biodiversity values.

¹³This Act is being replaced by the Biosecurity and Agriculture Management Act 2007 (BAM Act). Provisions of the BAM Act will be progressively implemented from 1 July 2010.

3. Rehabilitate cleared plantation and other disturbed areas with relevant native vegetation to minimise the likelihood of further weed invasion.
4. Liaise with relevant agencies and neighbouring landholders to facilitate effective, coordinated environmental weed management and use volunteers to assist in weed management control programs.
5. Develop and implement a weed control plan for high conservation value areas, being the eastern wetlands and mixed eucalypt woodlands, and areas of high community interest.
6. Remove the karri trial plot.

Key performance indicators

Performance measure	Target	Reporting requirements
11.1 Weed control program for selected parts of the planning area.	11.1 Develop and implement a weed control program for the eastern wetlands, mixed eucalypt woodlands and areas of high community interest.	Every five years
11.2 Removal of the karri trial plot.	11.2 Remove the trial plot of karri from the planning area.	Every five years

Introduced and other problem animals

The red fox, feral cat and rabbit are the most common and widespread introduced animals within the planning area and continue to pose a threat to the survival of the western ringtail possum, brush-tail possum, quenda, brush-tailed phascogale and the native water rat. Birds and ducklings that migrate from their nest in mature tuart hollows to the Vasse-Wonnerup wetlands are also affected by introduced predators.

As part of the department's *Western Shield* program, fox baiting occurs in the planning area four times a year, with additional baiting to protect specific habitats, known populations of threatened animals, or new fauna release sites. While the large boundary to area ratio is not conducive to long-term control of foxes, baiting will continue until alternative management options are available. The department is also seeking to maximise this control effort by working strategically and collaboratively with neighbouring land managers.

The presence of feral cats in the planning area is acknowledged. Control is difficult, however, due to the recurrence of domestic cats originating from adjacent rural and urban areas. At the time of writing, cat baits are being trialled elsewhere in the state as part of the *Western Shield* program and it is possible that during the life of this plan, cat baits will be used in the planning area.

There is concern about the number of western grey kangaroos in the planning area and on surrounding private properties, as elevated populations of kangaroos have the potential to overgraze native plant seedlings and hinder ecosystem rehabilitation. Despite the seemingly high number of kangaroos in the area, the role of the kangaroo in tuart ecosystems is poorly understood and further research is required.

The department will continue to monitor the population levels and grazing pressures from kangaroos, and will consider a kangaroo reduction program in conjunction with neighbouring land holders, both within and adjacent to the planning area if required.

Rabbits are widespread and highly abundant in the planning area and potential environmental impacts are likely to be similar to those imposed by kangaroos. Rabbit control measures will be implemented when environmental impacts become unacceptable.

The pink and grey galah has expanded its natural range to include the planning area and has increased in number. It can be aggressive in competing for tuart hollows (John Carter *pers. comm.* 2007) and as such is considered a problem animal. The eastern long-billed corella and little corella also occur and, like the pink and grey galah, their population sizes are increasing which creates competition for food and habitat. The department will continue to monitor the population size and impacts of these bird species.

Feral honeybees impact on the values of the planning area by competing with native fauna for tree hollows, floral resources such as pollen and nectar and by increasing seed-set in some weeds. The feasibility of completely removing them is low, as localised eradication would probably be followed by re-colonisation from new swarms invading the area. Management will focus on controlling colonies/ swarms around recreation sites and managing the distribution and density of managed hives in areas of high conservation value.

Insect damage alone generally does not affect the health of tuart trees; however, when insect attack occurs in conjunction with other threatening processes such as water stress or frequent fire, the impacts on tuart trees can be more severe. The following insects are of most concern in the planning area (TRG 2004):

- tuart bud weevil (*Haplonyx tibialis*) which impacts on the tuart canopy seed pool
- pasture-derived leaf feeders which impact on young or regenerating tuart
- the tuart longicorn beetle (*Phoracantha semipunctata*) which attack the trunks of younger trees, sometimes killing them.

In comparison to other areas, neither tuart nor flooded gum decline is occurring to a significant degree in the planning area, though it is known to occur in isolated cases. Stressed trees are more vulnerable to insect attack and hence the severity of insect attack will be considered when monitoring tuart and flooded gum health.

Desired outcome

The impacts of introduced and other problem animals on biodiversity values are minimised.

Strategies

1. Continue to provide advice and support for kangaroo control on adjacent private properties.
2. Where necessary erect fencing to protect rehabilitated and high conservation value areas from grazing by rabbits and kangaroos.
3. Monitor the population levels and grazing pressure of kangaroos on the values of the planning area and consider implementing a kangaroo reduction program if required.
4. Continue to undertake fox control as part of the *Western Shield* program.
5. Monitor the occurrence of other introduced animals and implement control actions as required.

Key performance indicator

Performance measure	Target	Reporting requirements
11.3 Fox baiting as part of the <i>Western Shield</i> program.	11.3 Carry out fox baiting a minimum of four times a year in the planning area.	Annually

Disease

Tuart is considered relatively resistant to *Phytophthora cinnamomi* (TRG 2004) but other plant species within the planning area are highly susceptible to the disease. *P. cinnamomi* is not known to occur in the planning area, however recent research has detected the presence of the endemic *P. multivora* (Paul Barber, *pers. comm.* 2008).

The department will monitor the planning area for signs of these diseases and will support continued research into the significance of *P. multivora*. Disease hygiene practices will be taken into account as part of on-ground works and in visitor planning to prevent the spread of the disease in the planning area.

At least 50 families and more than 200 species of native plant are susceptible to the endemic soil-borne fungus *Armillaria luteobubalina* including tuart, peppermint, jarrah, *Acacia pulchella* and *Banksia grandis*, all of which are found within the planning area (Robinson and Rayner 1998). When rehabilitation occurs in areas where pine and karri are removed, hygiene practices will be employed.

The intensity of tree felling may also influence the artificial spread of *Armillaria* (Richard Robinson *pers. comm.* 2007) and therefore pine and karri may need to be removed in patches. Prevention is the best treatment and disease hygiene practices are essential to ensure the disease is not spread. However, full elimination of this endemic pathogen is not considered desirable or possible as it is naturally occurring in undisturbed areas of the south-west (Richard Robinson *pers. comm.* 2007).

Some frog species within the planning area appear to have been impacted by chytridiomycosis, including slender tree frog, banjo frog, moaning frog and motorbike frog (Aplin and Kirkpatrick 2001). Due to limited knowledge of this pathogen, management will focus on implementing hygiene practices during all on-ground operations and monitoring current populations to detect any significant decline in numbers.

Desired outcome

The impact and spread of existing plant and animal diseases is minimal and no new diseases are introduced into the planning area.

Strategies

1. Monitor the impact of chytridiomycosis and *Armillaria* by progressively identifying and assessing significant disease-free areas and mapping the extent of chytridiomycosis.
2. Implement proper hygiene standards when undertaking works within the planning area (for example harvesting pines) to reduce the risk of introducing and/or spreading pathogens.
3. Document and respond as necessary to outbreaks of plant and animal diseases that become apparent during the life of the plan.
4. Liaise with relevant agencies and neighbouring land managers to facilitate effective, coordinated disease management in the planning area and surrounding areas.

Fire

Fire is an important disturbance factor that has influenced, and continues to influence, the biodiversity of all ecosystems in the planning area. The drying climate and flammable vegetation of the planning area make it highly prone to bushfire, and when lightning strikes coincide with severe fire weather conditions and areas with high fuel accumulation, damaging bushfire can occur. Hence, fire management planning is important to protect biodiversity as well as the community.

This management plan provides the strategic framework that will be used to develop fire regimes that are ecologically appropriate and protect life and community assets. Fire management requirements are considered annually through the department's Master Burn Planning process and prescribed burns identified through this process will be consistent with adaptive management principles. Engaging with the public is vital if the role and effects of fire, the application of planned fire and fire suppression operations are to be understood. There is community interest in the planning process and outcomes associated with prescribed fire management. To this end, the department has made, and will continue to make, its planned burn programs publicly available.

Many species possess a variety of adaptive traits or 'vital attributes' that enable persistence in this generally fire-prone environment (Burrows & Wardell-Johnson 2003). While many species are resilient to a range of fire regimes, some are sensitive to low intensity fire or have specific fire regime requirements.

The department has developed a range of fire management guidelines to protect specific fire sensitive species and communities. Guidelines relevant to the planning area relate to organic-rich soils (peatlands), habitat protection within reeds and rushes, tuart woodlands, western ringtail possum and black cockatoo habitat.

As there are gaps in knowledge of the fire requirements for some flora and fauna species, fire management will initially focus on the protection of threatened species, the proposed Busselton yate TEC and significant habitats that require specific fire regimes. As information on the ecological parameters of species becomes available, this will be incorporated into the prescribed burning program. Fire regimes that have been developed to protect life and community assets will complement ecological fire regimes where possible.

Threatened species within the planning area that are vulnerable to fire include the western ringtail possum, southern brush-tailed phascogale, Baudin's cockatoo and Carnaby's cockatoo. The fire-sensitive threatened flora species *Verticordia plumosa* var. *vassensis* also occurs in the planning area. Where no fire ecology information exists for a particular species, carefully monitored experimental burning might be considered. Protection of threatened species will take priority when devising fire regimes important to ecosystem function.

Tuart is well adapted to fire. It has the capacity to recover rapidly from low and moderate intensity fires and regeneration via seedlings occurs almost exclusively following fire (DEC 2008b). High intensity fire in tuart woodlands can result in prolific post-fire seedling regeneration; however, intense fires can also cause tree deaths (Ruthrof *et al.* 2002). Tuart also takes some time to produce new seed and repeated intense fires can be destructive to tuart woodlands (Ruthrof *et al.* 2002, Archibald *et al.* 2006). The size-class structure of tuart populations is often determined by fire history, however in the case of the planning area it is more attributable to previous land-use history. Cohorts of young trees, such as those resulting from seedling regeneration following fires, are critical as they replace trees in decline or that have died (Archibald *et al.* 2006).

Changes in the understorey of tuart communities in the planning area have been linked to the decline in regular burning and the commencement of grazing by cattle soon after European settlement (TRG 2004). In some parts, the lack of fire over recent decades, history of livestock grazing and extensive weed invasion have resulted in tuart stands dominated by veteran trees with limited regeneration.

Although tuart is well adapted to fire, many of the veteran trees may be unable to survive intense fires or produce enough quality seed to enable regeneration. In addition, many mature trees are in a state of structural decline which may render them vulnerable to low intensity fires including prescribed burns. Therefore, to ensure these individual trees are protected, raking or removing fuel from the base of trees, protecting with water when lighting, or physically excluding groups of trees from planned burns will be considered where practicable.

Patch burning of small areas has and will continue to be applied to regenerate tuart communities.



Forestry in Tuart Forest National Park © Battye Library

Trials involving fire have been applied within the planning area and in other tuart ecosystems in the past, although the findings are not well documented. There is a need to draw together all existing research and operational results as an initial step in designing future trials into tuart re-establishment. Outcomes from trials will be used to update fire management within the planning area. Monitoring of post-fire survival and recruitment success will be conducted to determine if tuart communities are benefiting from prescribed burns.

The risk of bushfires impacting life and community assets in the planning area is considered low to moderate. In making this determination, the location and extent of fire-vulnerable community assets and the likelihood and consequences posed by fire to those assets are considered. A summary of assets identified within and surrounding the planning area is at Table 5.

