



Environment,
Climate Change & Water
National Parks & Wildlife Service



Jerrawangala National Park and Parma Creek Nature Reserve

Plan of Management



**JERRAWANGALA NATIONAL PARK AND
PARMA CREEK NATURE RESERVE**

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

Part of the Department of Environment, Climate Change and Water

May 2010

This plan of management was adopted by the Minister for Climate Change and the Environment on 18th May 2010.

Acknowledgments

This plan of management is based on a draft plan prepared by officers of the South Coast Region of the National Parks and Wildlife Service.

Valuable information and ideas were contributed to the planning process by the South Coast Region Advisory Committee.

The NPWS acknowledges that these reserves are within the traditional country of the Dharawal-Dhurga Aboriginal people.

Cover photograph of the Jerrawangala Lookout by Richard Phelps, NPWS.

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For additional information or enquiries about any aspect of the plan, contact the NPWS Nowra Area office at 104 Flat Rock Road West Nowra (PO Box 707 Nowra 2541) or by phone on (02) 4428 6300.

FOREWORD

Jerrawangala National Park and Parma Creek Nature Reserve are adjacent conservation areas located south west of Nowra. The national park is primarily plateau bordered by escarpment and has an area of 4,013 hectares. The nature reserve is fairly flat, cut by a small gorge along Parma Creek, and has an area of 3,486 hectares.

Jerrawangala National Park and Parma Creek Nature Reserve contain tall, open and low forest, woodland, rainforest, heath and rocky escarpment. Three threatened plant species and six threatened fauna species have been recorded, including a particularly high density of heath frogs. There are several recorded Aboriginal sites and two 1940s charcoal burning sites in the park.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each national park and nature reserve. A plan of management is a legal document that outlines how an area will be managed in the years ahead.

A draft plan of management for Jerrawangala National Park and Parma Creek Nature Reserve was placed on public exhibition from 6th July until 15th October 2007. The submissions received were carefully considered before adopting this plan.

This plan contains a number of actions to achieve the State Plan priority to “Protect our native vegetation, biodiversity, land, rivers and coastal waterways”, including rehabilitation of former quarries and control of blackberry and lantana. Sediment control works will be installed to protect heath frog habitat. The plan also contains a number of actions to help achieve “More people using parks”, including completion of Jerrawangala Lookout and development of a new walking track.

This plan of management establishes the scheme of operations for Jerrawangala National Park and Parma Creek Nature Reserve. In accordance with section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.



Frank Sartor MP
Minister for Climate Change and the Environment

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1. MANAGEMENT CONTEXT

1.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of national parks and nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the NPW Regulation, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS). The matters to be considered in the preparation of a plan of management are listed in Section 72AA of the NPW Act. NPWS policies relate to nature conservation, cultural heritage conservation, recreation, fire management, commercial use, research and communication.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of the environmental impacts of any works proposed in this plan.

A plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, the plan must be carried out and no operations may be undertaken within the area covered except in accordance with the plan. The plan will also apply to any future additions to Jerrawangala National Park or Parma Creek Nature Reserve. Should management strategies or works be proposed in the future that are not consistent with the plan, an amendment to the plan will be required.

1.2 MANAGEMENT PURPOSES AND PRINCIPLES

National parks are reserved under the NPW Act to protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor use.

Under the Act, national parks are managed to:

- conserve biodiversity, maintain ecosystem functions, protect geological and geomorphological features and natural phenomena and maintain natural landscapes;
- conserve places, objects, features and landscapes of cultural value;
- protect the ecological integrity of one or more ecosystems for present and future generations;
- promote public appreciation and understanding of the park's natural and cultural values;
- provide for sustainable visitor use and enjoyment that is compatible with conservation of natural and cultural values;
- provide for sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to conservation of natural and cultural values; and

- provide for appropriate research and monitoring.