Table 5. Asset protection areas

Asset protection area	Management actions and considerations
Neighbouring farms and residential properties	<ul style="list-style-type: none"> • Response to bushfire requires joint operations with the Fire and Emergency Services Authority (FESA), the shires of Busselton and Capel, volunteer fire brigades, local landowners and residents. • Strategic buffers are required to act as low fuel zones and will be achieved through prescribed fire, mechanical fuel modification (slashed breaks and buffers) or weed control. • Maintenance of strategic access and firebreaks.
Ludlow forestry settlement	<ul style="list-style-type: none"> • The settlement is heritage listed and some buildings are currently tenanted. • Future use of the settlement may see an increase in visitor numbers. • Strategic access and firebreak network to be maintained. • Prescribed burning, mechanical fuel modification or weed control will be required to establish asset protection buffers. • New water sources for fire management activities may need to be established. • Powerlines at the settlement have potential to ignite fires and present a hazard in the event of fire. • Asbestos is present in some buildings and presents a hazard in the event of a fire. • The settlement is divided between the shires of Capel and Busselton. Fire suppression activities may require involvement of both local governments. • Consideration will be given to developing a site-specific fire protection plan for the Ludlow settlement.
Tuart Drive	<ul style="list-style-type: none"> • The high scenic quality of mature tuarts along Tuart Drive is valued by the community. • Prescribed burns and fire suppression activities must be planned to minimise impact on mature trees without compromising safety to the public and fire fighters.

Asset protection area	Management actions and considerations
Tree plantations	<ul style="list-style-type: none"> • Prescribed burning of understorey may occur. • Plantation timber is of significant economic value. • Strategic access within plantation areas will be maintained where practicable.
Recreation sites	<ul style="list-style-type: none"> • Existing recreation sites include the Possum Paths walk trail, Layman day-use site, Malbup bird hide and walktrail, Membenup day-use site and the Ludlow River day-use site. Additional recreation sites may be established.
Infrastructure	<ul style="list-style-type: none"> • There is a need for new water sources to facilitate prescribed burning and bushfire suppression activities. • An electrical transmission line and below ground gas pipeline traverse the southern part of the planning area. • A water pipeline and bore provide water for the Ludlow settlement. • Power transmission lines and telephone lines associated with the Ludlow settlement.
Rehabilitation areas and fire regime-specific species	<ul style="list-style-type: none"> • Newly planted or regenerated seedlings, including tuart, are susceptible to fire. • Rehabilitation plots are located both within the Bemax mining lease and other parts of the planning area. • Mature tuart trees may be killed or severely weakened by moderate to intense fires. Structurally weakened trees can pose a risk to the public and firefighters and will need to be assessed and managed in accordance with the department's Fire Operations and Visitor Risk guidelines.

The planning area adjoins agricultural land, tree plantations, residential settlements and a mining lease. In many cases, the adjacent private property contains small areas of remnant trees with some understorey. This is a particular concern for managers as these areas are generally burnt infrequently and may be in close proximity to key community assets. It is therefore important to foster good neighbour relations with adjoining landowners, particularly to ensure complementary fire management on adjoining lands. In this respect, local government authorities have a dual responsibility with the department to mitigate the impacts of bushfire. Engaging with local government, volunteer bush fire brigades, FESA, other relevant state government agencies and Bemax Cable Sands will be necessary to ensure effective fire management across jurisdictions. Fire management in the planning area will, as far as practicable, be integrated with fire management on adjoining lands.

There is a strategic access network for the planning area, which comprises both public and strategic access roads and tracks. This network will be maintained to ensure safe access for fire fighting vehicles and to permit effective fire management. A road and track maintenance program is in place that considers potential impacts on natural, cultural and recreation values. Where possible, bushfires will be contained within management units defined by existing roads, rather than by constructing new firelines around the perimeter of the fire. If temporary firebreaks are constructed during fire suppression activities, they will be rehabilitated to minimise soil erosion, spread of disease or weeds and unauthorised access.

Desired outcome

There is no long-term reduction in the diversity, distribution and abundance of threatened or fire sensitive species and communities that can be attributed to inappropriate fire regimes.

Strategies

1. Use fire management guidelines to protect and conserve fire regime specific ecosystems, species and significant habitats.
2. Undertake research on the recruitment success of tuart after fire, including reviewing previous investigations and carrying out patch burning of small-scale areas and adapt management accordingly.
3. Maintain roads and tracks used for fire management.
4. Implement weed and feral animal control programs in association with prescribed burns and bushfires to minimise post-fire weed invasion and predation of native animals.
5. Adapt fire management to new knowledge gained through research, monitoring and experience, including unplanned events such as bushfires.
6. Liaise with relevant agencies, local bushfire brigades and neighbouring landowners and managers to facilitate effective, coordinated management of fire in the planning area and surrounding areas by encouraging cooperative arrangements and ensuring community protection from fire is at an appropriate level.
7. When undertaking prescribed burns, implement measures to protect veteran tuart trees where possible.
8. Unless deemed necessary for ongoing management requirements, rehabilitate firebreaks constructed during fire suppression activities.

Key performance indicator

Performance measure	Target	Reporting requirement
11.4 Small-scale patch burns in the planning area.	11.4 Undertake a minimum of two small-scale patch burns.	Every five years

Managing cultural heritage

12. Aboriginal and other Australian heritage

Management of Aboriginal and other Australian cultural heritage in the planning area is guided by WA's *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act), the *Heritage of Western Australia Act 1990* and the department's Policy Statement No. 18 – *Recreation, Tourism and Visitor Services*.

Aboriginal heritage

There are six Aboriginal heritage sites registered with the Department of Indigenous Affairs in the planning area, which include mythological and historical sites and sites containing physical evidence of Aboriginal presence in the area such as artefacts, scatter and a modified tree. The planning area is part of land traditionally occupied by the Wardandi people, who occupied the coast from Bunbury to Cape Leeuwin and inland as far as Nannup (Berndt & Berndt 1979, Tindale 1974, cited in WAPC 2005). Tilbrook (1983) suggested that at least 13 different socio-linguistic Aboriginal groups existed in the south-west. These groups, including the Wardandi people, shared traditions and a common language, albeit with local variations and are collectively known as Noongars. The word 'Noongar', or its linguistic equivalent, is identifiable as the word for Indigenous person from the region, even though they may have different vocabularies.

As the register maintained by the Department of Indigenous Affairs is not a comprehensive listing of all Aboriginal sites, assessments may be necessary prior to any operations that may inadvertently cause damage to sites of significance for Aboriginal people. Appropriate approvals under the Aboriginal Heritage Act are required before proceeding with any public works¹⁴ that may affect Aboriginal heritage values.

Traditional custodians have a strong desire to care for country and practise customary activities according to their traditional laws and customs, to be involved in the cooperative management of conservation reserves in WA and to strengthen cultural ties to the land. Working with Aboriginal people to care for the land will be beneficial to the preservation of natural and cultural heritage, as well as enriching cross-cultural awareness. The involvement of traditional custodians in the cooperative management of the conservation estate also provides a suite of cultural, spiritual and economic benefits to Aboriginal people. While it is possible that management arrangements with Aboriginal people may change during the life of the management plan, the department will continue to recognise the interests of Aboriginal people on reserves where native title has been extinguished and their desire to continue cultural activities and customs in these areas.

Other Australian heritage

The planning area has a long history associated with early settlement and the agricultural and forestry industries. There are several notable sites linked to European settlement, including two sites listed on the *State Register of Heritage Places*¹⁵ (the lime kilns and the Ludlow settlement) and 10 sites listed on the *Municipal Heritage Inventory* of the Busselton and Capel shires:

- Ludlow Tuart Forest Heritage Precinct (Shire of Busselton)
- Ballarat Tramline Plaque and Wheel (Shire of Busselton)

¹⁴ A public work includes buildings or fixed structures, roads, railways, bridges, bores or any major earthworks.

¹⁵ The State Register of Heritage Places is managed by the Heritage Council of WA.

- Route of the Ballarat Railway Line (Shire of Busselton)
- Wonnerup wetlands (Shire of Busselton)
- Vasse River and Estuary (Shire of Busselton)
- Dinny Connell's House, National Park (Shire of Capel)
- Single Men's Quarters, State Forest No. 2 (Shire of Capel)
- Formation Road existing alignment (Shire of Capel)
- Lime kilns (Shire of Capel)
- Forestry houses, State Forest No. 2 (Shire of Capel)



Former land use around the lime kilns.
Photo – DEC

The Ludlow settlement is a permanent entry on the *State Register of Heritage Places* and is also listed on the *Municipal Heritage Inventory* of the Busselton and Capel shires. The settlement includes Ludlow Road and the bridge over the Ludlow River, three groups of forestry cottages, the former sawmill, forestry workshops and compound, a school and the former Forests Department district office, among other buildings.

To the north of the Ludlow settlement are remains of a wooden tramway which was used between 1921 and 1928 to transport tuart logs to the Wonnerup mill. The tramway is listed on the Shire of Capel's *Municipal Heritage Inventory* and several original sleepers remain along the side of the road (Shire of Capel 1999). Part of this site was disturbed during mining of the Bemax lease site; however, any infrastructure that was unearthed was removed and replaced on the cessation of mining.

The remains of the old Ballarat Tramline and bridges can also be found in the planning area. The railway passed through the southern portion of Tuart Forest National Park and is listed on the Shire of Busselton's *Municipal Heritage Inventory*.



Remains of the tramline. Photo – DEC

The remains of the lime kilns, an industrial complex of circular kilns with unique spiral loading ramps, are located in Tuart Forest National Park. The kilns are listed on both the *State Register of Heritage Places* and the Shire of Capel's *Municipal Heritage Inventory*. Though the date of construction of the kilns is unknown, it is possible they were built as early as the 1840s (Heritage Council of WA 1998).

Desired outcome

Cultural heritage is conserved and protected.

Strategies

1. Create opportunities for local Noongar people to be involved in protecting and maintaining cultural heritage values.
2. Comply with Commonwealth and state legislation and departmental policies prior to commencing operations that have the potential to impact on cultural heritage.
3. Consult local Noongar people, SWALSC and the Department of Indigenous Affairs, and refer to the state Aboriginal Site Register and other relevant registers to ensure the protection and conservation of Aboriginal cultural heritage.
4. Provide culturally appropriate information and interpretation on Aboriginal cultural heritage to promote awareness, appreciation and understanding in the community.
5. Manage and regularly monitor threatening processes (such as fire, introduced plants and animals) and visitor activities to ensure Aboriginal and other Australian cultural heritage is not adversely impacted.
6. Consult and involve the local community and relevant organisations, and refer to heritage registers to ensure the protection and conservation of other Australian cultural heritage.

Key performance indicator

Performance measure	Target	Reporting requirement
12.1 Protection of registered or identifiable heritage sites.	12.1 No disturbance of registered or identifiable heritage sites without formal consultation and approval with local Noongar people and/or relevant stakeholders.	Annually

Managing visitor use

In the planning area, the major foci for managing visitor use are to:

- improve facilities at existing recreation sites
- provide interpretation at recreation sites to enhance visitor understanding and enjoyment
- consider the development of new walk and dual-use trails.

The provision of visitor services, facilities and experiences in the planning area is guided by the department's Policy Statement 18 – *Recreation, tourism and visitor services*.

13. Visitor opportunities and planning



Birdwatching is a popular activity in the planning area. Photo – DEC

Regional recreational context

Bussell Highway runs parallel and adjacent to the planning area and is intersected at two points by Tuart Drive, a dedicated scenic route that runs through the middle of the planning area. Both roads provide opportunities to view the tall tuarts, which is the main natural attraction for visitors. As well as scenic driving, the planning area provides a desirable setting for other recreational activities such as bushwalking, bird watching, photography and horseriding.

While it is recognised that recreational opportunities in the planning area are comparatively limited, it is important that visitor planning takes into account activities provided for elsewhere in the region, rather than endeavouring to provide a wide range of visitor opportunities that could reduce the quality of experience or compromise natural and cultural values. There are many opportunities for recreational activities in close proximity to the planning area including four-wheel driving, scenic driving, cycling, boating, walking, caving, climbing, sightseeing, camping, fishing, swimming, surfing and picnicking.

Vehicle counts undertaken in 2006–07 along Tuart Drive indicate an average of 1,580¹⁶ vehicles passing daily during summer and 1,349¹⁷ in winter. However, most of these vehicles continue without stopping, as Tuart Drive is a major thoroughfare for local residents and tourists destined for the nearby towns. There are no records of vehicle or visitor numbers for any of the recreation sites within the planning area.

Visitors who stop in the planning area do so at established recreation sites located at the southern end including the Layman, Membenup and Malbup day-use sites (see Map 3). While there are no established recreation sites in the north of the planning area, recreational activity does occur, particularly horseriding and bushwalking.

¹⁶Traffic count 25 January to 2 February 2006 (information provided by the Shire of Capel)

¹⁷Traffic count 27 August to 10 September 2007 (information provided by the Shire of Busselton)

The number of visitors to the planning area is low; however, if visitor numbers increase or there is a clear need for additional visitor information during the life of the plan, the department may undertake visitor surveys to gain an understanding of trends and satisfaction levels.

Visitor planning

Planning for visitor use is necessary to manage issues of visitor risk, environmental impacts, social benefit, equity, public demand and potential economic benefit. More detailed site planning will be required prior to the development of recreation sites and to manage more specific visitor use issues.

The planning area has significant visual landscape values in the distinctive tall tuart woodlands and open views over the wetlands. The department's Visual Resource Management Guidelines will be adhered to in all aspects of land management, particularly in the planning and development of new facilities, signs and infrastructure.

Visitor safety

The department routinely conducts risk audits of all designated recreation areas, with mitigation works undertaken on a priority basis according to the degree of risk posed to visitors. Personal injury and damage to property as a result of falling trees and limbs, particularly from tuart trees, can pose a serious risk to visitor safety. Removal of hazardous trees and lopping limbs in and around all designated recreation areas has been undertaken and will be an ongoing requirement. Tree pruning may be required along existing and potential new walk trails, particularly at points where people are likely to congregate, such as interpretation sites.

Mosquito breeding sites occur within the planning area and present an increased risk of exposure to mosquitoes and thus possible infection by diseases they transmit. The shires of Busselton and Capel have mosquito control strategies which detail the intention to apply a larvicide (*altosid*) at breeding sites within the Vasse-Wonnerup Estuary, outside the planning area (Shire of Busselton 2005, Shire of Capel 2006). Mosquito risk warning signs will be maintained at all designated recreation sites.

Desired outcome

People are able to enjoy a range of nature-based recreation and tourism opportunities.

Strategies

1. Provide and maintain a range of safe nature-based visitor services and facilities consistent with the department's Policy 18 – *Recreation, tourism and visitor services*.
2. Ensure existing and future recreation and tourism developments and visitor activities have a minimal impact on key values and ensure they are designed, developed and maintained to department standards.
3. Undertake informal surveys of visitor activities such as bushwalking and horseriding.
4. Use the data collected from visitor satisfaction surveys and social research to improve management and minimise environmental, social and economic impacts in the planning area.
5. Undertake formal visitor risk assessments of all recreation sites and facilities as part of a visitor risk management program and in addition to that which occurs on a day-to-day basis, and implement appropriate action as necessary.

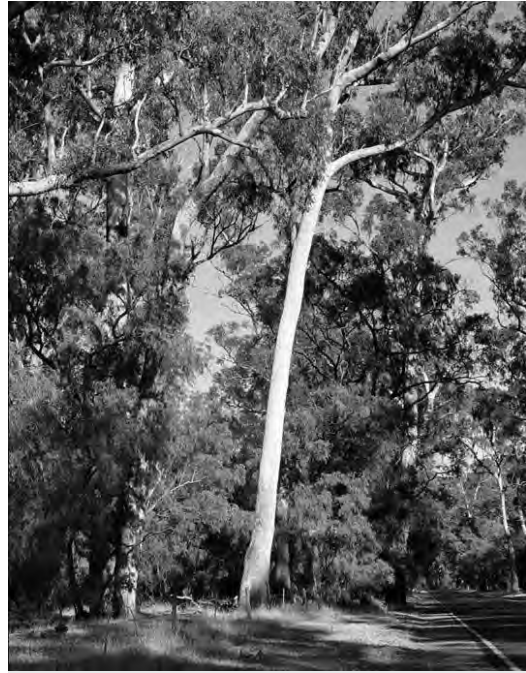
Key performance indicator

Performance measure	Target	Reporting requirement
13.1 Visitor satisfaction with nature-based facilities.	13.1 Maintain or increase visitor satisfaction with nature-based facilities.	Every 5 years

14. Access

The planning area is easily accessible, with public access available to vehicles via sealed and unsealed roads and tracks. Access needs to be carefully managed to balance the demand for access with protection of key values, including qualities of naturalness that are highly valued by many visitors and the community.

Access to the planning area occurs predominantly via Tuart Drive and Layman Road. Other roads that provide access to the planning area include Ludlow North Road, Stirling Road and Mallokup Road (see Map 3). Formation Road is a historic unsealed road managed by the department that runs through the middle of the planning area north of the Ludlow settlement. Public access to the southern section of Formation Road is restricted due to the need to protect rehabilitated areas within the Bemax mining lease, but will eventually be re-opened once rehabilitation requirements have been met.



Tuart Drive is the main access road through the planning area. Photo – Bronwyn Keighery

The planning area contains numerous tracks that were formed before the national park was gazetted. Tracks through the planning area (except those indicated on Map 3 or tracks required for management access) will be progressively closed to the public over the life of this plan. This will aid in tuart rehabilitation, assist with the maintenance of environmental values and improve visitor safety. Tracks that are designated as management access only will be signposted accordingly.

Fences surround the planning area, although limited maintenance is carried out and some gates are not locked. The majority of fences were constructed to control livestock when the planning area was used for grazing and will be retained and maintained as required for management purposes. Problems associated with unauthorised access into the planning area include rubbish dumping, abandoned vehicles, vandalism and theft of infrastructure such as gates and signs and illegal access by off-road vehicles. Public access to the planning area will be managed through the provision of clearly identified access points and signage.

Unauthorised off-road driving has led to the degradation of vegetation and soils, the spread of weeds and is a risk to public safety through conflicts between vehicles and other park users. In particular, off-road vehicle activity in the cleared corridors beneath the powerlines that traverse the eastern wetlands is causing significant environmental damage. The railway reserves managed by the Public Transport Authority (outside the planning area) act as a conduit for unauthorised vehicle access into the planning area. The department will liaise with the relevant agencies to restrict unauthorised vehicle access into the planning area.

Off-road driving along roads and tracks closed to the public or where there are no tracks is not permitted. All vehicles within the planning area must be registered under the *Road Traffic Act 1974* and drivers must possess a current driver's licence. Vehicles registered under the *Control of Vehicles (Off-road Areas) Act 1978* and unregistered off-road vehicles (for example ATVs, off-road motorbikes and dune buggies) are not permitted.

Access to the Bemax mining lease (M 70/86) is restricted and is specifically fenced to prevent unauthorised entry to the lease site.

Desired outcome

Provide and maintain safe and effective access that facilitates visitor enjoyment of the planning area while minimising impacts on natural, cultural and recreation values.

Strategies

1. Provide and maintain access as shown in Map 3 for management and public use consistent with department standards and in consultation with visitors and relevant stakeholders.
2. Prohibit vehicles driving off dedicated roads, CALM Act roads and tracks, except with the approval of the District Manager.
3. Close management access tracks to the public and signpost them as management access only.
4. Provide information to visitors on the different types and locations of safe and appropriate access.
5. Negotiate with the appropriate authorities to close unnecessary or unused road reserves, adding them to Tuart Forest National Park (see Section 4 *Land Tenure and Boundaries*).
6. Retain and maintain existing fences that are required for management purposes.
7. Where appropriate, improve access for disabled visitors.
8. Seek complementary management of the adjacent unvested railway reserves to minimise impacts on adjacent parts of the planning area through unauthorised access.

15. Visitor activities and use

Day-use

Established day-use sites include the Layman and adjacent Malbup day-use sites, Membenup and Ludlow River. The lime kilns site and Ludlow settlement are occasionally used by visitors as informal day-use areas, although there are no facilities at these sites. Day-use sites are shown at Map 3 and their management settings are listed in Table 6.

Management of day-use sites will focus on improving the quality of established sites in combination with a better standard of access and interpretation to direct visitors to sites that best meet their requirements.

There are no authorised camp sites in the planning area, although unauthorised camping does occur at the Ludlow River day-use site. Camping will not be provided for due to the proximity of the planning area to caravan and camping facilities in the nearby towns of Busselton and Capel.

Table 6. Existing and proposed day-use sites

Day-use site	Activity	Comments or proposals
Layman	Picnicking	Picnic tables, toilets and rubbish bins are provided.
Malbup	Bushwalking, interpretation and wildlife viewing	This site is the access point for the Possum Paths and Malbup bird hide (see Table 7). Facilities include interpretation panels and a car parking area. The <i>Busselton Wetlands Trails Master Plan</i> (Shire of Busselton 2007) outlines a concept for a proposed bird hide (overlooking the Vasse Estuary) and access path leading off the existing Possum Paths.
Membenup	Nature appreciation, bushwalking, picnicking and interpretation	This site is a popular area to view tall tuart trees. The <i>Busselton Wetlands Trails Master Plan</i> (Shire of Busselton 2007) outlines a concept for a new walk trail leading to a proposed bird hide overlooking the Wonnerup Estuary).
Ludlow forestry settlement	Picnicking, overnight stays and interpretation	There are no day-use facilities at the settlement but it is used as an informal picnic area. A new day-use area may be established but is dependent on future management of the settlement.
Ludlow River	Road side rest area	Picnic tables and rubbish bins are provided at this site.

Day-use site	Activity	Comments or proposals
Higgins Road	Interpretation	Interpretation has been installed about tuart regeneration after fire. A new short walk trail is proposed (see Table 8), as well as a car parking area.
Lime kilns (proposed)	Interpretation	Proposals include formalising a car park and walk paths and establishing interpretation about the heritage values of the site, once the kilns have been made structurally secure and consistent with the <i>Lime Kilns Heritage Assessment and Conservation Plan</i> (Ecoscape 1996).

Bushwalking

The two established walk trails in the planning area are the Possum Paths (two kilometres) and the Malbup bird hide access trail (a 400-metre gravel path and boardwalk off the Possum Paths trail). Several short informal walk trails exist at the lime kilns heritage site and Ludlow settlement, and bushwalking also occurs on vehicle tracks and firebreaks.

Two walk trails leading to new bird hides overlooking the Vasse-Wonnerup wetlands are proposed in the *Busselton Wetlands Trails Master Plan* (Shire of Busselton 2007). The department has indicated in-principle support for these trail concepts, as well as others proposed in the *Shire of Capel Trails Master Plan* (Shire of Capel 2009) but their development will be subject to assessment of social and environmental considerations and availability of resources for the design, construction and maintenance of the trails.

Although several walk trails are proposed here, which trails are developed will depend on the availability of funding, outcomes of further trail planning and consultation with the local Aboriginal community and other interest groups. A summary of the existing and proposed trails within the planning area and their class is provided in Table 7 and shown at Map 3. Other bushwalks may be developed as demand increases after detailed planning and public consultation.