Nature Reserves are reserved under the NPW Act to protect areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the Act, nature reserves are managed to:

- conserve biodiversity, maintain ecosystem function, protect geological and geomorphological features and natural phenomena;
- conserve places, objects, features and landscapes of cultural value;
- promote public appreciation, enjoyment and understanding of the nature reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

1.3 REGIONAL FOREST AGREEMENTS

Jerrawangala National Park and Parma Creek Nature Reserve are covered by the Southern Regional Forest Agreement. Regional Forest Agreements (RFAs) are one of the principal means of implementing the National Forest Policy Statement of 1992. Under this Statement, Commonwealth, State and Territory governments agreed to work towards a shared vision for Australia's forests. Joint comprehensive regional assessments were undertaken of the natural, cultural, economic and social values of forests. The assessments formed the basis for negotiation of RFAs providing for, amongst other things, ecologically sustainable forest management.

1.4 CLIMATE CHANGE

Climate change has been listed as a key threatening process under the Threatened Species Conservation Act 1995 and needs to be taken into account when assessing management requirements for Jerrawangala National Park and Parma Creek Nature Reserve.

Climate change projections for NSW include higher temperatures and greater temperature extremes, higher sea levels and water temperature, elevated CO₂, more intense but possibly reduced annual average rainfall and higher evaporative demand. These changes are likely to lead to greater intensity and frequency of fires, more severe droughts, reduced river runoff and water availability, regional flooding, increased erosion and ocean acidification. Associated ecosystem effects may include changes in productivity and nutrient cycling, increasing threat to freshwater ecosystems and progressive decoupling of species interactions (for example plants and pollinators).

The rate and extent of predicted climate change is likely to exceed the ecological tolerances of many species. Individual species have two possible survival mechanisms in response – adaptation or migration. Evolutionary responses are likely to be too slow for most species to adapt in the short term. Shifts in distribution, behavioural changes, and local extinction are therefore more likely responses but the

ability of species to shift their range may be compromised by loss, fragmentation and isolation of natural habitats. Another complicating factor is likely to be increased invasion by opportunistic, weedy or highly mobile species, especially into sites where local populations of existing species are declining.

Programs to reduce the pressures arising from threats such as habitat fragmentation, invasive species, bushfires, pollution and urban expansion will help reduce the severity of the effects of climate change. Actions could include:

- Continuing and enhancing existing fire, pest and weed management programs to increase the ability of native plants and animals to cope with future disturbances;
- Liaising with neighbours, local Landcare groups, catchment management authorities and other agencies to encourage retention, and if possible expansion, of areas of native vegetation close to parks and reserves to create wildlife corridors and increase habitat connectivity; and
- Encouraging research into appropriate indicator species to monitor the effects of climate change.