Birdwatching. Photo – Roger Paine

Table 7. Existing and proposed walk trails

Walk trail	Proposed class (1–6) ¹⁸	Comments or proposals
Possum Paths	3	A 2 km walk trail popular for spotlighting of western ringtail and brushtail possums.
Malbup bird hide	1	A 400 m walk trail leading from the Possum Paths to the Malbup bird hide.
Malbup-Abba bird hide (proposed)	3	A 930 m walk trail extending from the existing Possum Paths leading to a new bird hide on the Vasse Estuary. This trail concept is outlined in the <i>Busselton Wetlands Trails Master Plan</i> .
Membenup bird hide (proposed)	2	A 1.4 km walk trail and new bird hide on the Wonnerup Estuary. This trail concept is outlined in the <i>Busselton Wetlands Trails Master Plan</i> .
Ludlow-Layman (proposed)	3	A proposed 6 km walk trail leading from the Ludlow settlement to the Layman day-use site, connecting with the Membenup day-use site. Consideration will be given to a dual-use path, and linking with the existing Busselton path network.
Higgins Road	3	A proposed short (<500 m) walk trail demonstrating the effects of fire on tuart regeneration, to be developed in conjunction with interpretation at the Higgins Road day-use site.
Lime kilns (proposed)	2	Development of a short walk trail around the lime kilns may be required to protect the structures.

Horseriding

Horseriding is a popular activity in the planning area, particularly in the northern parts, including Minnipup Block. Commercial horse training has also occurred for a number of years, with trainers known to exercise racehorses within the planning area. There are no formal bridle trails and unrestricted access has led to both recreational horseriders and commercial horse trainers using informal tracks, particularly adjacent to rural residential properties in the Minnipup area. These include tracks created for management, as well as tracks created illegally by the horseriders themselves.

Recently, horseriding has become a more contentious management issue because natural areas may be unable to sustain the pressures that result from the activity. Of particular concern is the potential for horseriding to affect ongoing rehabilitation of tuart ecosystems through the creation of unauthorised tracks and by riding through environmentally sensitive areas.

Given its previous history and demand as a recreational activity, recreational riding will be permitted in the planning area on selected tracks and on undeveloped public road reserves. Tracks designated for horseriding will be selected in consultation with horseriders, with proposed tracks identified by the department shown on Map 3. Signs will be provided to guide horseriders and the department will consider developing a voluntary recreational horseriding permit system to monitor the level of use. If demand for recreational riding increases during the life of the plan, the department will liaise with the shires of Busselton and Capel to investigate the feasibility of providing formal facilities such as horse trailer parking to discourage unauthorised access points (for example, cutting fences) and *ad hoc* circuits/tracks and tethering yards. Any tracks that are designated for horseriding will still be available to other park users.

¹⁸ Walk trails are classified according to Australian Standard 2156.1 *Walking Tracks – Classification and Signage*. Variables taken into consideration include track condition, gradient, signage, infrastructure and terrain. Classification ranges from 1 (least degree of difficulty) to 6 (most difficult).

To minimise the potential for conflict with other visitors, horseriding will not be permitted south of the Ludlow settlement, as other recreational activities are concentrated in this area. Horseriding will also not be permitted in environmentally sensitive areas such as wetlands and rehabilitated areas. The department will continue to monitor horseriding activity and, if the activity is shown to have an unacceptable impact on natural, cultural, or other recreational values, access will be modified or the activity excluded from the planning area.

The training and exercising of racehorses is not considered recreational, but a commercial activity undertaken for private financial benefit, which provides limited or no benefit to the park or park users. As such, use of the planning area by commercial horse trainers will be phased out over five years from when the final management plan is gazetted. In the meantime, commercial horse trainers will be required to apply for a commercial operator's licence to allow the department to regulate the activity and minimise environmental impacts and conflicts with other visitors. This issue is discussed further in Section 15 – *Tourism and Commercial Operations*.



Horseriding is one of the most popular recreation activities.

Until the activity is phased out, the training and exercising of commercial race horses will be permitted on the same tracks available to recreational horseriders.

Dogs

Because of the limited availability of space at recreation sites, potential for conflict with visitors, and impacts on breeding populations of threatened fauna species and migratory birds, there are no designated areas for dog use in the planning area. Additionally, fox baiting programs occur throughout the planning area and these baits are fatal to dogs.

If Ludlow settlement is developed for accommodation, it may be possible to allow domestic dogs within the boundary of the settlement. This needs further consideration as it is important that the ability to undertake fox control with 1080 baits in the planning area is not affected.

Public dog exercise areas managed by the shires of Busselton and Capel exist in close proximity at Forrest Beach, Peppermint Grove Beach and at Busselton.

Desired outcome

Provide a range of opportunities for visitor activities that facilitate enjoyment, appreciation and understanding of the key values of the planning area.

Strategies

1. Provide and maintain a range of recreation opportunities as shown at Map 3, consistent with the adequate protection of key values, recreational development criteria, site capability, safety standards and the rights and enjoyment of other visitors.
2. Monitor the impacts of, and demand for, recreational activities and manage activities in liaison with users where impacts become significant or unacceptable.
3. Allow horseriding and horse training on designated tracks to the north of the Ludlow settlement and on undeveloped public roads, and consider the development and implementation of a recreational horseriding permit system.

4. Install signage for horseriders that outlines the location of tracks and access points, safety guidelines and guidelines for minimising the impacts of horseriding on natural values.
5. Continue to restrict camping in the planning area (with the possible exception of Ludlow settlement).
6. Prohibit dogs within the planning area, except registered guide dogs and dogs required for emergency search and rescue purposes.
7. Provide information to visitors about recreational opportunities.
8. Liaise with the shires of Capel and Busselton to develop recreational facilities both within and adjacent to the planning area.
9. Phase out the training and exercising of commercial race horses within five years from when the final management plan is gazetted.

Key performance indicator

Performance measure	Target	Reporting requirement
15.1 Horseriding is provided for on designated tracks.	15.1 Identify suitable tracks to designate for use by recreational horseriders in consultation with the community.	Every 5 years

Visitor interpretation and education

Information on facilities, attractions, activities, access and regulations is available through signage, printed materials (for example books and brochures), the department's website and staff. Information is also available from external sources, including conservation groups, volunteers, tour operators and the tourism industry.

The key values of the planning area have been used to develop two primary themes for interpretation within Tuart Forest National Park, which are outlined in Table 8.

Table 8. Primary interpretive themes

Primary theme	Interpretive stories	Major sites for interpretation
Woodlands and Wetlands – a rich mosaic of wetland and upland ecosystems	<ul style="list-style-type: none"> • tuart the species – <i>Eucalyptus gomphocephala</i> • tuart on the Swan Coastal Plain • unique eucalypt biology • Tuart Forest National Park – the tallest tuarts and the largest woodlands • problems with tuart (woodland structure and regeneration, tuart decline) 	Membenup, Higgins Road, Malbup, Ludlow settlement, proposed Ludlow – Layman walk trail
	Wildlife of the tuart woodlands <ul style="list-style-type: none"> • western ringtail possum, Carnaby's and Baudin's cockatoos, wambenger, kangaroo, bats, reptiles, invertebrates 	Malbup, proposed Ludlow – Layman walk trail
	River and wetland ecosystems <ul style="list-style-type: none"> • Vasse-Wonnerup wetlands – Ramsar and waterbirds • the Abba and Ludlow rivers • the eastern wetlands 	Malbup (bird hides, proposed Malbup-Abba trail), Ludlow settlement (Ludlow River)

Primary theme	Interpretive stories	Major sites for interpretation
The Tuart Forest and People – people affect the forest, the forest affects people	Noongar people and the tuart forest <ul style="list-style-type: none"> • significant sites for Wardandi people • stories about the tuart forest area, people, plants and animals 	Proposed walk trails (Membenup, Ludlow-Layman, Malbup-Abba)
	Explorers and settlers <ul style="list-style-type: none"> • exploration and encounters with Aboriginal people • colonial settlement 	Lime kilns, Layman
	Resource use <ul style="list-style-type: none"> • livestock grazing • lime production • forestry in the tuart forest – the early days of forestry management in WA • plantation timber • mineral sands mining 	Lime kilns, Ludlow settlement, Layman, Ludlow River (plantations)
	The tuart forest now and in the future <ul style="list-style-type: none"> • conservation – State Forest No. 1 and 2, protests against the mine, the values of the tuart forest today • research – woodland rehabilitation, fire management, tuart decline • rehabilitation – (tuart re-establishment, understorey diversity, woodland structure), including the success or otherwise of minesite rehabilitation 	

These primary themes will be used to guide the type of interpretation likely to be provided at each recreation site in the planning area.

Use of the planning area for educational activities is currently low, with the Possum Paths and Malbup bird hide the most popular sites visited by school groups. Development of new recreation sites and walk trails, together with improvements to existing sites, will increase opportunities for providing education programs. In particular, the possible development of a day-use area with interpretation at Higgins Road or development of the Ludlow settlement for overnight accommodation will provide more opportunities for educational programs.

Desired outcome

Provide visitors with a range of experiences based on natural and cultural while ensuring adverse impacts on key values are minimised.

Strategies

1. Provide, through partnerships and sponsorships where appropriate, quality information, interpretation and educational opportunities for visitors to increase their understanding and appreciation of (i) key values and management issues, such as appropriate visitor activities, behaviour, access and visitor safety (ii) the tall tuart woodlands, and (iii) the Noongar cultural values and other Australian history of the planning area.
2. Work with Noongar people in the development of visitor information and education opportunities.

Key performance indicator

Performance measure	Target	Reporting requirement
15.2 Provision of interpretive sites	15.2 A range of interpretive sites consistent with the themes outlined in Table 8 are provided	Every 5 years

16. Tourism and commercial operations

At present, there are no leases within the planning area for recreation or tourism purposes.

The Ludlow settlement includes several former forestry cottages that are let by the department to private tenants, however the maintenance of buildings and provision of services is placing a significant drain on the department's resources. Due to insufficient income being generated under the current management arrangement, the condition of the buildings and other facilities is deteriorating and significant restoration and ongoing maintenance work is required to maintain the heritage values of the site. From a financial perspective, the department does not consider the current arrangement a viable option. The future management of Ludlow settlement is unclear and a change in management may occur during the life of this management plan. It is likely a new reserve will be created over the settlement, with the reserve vesting and purpose dependent on future management arrangements.

At the time of writing, 101 'T class' commercial tour operators (CTOs) possess licenses to conduct activities in Tuart Forest National Park. However, it is believed that none of the operators actually run tours or activities in the area (Ken Ninnette *pers. comm.* 2008). Although use of the planning area by CTOs is low, opportunities may increase during the life of this plan, particularly if the Ludlow settlement is developed for short-stay accommodation.

Horsing is permitted as a recreational activity in parts of the planning area (see Map 3), however the use of the planning area by horse trainers is considered a commercial activity under the Conservation and Land Management Regulations 2002 (CALM Regulations). The department will phase out the training and exercising of commercial race horses within five years from when the final management plan is gazetted. Until this time, commercial horse trainers will be required to apply for and gain a 'T class' commercial operator's licence pursuant to Part 7 of the CALM Regulations in order to train horses in the planning area. Licence applications will be assessed in accordance with Policy 18 – *Recreation, tourism and visitor services*.

Desired outcome

Allow for a range of services and experiences in the planning area through the involvement of private enterprise, consistent with the objectives of this management plan.

Strategies

1. Ensure commercial horse trainers apply for a 'T class' commercial operator's licence to carry out horse training in the planning area.
2. Ensure all commercial operations operate under a lease, licence or permit agreement with appropriate conditions in accordance with departmental policies and the department's *Commercial operator handbook – Terrestrial*.
3. Monitor commercial operator compliance with licence conditions and the level and impact of operator use to ensure commercial operations are sustainable.

Managing resource use

17. Mineral and petroleum exploration and development

For three years until 2009, Bemax Cable Sands Pty Ltd mined titanium minerals from mining lease M70/86 within State Forest No. 2 (Minister for the Environment 2003). Mining of the deposit disturbed 110 hectares of the 216-hectare lease (CALM 2006). Rehabilitation of 106 hectares of unmined land is being undertaken by the department over a 10-year period and monitoring and maintenance of rehabilitation on the mined area is likely to be ongoing during the life of this plan. Public access to the lease area is restricted to prevent disturbance to rehabilitated areas. This will continue until rehabilitation has reached a stage where it is considered robust enough to withstand visitor pressures.

In total, there are five tenements issued under the *Mining Act 1978* across the planning area. Bemax Cable Sands has a pending tenement (E70/3525) over part of Minninup Block and North Block, however a condition for approval to mine the M70/86 lease was for the company to never pursue further mining within Tuart Forest National Park (Minister for the Environment 2003). There are also pending tenements held by Balde Exploration Consultants (E70/1512) and Iluka Midwest (M70/739) over national park and state forest tenure. Iluka Midwest has a small live tenement (L70/22) over the rail reserve that crosses the southern part of the national park.

Extraction of basic raw materials (BRM) does not occur and there is no foreseeable need to extract BRM within the planning area in the future. In the unlikely event that there is demand for access to BRM, alternative sources outside the planning area will be encouraged. Extraction will be permitted only where the use of the material assists in the protection and management of the area; a more environmentally acceptable alternative is not available; where the material is used within the reserve boundaries, and extraction is consistent with this management plan and the tenure of the area.

Desired outcome

Minimise impacts from mineral and petroleum exploration and development on key values.

Strategies

1. In conjunction with the Department of Mines and Petroleum, evaluate the likely impact of proposed mineral exploration and development activities, and monitor existing activity.
2. Refer exploration or mining proposals with the potential to impact upon the planning area to the Environmental Protection Authority as appropriate.
3. In accordance with department and Conservation Commission policies, permit access to BRM from the planning area where:
 - the use of the material assists in the protection and management of the area
 - a more environmentally acceptable alternative is not available
 - the material is used within the boundaries or enclaves of the planning area
 - extraction is consistent with this management plan and purpose and tenure of the area.
5. Ensure that all sites in which mining activity or BRM extraction occurs are rehabilitated according to the conditions of the mining lease and department rehabilitation standards and guidelines.

18. Other resource use

Water resources

There are two groundwater bores in the planning area. One is licensed to the department and provides drinking water to Ludlow settlement, the other is allocated to Bemax Cable Sands to assist with its rehabilitation obligations (Bemax Cable Sands 2008), however Bemax Cable Sands no longer require the bore and it will subsequently be transferred to the department. There are also unlicensed bores within the planning area which will be closed to prevent leakage and unlicensed abstraction.

In addition to bores within the planning area, there are many bores in close proximity that are licensed with the Department of Water. Unsustainable groundwater use has the potential to impact on the values of the planning area, by lowering the watertable which could impact on wetlands and plant communities. The department will continue to liaise with the Department of Water to ensure environmental impacts due to groundwater abstraction are avoided.

Forest produce and forest products

Tuart Forest National Park contains some exotic plantation species which will be removed during the life of this management plan and cleared areas will be rehabilitated with tuart. Parts of State Forest No. 2 also contain exotic tree species, primarily pine, which are managed by the Forest Products Commission for the commercial harvest of timber. Eventually it is the department's intention for all of State Forest No. 2 to be incorporated into Tuart Forest National Park but only after all exotic timber within State Forest No. 2 has been harvested.

Removal of firewood has detrimental impacts including reduced habitat integrity and the spread of disease, such as *Phytophthora*, through illegal access. Furthermore, there is a shortage of dead wood in the planning area that can be used for rehabilitation purposes (for example, for the creation of ashbeds) and this is likely to be the case for the duration of this plan. As such, firewood collection will not be permitted in the planning area.



Needle-leaved chorizema (*Chorizema aciculare*) is a common species found throughout the south-west. Photo – DEC

Beekeeping

There are six apiary sites within the planning area. As part of developing the management plan, the sites have been assessed in accordance with the department's Policy Statement 41 – *Beekeeping on public land* (subject to final consultation). None of the apiary sites are rated as 'suitable', three sites are classified as 'highly constrained' and the other three sites are 'suitable but conditional', with conditions that include seasonal restrictions. Appendix 4 shows the conditions to be placed on each permit. These conditions may render the existing sites unviable for use by commercial beekeepers and there are few suitable locations within the planning area to relocate sites. Therefore, continued use of the planning area for commercial beekeeping may be unviable. To address this, the department will negotiate with beekeepers to identify replacement sites outside the planning area.

Public utilities and services

This management plan provides for the continuation of existing utility and service arrangements. Utilities that traverse the planning area are shown at Map 4.

Two railway reserves cross the southern portion of the planning area to the east of Tuart Drive and are managed by the Public Transport Authority. Cross-boundary management issues such as weed establishment and four-wheel-drive vehicle and trail bike activity are impacting on parts of the planning area.

An underground gas pipeline is located within one of the unvested railway reserves. The department will liaise with the Public Transport Authority and Alinta to ensure these easements are managed to minimise impacts on the planning area.

A high-voltage powerline traverses the eastern boundary of the planning area crossing both occurrences of the eastern wetlands. Uncontrolled vehicle access along the powerline corridors is degrading the wetlands and there is a potential for powerline maintenance to also cause negative impacts. Powerlines are also situated to the south of Layman Road, near Lot 100, in the vicinity of the Ludlow settlement and to the south of Stirling Road.

The department will continue to assess and monitor any future developments or proposals that may impact on the values of the planning area. Where proposals are likely to have a significant adverse impact, they will be referred to the Environmental Protection Authority for formal environmental impact assessment under the *Environmental Protection Act 1986* and may also require approval under the EPBC Act.

Desired outcome

Impacts on the values of the planning area from resource use are minimal and any disturbance from resource use is appropriately rehabilitated and/or restored.

Strategies

1. Refer any proposals for resource use to the Environmental Protection Authority for formal assessment where such proposals are likely to adversely affect the key values of the planning area.
2. Liaise with the Department of Water to ensure groundwater abstraction does not impact on the natural values of the planning area.
3. In accordance with the CALM Act, use forest produce that becomes available from essential works for the purposes of making improvements to conservation reserves.
4. Manage apiary sites according to relevant departmental policies.
5. Designate apiary access routes, supervise apiary field activities (including application of dieback hygiene principles), install signage at apiary sites and review apiary site management.
6. In accordance with the apiary analysis (see Appendix 4), renew apiary permits and consider the cancellation or relocation of sites, possibly outside the planning area, consistent with assessment criteria. No new apiary sites will be permitted in conservation reserves that have no historical use.
7. Liaise with beekeepers, the Beekeeping Consultative Committee and the Department of Agriculture and Food to ensure the most efficient and sustainable use of sites.
8. Permit new utilities and services only where they are consistent with the CALM Act and government policy, where there are no viable alternatives, and where they minimise adverse impacts on the planning area's key values.
9. Liaise and consider the development of a cooperative management arrangement with the Public Transport Authority, Alinta and Western Power for management of the unvested railway reserves and associated utilities to minimise impacts on adjacent parts of the planning area.
10. Continue to prohibit the collection of firewood within the planning area.

Involving the community

19. Community involvement and off-reserve management

The involvement and support of, and partnership with, the community is an integral part of the department's operations, including the development and 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 promote community involvement in its protection and conservation.

Community involvement and support

The community has been involved in the preparation of this draft management plan. In particular, members of the Tuart Forest National Park Community Advisory Committee provided advice on many issues throughout the planning process.

Working together with Noongar people will assist heritage preservation and conservation of the environment, as well as enrich cross-cultural awareness. Involving Noongar people in management of the planning area is important and will be encouraged.

Ongoing community support is essential for the successful implementation of this management plan. Tuart Forest National Park provides opportunities for community members to take part in volunteer activities such as track maintenance, vegetation rehabilitation, fauna surveys and weed removal. Volunteer activities not only increase the department's work capabilities and skills base but also foster communication links and understanding with the community.

Off-reserve management and partnerships

Principles for effective neighbour relations are outlined in the department's *Good Neighbour Policy* (DEC 2007b) and are important for fostering partnerships with the community. Management objectives for this plan cannot be achieved in isolation as various land tenures adjoin the planning area. In particular catchment protection, feral animal control, threatened species protection and fire management need to be approached from the broader integrated land management perspective in order to achieve management objectives for the planning area. The department works with other land managing agencies, neighbours and the local community to achieve effective and coordinated management of cross-boundary issues.

The department liaises with the relevant Australian government department responsible for the management of Ramsar wetlands such as the Vasse-Wonnerup wetland system, migratory bird species and threatened plants and animals listed under the EPBC Act. Several state government agencies have responsibilities for, or provide advice on, land-use practices within the vicinity of the planning area, including drainage and declared pest animals and plants (Department of Agriculture and Food) and water resource use (Department of Water).

Liaison with the shires of Busselton and Capel is especially important, given local government:

- broadly represents the views of the communities within their constituency
- is able to encourage planning and land management practices that complement management of the planning area

- along with local bushfire brigades and volunteers, work with the department to provide cooperative and coordinated fire fighting on or near department-managed land
- shares responsibilities in the provision and maintenance of the public road network.

The planning area is within the South West natural resource management (NRM) region which, in partnership with governments, Aboriginal groups, land managers and community groups, help deliver Australian Government conservation funding programs. Annual funding programs across catchments, such as GeoCatch (covering the Geographe Bay Catchment), contribute toward effective management of the planning area, and interaction with NRM groups is important to provide for integrated natural resource management.

Many threatened species, including Baudin's and Carnaby's cockatoos, are highly mobile and travel across tenures. For those species that have recovery plans, liaising with landholders will be important in implementing recovery actions, especially in increasing awareness of the species' conservation status and providing information on how landholders can assist in recovery efforts.

Desired outcome

Facilitate effective community involvement and support in planning and management.

Strategies

1. Create opportunities for Noongar people to be involved in park management.
2. Liaise with neighbours, local authorities, relevant agencies and other stakeholders to facilitate off-reserve conservation and the effective, coordinated management of cross-boundary issues.
3. Continue to support, promote and provide opportunities for volunteer and community involvement in management of the planning area.
4. Continue to contribute towards the department's volunteer database.

Research and monitoring

Research and monitoring are important components of management and are necessary for the successful implementation of this management plan. The plan allows for the adaptation of management in light of new knowledge arising from research and monitoring through the continual review of management activities to ensure best practice management.

Broad direction for research and monitoring in the planning area is provided by the department's Science Division in *A Strategic Plan for Biodiversity Conservation Research 2008–2017* as well as species recovery plans, the nature conservation plan for the South West Region and research priorities set by the Centre of Excellence for Climate Change Woodland and Forest Health, based at Murdoch University (which replaced the Tuart Response Group).

Desired outcome

Increase knowledge and understanding of the values and threats to the planning area to inform management and allow assessment of the key performance indicators included in this management plan.

Strategies

1. Develop and implement an integrated program of survey, research and monitoring aimed at collecting evidence to allow reporting on KPIs and facilitating management of the planning area, with a focus on key values and issues identified in this management plan, the establishment of baseline information and other department research priorities.
2. Incorporate research and monitoring findings into interpretive and educational material where appropriate.
3. Encourage and support volunteers, educational institutions and other organisations where their research contributes directly to department strategies or the implementation and assessment of this management plan.
4. Monitor for signs of tree decline, particularly tuart, flooded gum and peppermint.
5. Monitor the distribution and abundance of western grey kangaroos and evaluate any environmental impacts.
6. Adapt management according to research outcomes, including the assessment of ecosystem rehabilitation and experimental trials.
7. Collate and review previous research findings from experimental trials involving fire and tuart regeneration, both from within the planning area and in other tuart ecosystems. Incorporate any findings when planning for fire in the future.

References

- Aplin, K., & Kirkpatrick, P. (2001). In the pursuit of the frog fungus. *LANDSCOPE*, pp. 10–16.
- Bemax Incorporating Cable Sands. (2008). *Ludlow titanium minerals mine M70/86 decommissioning and closure plan*. Bunbury: Bemax Incorporating Cable Sands (unpublished).
- Biota Environmental Sciences. (2003). *Ludlow stygofauna survey*. Bunbury: Cable Sands (WA) Pty Ltd (unpublished).
- Bureau of Meteorology (BOM). (2010). *Summary statistics – Busselton*. Retrieved February 15, 2010, from Climate statistics for Australian locations: www.bom.gov.au/climate/averages/tables/cw_009569.shtml
- Burrows, N. (2008). Linking fire ecology and fire management in south-west Australian forest landscapes. *Forest Ecology and Management*, 255, 2394–2406.
- Burrows, N., & Wardell-Johnson, G. (2003). Fire and plant interactions in forested ecosystems of south-western Western Australia. In I. Abbott, & N. Burrows, *Fire in ecosystems of the south-west of Western Australia: impacts and management* (pp. 225–268). Leiden: Backhuys Publishers.
- Cable Sands. (2004). *Fauna management plan: Ludlow*. Cable Sands (WA) Pty Ltd. Bunbury: unpublished.
- Cable Sands. (2002). *Ludlow titanium minerals/mine: environment review and management program*. Cable Sands (WA) Pty Ltd. Bunbury: unpublished.
- CALM. (1999). *Environmental weed strategy for Western Australia*. Perth: Department of Conservation and Land Management.
- CALM. (2006). *Ludlow tuart forest rehabilitation plan for Bemax Resources (Cable Sands Ltd) Mining Lease 70/86 - Draft version 4*. Busselton: unpublished.
- Chapman, A., & Dell, J. (1985). Biology and zoogeography of the amphibians and reptiles of the Western Australian wheatbelt. *Records of the Western Australian Museum*, 12 (1), pp. 1–46.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO). (2007). *Climate change in Australia: technical report 2007*. Clayton South: CSIRO and Bureau of Meteorology.
- Conservation Commission. (2004). *Forest Management Plan 2004–2013*. Perth: Conservation Commission of Western Australia.
- Conservation Commission. (2006). *Policy Statement No.3 Basic raw materials: Government and local government access to conservation estate (national parks, nature reserves and conservation parks)*. Perth: Conservation Commission of Western Australia.
- Conservation International. (2009). *Hotspots science – key findings*. Retrieved July 28, 2009, from Biodiversity Hotspots: www.biodiversityhotspots.org/xp/Hotspots/hotspotsScience/key_findings/Pages/default.aspx
- DEC. (2007a). *Disability Services and Inclusion Plan*. Perth: Department of Environment and Conservation.
- DEC. (2008a). *Fire management guideline No. E1: organic rich soils (peatlands)*. Perth: Department of Environment and Conservation.

DEC. (2008b). *Fire management guideline No. E4: tuart woodlands*. Perth: Department of Environment and Conservation.

DEC. (2007b). *Good neighbour policy*. Perth: Department of Environment and Conservation.

DEHWA. (2009). *Bridal creeper (Asparagus asparagoides) weed management guide*. Retrieved September 10, 2010, from Guidelines and manuals: www.weeds.gov.au/publications/guidelines/wons/asparagoides.html

Dell, J., How, R. A., & Burbidge, A. H. (2002). Vertebrate fauna of tuart woodlands. In B. J. Keighery, & V. M. Longman, *Tuart (Eucalyptus gomphocephala) and tuart communities* (pp. 254–276). Perth: Wildflower Society of Western Australia (Inc).

DoE. (2003). *General guidance on managing acid sulfate soils*. Perth: Department of Environment.

DoW. (2008). *South west groundwater areas water management plan – allocation. Draft for public comment*. Perth: Department of Water.

Ecoscope. (1996). *Heritage assessment and conservation plan for lime kilns, Tuart Forest National Park*. Perth: Ecoscope Australia Pty Ltd and Hammond & Green Pty Ltd.

Environment Australia. (2001). *A directory of important wetlands in Australia (third edition)*. Canberra: Environment Australia.

EPA. (2003). *Ludlow titanium minerals mine, 34 kilometres south of Bunbury – report and recommendations of the Environmental Protection Authority. Bulletin 1098*. Perth: Environmental Protection Authority.

Forests Department of WA. (1979). *Ludlow tuart forest working plan 1979–1985*. Perth: Forests Department of Western Australia.

Gibson, N., Keighery, B. J., Keighery, G. J., Burbidge, A. H., & Lyons, M. N. (1994). *A floristic survey of the southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission*. Perth: Department of Conservation and Land Management and Conservation Council of Western Australia (inc).

Hallam, S. J. (1975). *Fire and hearth: a study of Aboriginal usage and European usurpation in south-western Australia*. Canberra: Australian Institute of Aboriginal Studies.

Heritage and Conservation Professionals. (2004). *Ludlow forestry settlement, Ludlow Road. Ludlow heritage assessment*. Perth: Prepared for Department of Housing and Works on behalf of CALM.

Heritage Council of WA. (1998). *Register of heritage places – Lime Kilns place No. 4622*. Retrieved April 28, 2009, from Places database: www.register.heritage.wa.gov.au/viewplace.html?offset=0&place_seq=25617

How, R. A., Dell, J., & Humphreys. (1987). The ground vertebrate fauna of coastal areas between Busselton and Albany, Western Australia. *Records of the Western Australian Museum*, 13 (4), pp. 553–574.

Hussey, B. J., Keighery, G. J., Cousens, R. D., Dodd, J., & Lloyd, S. G. (1997). *Western weeds - a guide to the weeds of Western Australia*. Perth: The Plant Protection Society of Western Australia.

Hussey, P. (2005). *Wildlife notes No. 15 – tree hollows and wildlife*. Perth: Department of Conservation and Land Management.

Johnston, J. (1993). The history of the tuart forest. In B. K. De Garis, *Portraits of the South West. Aborigines, women and the environment* (pp. 136–153). Perth: UWA Press.

Jones, B. (2004). The possum fauna of Western Australia: decline, persistence and status. In R. L. Goldingay, & S. M. Jackson, *The biology of Australian possums and gliders* (pp. 149–160). Chipping Norton: Surrey Beatty.

- Jones, B., & Hillcox, S. (1995). A survey of the possums *Trichosurus vulpecula* and *Pseudocheirus occidentalis* and their habitats in forest at Ludlow, Western Australia. *Western Australian Naturalist*, 20, pp. 139–150.
- Keighery, G. J., & Keighery, B. J. (2002). Floristics of the Tuart Forest reserve. In B. J. Keighery, & V. M. Longman, *Tuart (Eucalyptus gomphocephala) and tuart communities* (pp. 180-252). Perth: Wildflower Society of Western Australia (Inc).
- May, J. E., & McKenzie, N. L. (2003). *A biodiversity audit of Western Australia's biogeographical subregions in 2002*. Perth: Department of Conservation and Land Management.
- McArthur, W. M. (1991). *Reference soils of south-western Australia*. Perth: Department of Agriculture.
- Minister for the Environment. (2003). *Statement No. 639: Statement that a proposal may be implemented (pursuant to the provisions of the Environmental Protection Act 1986) - Ludlow titanium minerals mine, 34 kilometres south of Bunbury, Shire of Capel*. Perth: Government of Western Australia.
- Napier, G. J. (1982). *A biological survey of the Ludlow tuart forest*. Busselton: Forests Department of Western Australia (unpublished).
- National Reserve System Task Group. (2009). *Australia's strategy for the national reserve system 2009–2030*. Canberra: National Reserve System Task Group convened under the Natural Resources Policies and Program Committee, Department of the Environment, Water, Heritage and the Arts.
- Newsome, D., Smith, A., & Moore, S. A. (2008). Horse-riding in protected areas: a critical review and implications for research and management. *Current Issues in Tourism*, 11 (2), 144–166.
- O'Connor, R., Quartermaine, G., & Bodney, C. (1989). *Report on an investigation into Aboriginal significance of wetlands and rivers in the Perth-Bunbury region*. Perth: Western Australian Water Resource Council.
- O'Connor, R., Quartermaine, G., & Yates, A. (1995). *An investigation into the Aboriginal significance of wetlands and rivers in the Busselton-Walpole region*. Perth: Water Authority of Western Australia.
- Robinson, R., & Rayner, M. (1998). *Armillaria luteobubalina in regrowth karri stands: a report on the state of knowledge of Armillaria root disease in karri regrowth forests in the southwest of Western Australia and recommendations for future research*. Perth: Department of Conservation and Land Management.
- Ruthrof, K. X., Yates, C. J., & Loneragan, W. A. (2002). The biology of tuart. In B. J. Keighery, & V. M. Longman, *Tuart (Eucalyptus gomphocephala) and tuart communities* (pp. 254–276). Perth: Wildflower Society of Western Australia (Inc).
- Scott, P. M., Burgess, T. I., Barber, P. A., Shearer, B. L., Stukely, M. J., Hardy, G. E., et al. (2009). *Phytophthora multivora* sp. nov., a new species recovered from declining Eucalyptus, Banksia, Agonis and other plant species in Western Australia. *Persoonia*, 22, 1–13.
- Shire of Busselton. (2007). *Busselton wetlands trails master plan*. Perth: Transplan Pty Ltd and Mike Halliburton Associates.
- Shire of Busselton. (2005). *Mosquito control minimisation strategy*. Busselton: Shire of Busselton.
- Shire of Capel. (2006). *Mosquito management strategy*. Capel: Shire of Capel.
- Shire of Capel. (1999). *Municipal inventory of heritage places*. Capel: Shire of Capel.
- Tilbrook, L. (1983). *Nyungar tradition: glimpses of Aborigines of south-western Australia, 1829–1914*. Perth: University of Western Australia Press.

Tille, P. J., & Lantzke, N. C. (1990). *Busselton, Margaret River, Augusta: land capability study*. Perth: Department of Agriculture.

Tindale, N. B. (1974). *Tribal boundaries in Aboriginal Australia*. Canberra: Department of National Development.

TRG. (2004). *Draft tuart conservation and management strategy*. Perth: Tuart Response Group, Government of Western Australia.

TRG. (2002). *Status report: tuart conservation and protection*. Perth: Tuart Response Group, Government of Western Australia.

WAPC. (2003). *Acid sulfate soils planning bulletin No. 64*. Perth: Western Australian Planning Commission.

WAPC. (2005). *Busselton wetlands conservation strategy*. Perth: Western Australian Planning Commission.

Weaving, S. (1998). *Geographe Bay catchment, natural resource atlas*. Busselton: Geographe Catchment Council.

WRC. (2001). *Water and Rivers Commission position statement: wetlands*. Perth: Water and Rivers Commission.

WRM. (2007). *Ecological character description Vasse-Wonnerup wetlands, Ramsar site, south-west Western Australia*. Perth: Unpublished report to the Department of Environment and Conservation and Geographe Catchment Council by Wetland Research and Management.

Personal communications

Department of Environment and Conservation

Ken Ninnette, National Park Ranger, Blackwood District, Regional Services Division

Greg Keighery, Principal Research Scientist, Science Division

Andrew Webb, Nature Conservation Officer, Blackwood District, Regional Services Division

Kim Williams, Regional Leader Nature Conservation, South West Region, Regional Services Division

Allan Wills, Technical Officer, Science Division

Val English, Principle Ecologist, Nature Conservation Division

Bronwen Keighery, Senior Environmental Officer, Strategic Policy Division

John Carter, Planning Officer, Blackwood District, Regional Services Division

Drew Haswell, Policy and Projects Officer, Regional Services Division

Richard Robinson, Senior Research Scientist, Science Division

Helen McCutcheon, Postgraduate Researcher, Science Division

Murdoch University

Paul Barber, Project Coordinator, Tuart Health Research Group

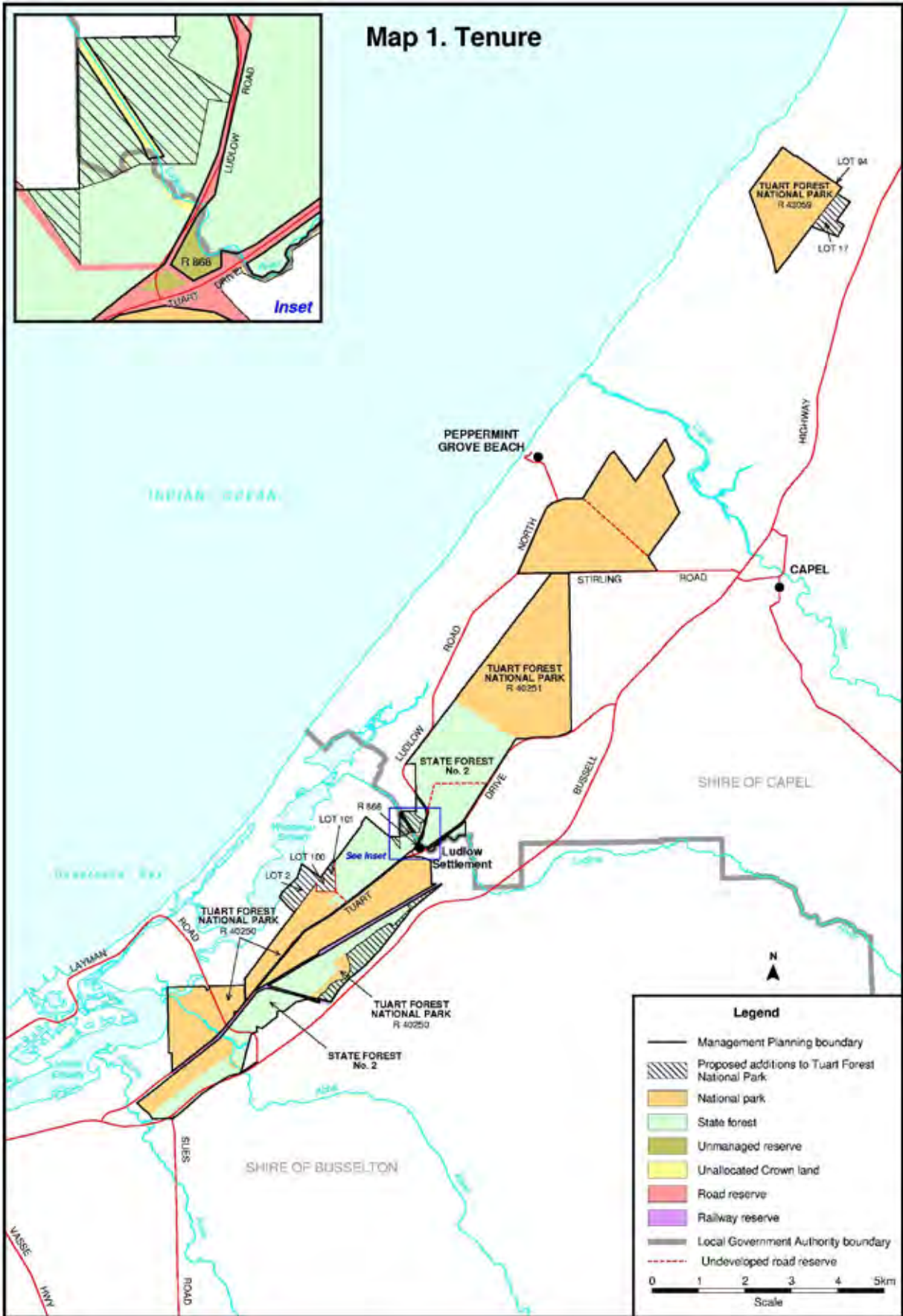
Others

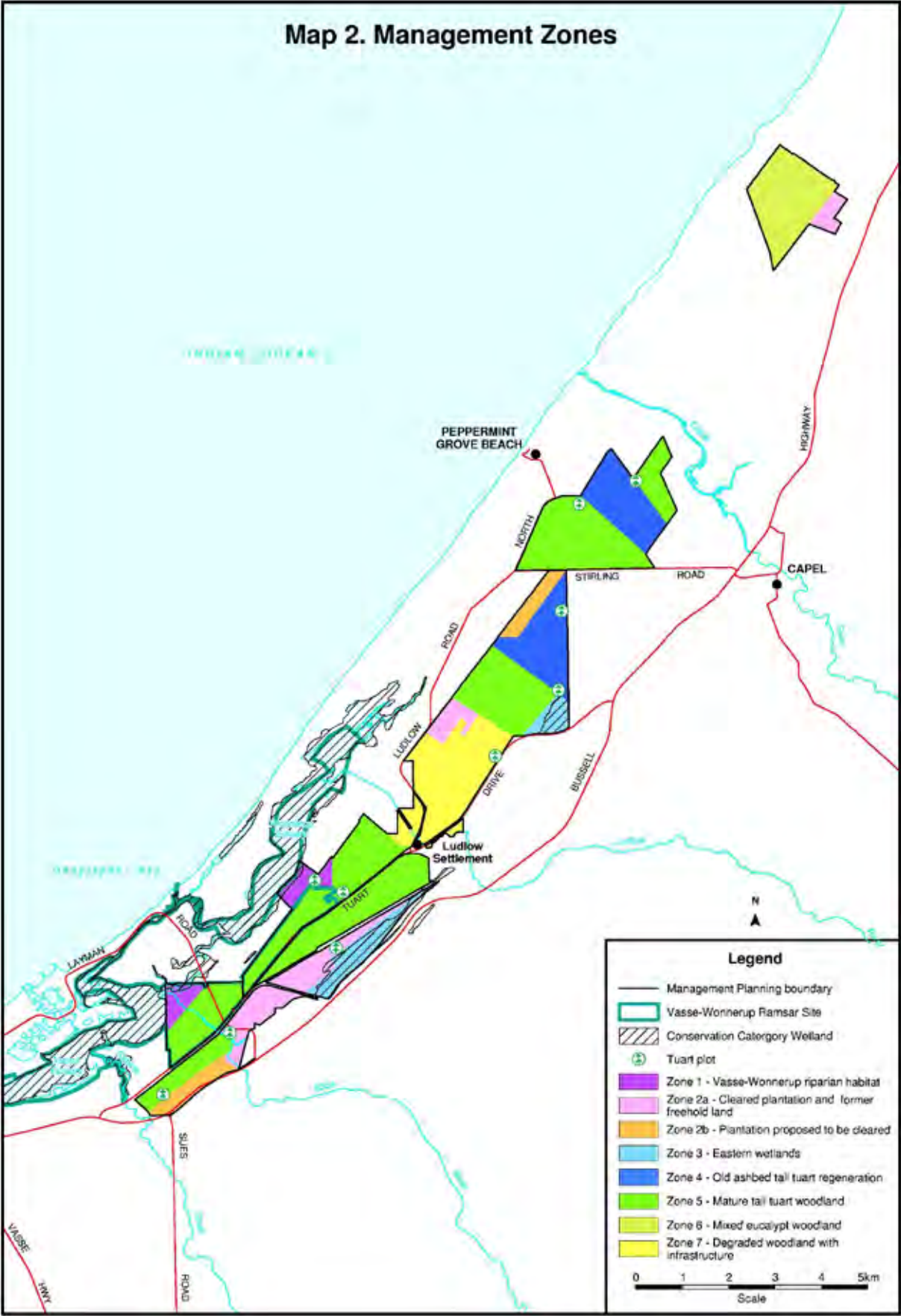
Bernie Masters, Chair, Tuart Forest National Park Community Advisory Committee

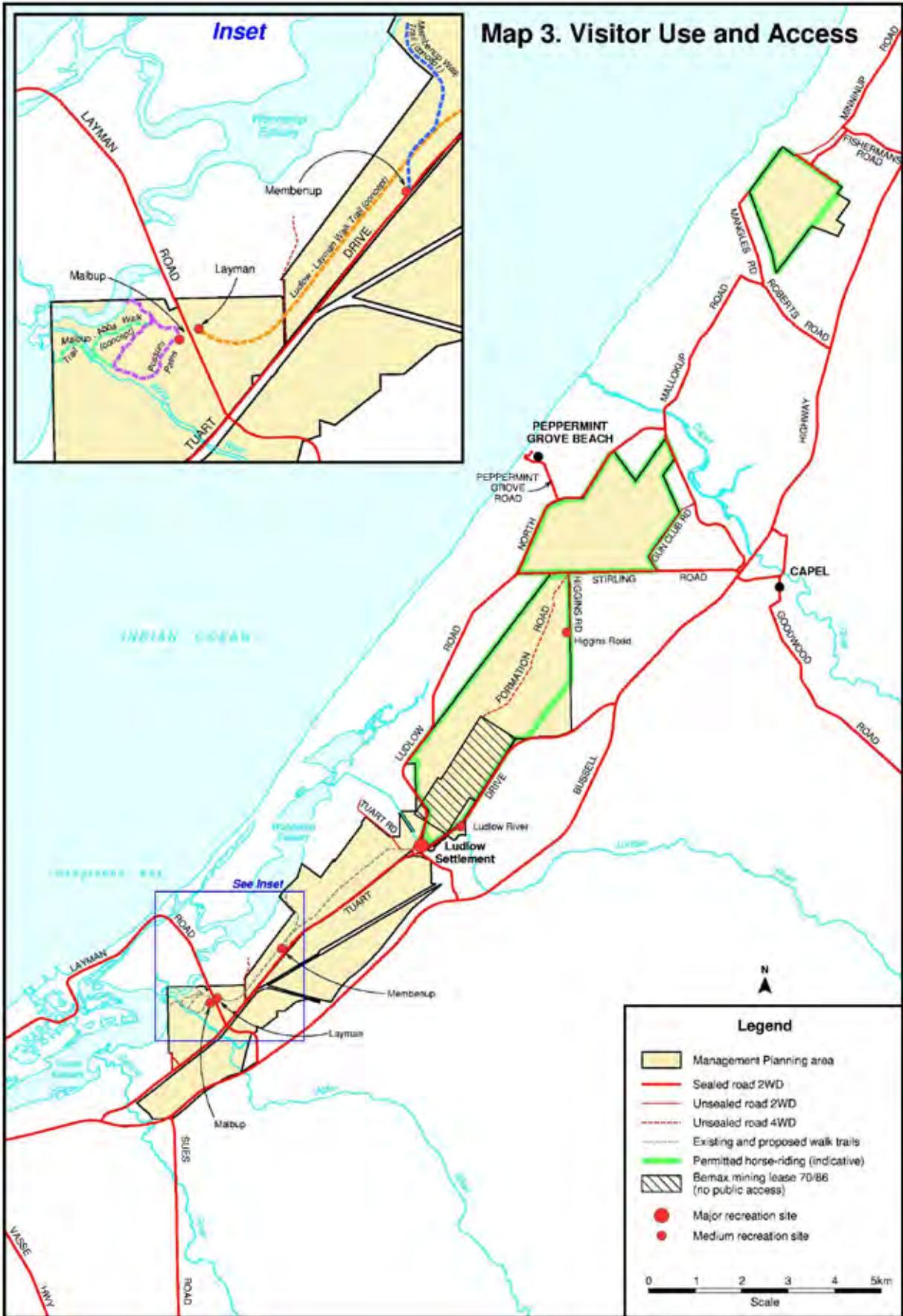
Rob Breeden, Tuart Forest National Park Community Advisory Committee

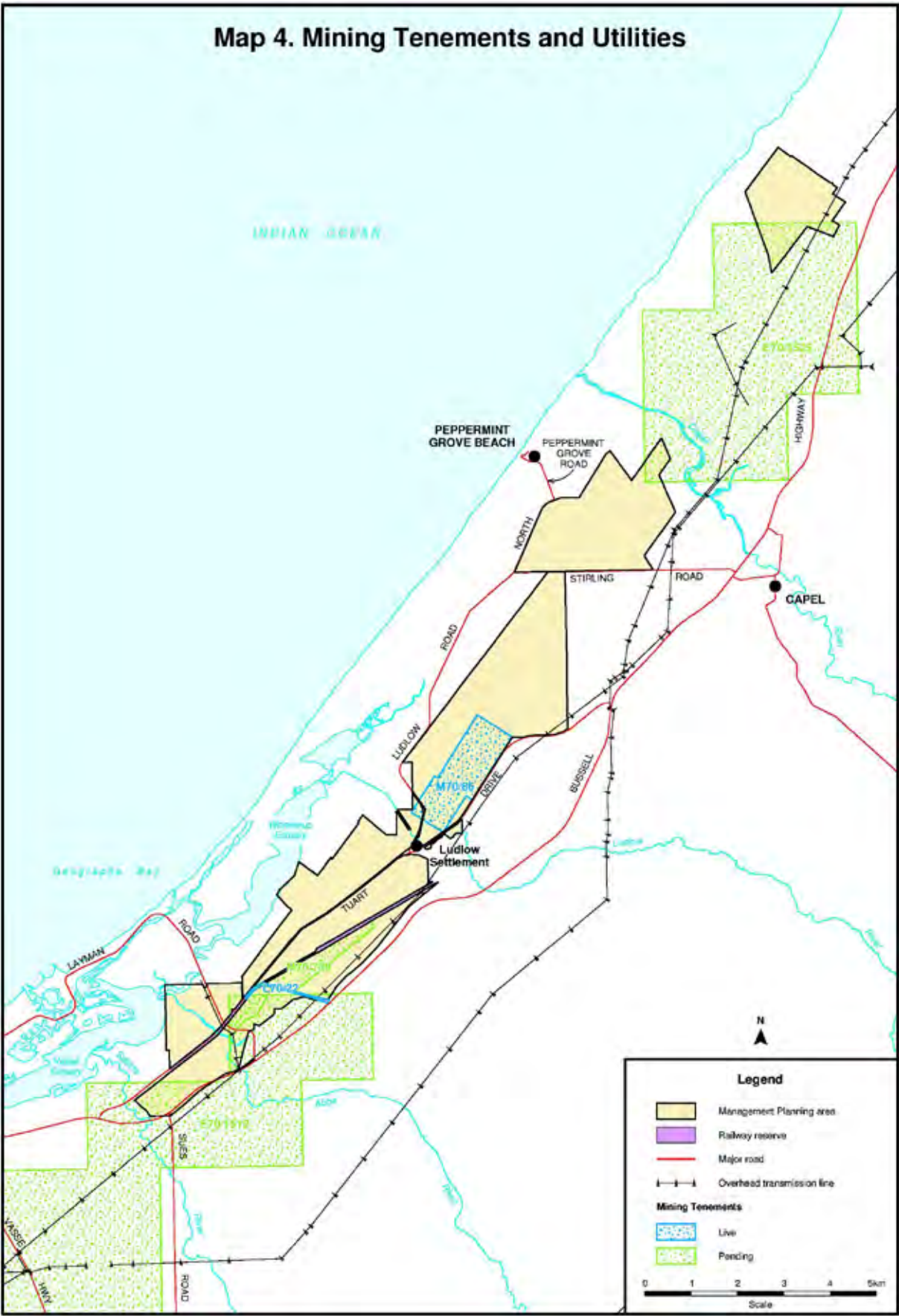
Des Donnelly, Tuart Forest National Park Community Advisory Committee

Jack Bradshaw, Tuart Forest National Park Community Advisory Committee









Appendix 1. Rare, priority and other significant flora

Species	Common name	Conservation code
<i>Calytrix</i> sp. <i>Tutunup</i> (G.J. Keighery & N. Gibson 2953)		P2
<i>Cardamine paucijuga</i>		P2
<i>Trichocline</i> sp. <i>treeton</i>		P2
<i>Blennospora doliiformis</i>		P3
<i>Chamaescilla gibsonii</i>		P3
<i>Eryngium ferox</i>		P3
<i>Rhodanthe pyrethrum</i>		P3
<i>Acacia semitrullata</i>		P3, LE
<i>Isopogon formosus</i> ssp. <i>dasylepis</i>		P3, LE
<i>Verticordia attenuata</i>		P3, LE
<i>Angianthus drummondii</i>		P3
<i>Eryngium pinnatifidum</i> subsp. <i>palustre</i> ms		P3
<i>Haloragis tenuifolia</i>		P3
<i>Lasiopetalum membranaceum</i>		P3
<i>Myriophyllum echinatum</i>		P3
<i>Schoenus capillifolius</i>		P3
<i>Stylidium longitubum</i>	Jumping jacks	P3
<i>Aponogeton hexatepalus</i>	Stalked water ribbons	P4
<i>Chamelaucium erythrochlorum</i>		P4, LE
<i>Anthotium junciforme</i>		P4
<i>Caladenia speciosa</i>		P4
<i>Eucalyptus rudis</i> ssp. <i>cratyantha</i>		P4
<i>Stylidium striatum</i>	Fan-leaved triggerplant	P4
<i>Thysanotus glaucus</i>		P4
<i>Villarsia submersa</i>		P4
<i>Verticordia plumosa</i> var. <i>vassensis</i>		R, LE
<i>Isolepis oldfieldiana</i>		D
<i>Astartea</i> sp. <i>Gingalup</i> (N. Gibson & M. Lyons 119)		LE
<i>Eucalyptus cornuta</i>	Yate	RE
<i>Eucalyptus gomphocephala</i>	Tuart	RE
<i>Cheilanthes austrotenuifolia</i>		RT
<i>Homalosciadium homalocarpum</i>		RM
<i>Leptoceras menziesii</i>		RM
<i>Pilularia novae-hollandiae</i>	Austral pillwort	RT

R = rare, P = priority, LE = locally endemic, D = disjunct, RT = relictual taxonomic, RM = relictual monotypic, RE = range-end

Records obtained from the Western Australian Herbarium 2007 and the department's Species and Communities Branch 2008.

Appendix 2. Rare, priority and other significant fauna

Common name	Scientific name	Conservation code*			Ref
		WA	EBPC	Other	
Amphibians					
Crawling frog or Gunther's toadlet	<i>Pseudophryne guentheri</i>	En			1, 2
Moaning frog	<i>Heleioporus eyrei</i>	En			1, 2, 3, 4
Motorbike frog	<i>Litoria moorei</i>	En			2, 3
Sandplain or squelching froglet	<i>Crinia insignifera</i>	En			1, 2, 3, 4
Slender tree frog	<i>Litoria adelaidensis</i>	En			2, 3
Whooping frog	<i>Heleioporus inornatus</i>	En			3
Birds					
Baudin's cockatoo	<i>Calyptorhynchus baudinii</i>	T(S1), En	VU	T(EN), CITES	2, 3
Carnaby's cockatoo	<i>Calyptorhynchus latirostris</i>	T(S1)	EN	T(EN)	4
Fish					
Hardyhead species	<i>Atherinosoma sp.</i>	En			5
Nightfish	<i>Bostockia porosa</i>	En			3, 5
Western minnow	<i>Galaxias occidentalis</i>	En			3, 5
Western pygmy perch	<i>Edelia vittata</i>	En			
Mammals					
Quenda or southern brown bandicoot	<i>Isodon obesulus</i>	P5		LR(nt)	1, 4
Southern brushtailed phascogale	<i>Phascogale tapoatafa</i>	T(S1)		LR(nt)	1, 2, 3, 4
Western false pipistrelle	<i>Falsistrellus mackenziei</i>	En, P4		LR(nt)	1, 2, 3
Western ringtail possum	<i>Pseudocheirus occidentalis</i>	En, T(S1)	VU	T(VU)	1, 2, 3, 4
Reptiles					
South western cool skink	<i>Acritoscincus trilineatum</i>	En			2
South western crevice skink	<i>Egernia napoleonis</i>	En			2
Two-toed earless skink	<i>Hemiernis quadrilineata</i>	En			2
West coast morethia (skink)	<i>Morethia lineocellata</i>	En			1, 2, 4

* As of March 2008

References

1 = Western Australian Museum (2007); 2 = Dell et al. (2002); 3 = Napier (1982); 4 = Cable Sands (2002); 5 = Morgan et al. (1998)

EXPLANATION OF CODES

WA

En Endemic to the south-west

T Threatened or **SP** Specially Protected fauna declared under the Wildlife Conservation Act, and in particular:

- **T(S1)** Rare or likely to become extinct

Priority fauna:

- **P4** Taxa in need of monitoring (not considered threatened or in need of special protection but could be if present circumstances change)
- **P5** Taxa in need of monitoring (subject to a conservation program, the cessation of which would result in the species becoming threatened within five years)

EPBC Under the Environment Protection and Biodiversity Conservation Act: **EN** Endangered; **VU** Vulnerable

Other

T Threatened according to the IUCN categories:

(EN) Endangered – facing a very high risk of extinction in the wild in the near future

(VU) Vulnerable – facing a high risk of extinction in the wild in the medium-term future

LR Lower Risk when evaluated against the IUCN categories the criteria for threatened status not met:

(nt) Near Threatened – not Conservation Dependent but is close for qualifying for Vulnerable

Appendix 3. Assessment of beekeeping sites within the planning area

Beekeeping sites within the planning area were assessed against environmental and management criteria and subsequently categorised as either suitable, suitable but conditional or highly constrained. The table below shows the result of the assessment and indicates criteria that require additional conditions. Some of these additional conditions have been included as guidance and should be seen as a minimum set.

Beekeeping site no.	Environmental criteria										Management criteria			Additional conditions
	Are rare, priority 1 or priority 2 flora visited by bees?		Are other conservation significant flora visited by bees?	Presence of TECs and likely impacts		Fauna habitat (for example nesting hollows)	Recreation sites within 500m	Class 1 or 2 walk trail within 200m	Disease risk areas	Weed management				
	Yes -Impact year round	Yes -impact seasonal		No predicted impact	Impact year -round					Impact seasonal	Impact year -round			
3162			X								X			B, C, F (Jun-Dec)
3530		X	X								X			A (Sep-Oct), C, F (Aug-Jun)
2847		X	X							X	X			A (Aug-Apr), B, C, F (Jul-Feb)
<i>Suitable (none of the sites in the planning area are considered suitable)</i>														
<i>Suitable but conditional</i>														
3163	X		X								X			N/A
2765		X	X								X			N/A
2764		X	X								X			N/A
<i>Highly constrained</i>														

Guidance for additional conditions

A	Seasonal restriction based on flowering period of flora. Site must be available for a minimum of one month. Placement and number of hives may be restricted.
B	Placement (at least 100m from TEC/PEC populations) and number of hives may be restricted. Monitoring of representative samples for health of adult populations and seedling recruitment or TEC/PEC to ensure there is no decline due to apiary management, taking into account other factors such as drought, disease, fire, environmental weeds or other disturbances. If unacceptable impacts are shown or observed later, treatment will become 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 become the same as A.
D	When a feral honeybee program is in place, then use of the site will be restricted during periods when the queen 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 honeybees present, a condition may be that if during the period of the permit, feral honeybees are located within 2km of the site, the site will be temporarily restricted until the feral honeybees are controlled.
F	Seasonal restriction based on flowering period of environmental weeds however, only until the environmental weed has been successfully eradicated.