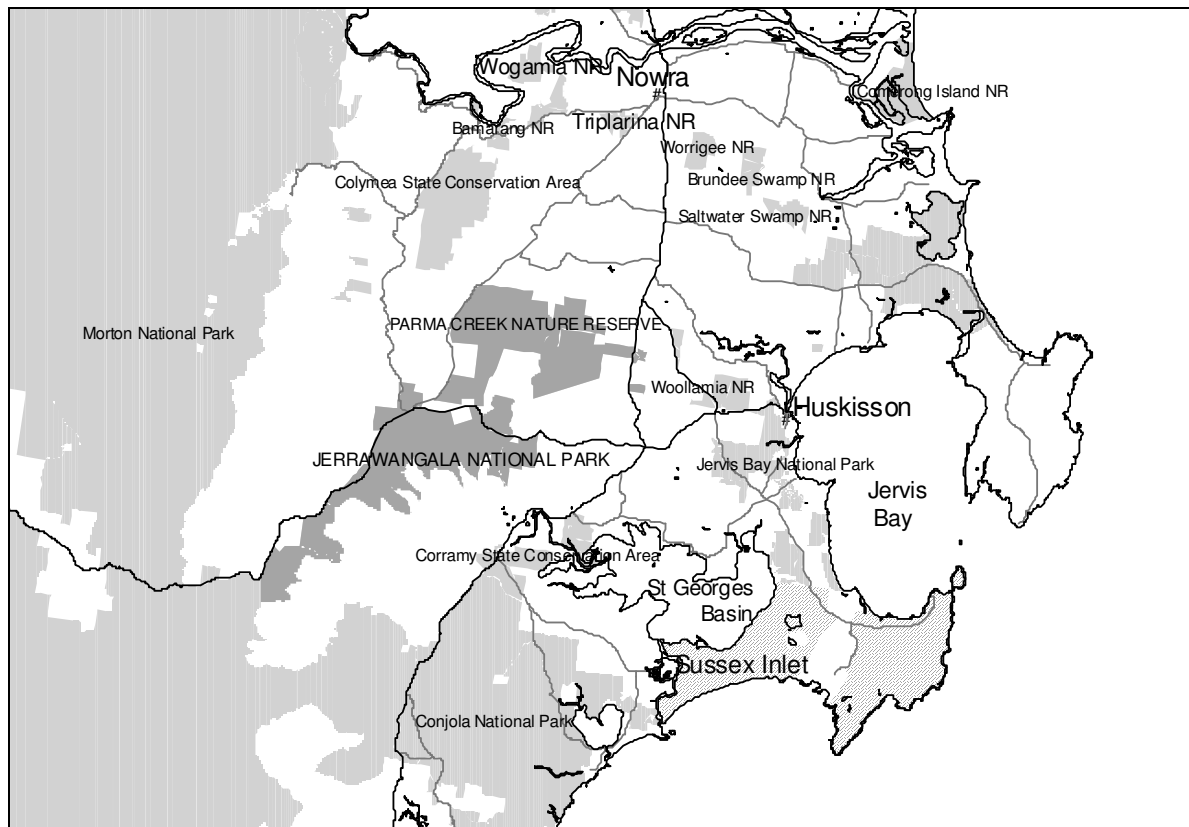
2. THE PLANNING AREA

2.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Jerrawangala National Park and Parma Creek Nature Reserve (jointly called 'the reserves' in this plan of management) are adjacent conservation areas located on the south coast of New South Wales approximately 22 and 13 kilometres south west of Nowra respectively (see map below). They were created in January 2001 as a result of the Southern RFA. The national park has an area of 4,013 hectares and was previously part of Yerriyong State Forest, with the exception of the most easterly section which was Crown land. The nature reserve has an area of 3,486 hectares and was formerly Crown land, apart from the most southerly block adjacent to the national park which was part of Yerriyong State Forest.

The two reserves form part of a system of conservation reserves on the south coast. Jerrawangala National Park abuts Morton National Park at its southern end and both the national park and nature reserve are close to Woollamia Nature Reserve, Colymea and Corramy State Conservation Areas and Conjola and Jervis Bay National Parks.

The reserves fall within the Shoalhaven City Local Government Area. The surrounding land use is predominantly forestry to the southeast, Crown land subject to Aboriginal land claim to the west and rural properties to the north and east.



Location Map

2.2 LANDSCAPE CONTEXT

The reserves protect a range of landscapes including flat plateau country, clifflines, scree slopes, a gorge along Parma Creek and gently sloping coastal hinterland. They support mainly dry open forest and woodland but also have significant areas of heathland and some tall moist forest. Because of the varied habitat and the presence of rock overhangs and campsites it is likely that the area provided a variety of resources for Aboriginal people. Use since European settlement has centred on timber getting, some grazing and recreational uses such as four wheel drive vehicle touring.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

3. VALUES AND MANAGEMENT DIRECTIONS

3.1 VALUES OF THE AREA

Natural values

Jerrawangala National Park and Parma Creek Nature Reserve have the following important natural values:

- They contain diverse vegetation including tall, medium and low forest, woodland, rainforest and heath.
- They protect a regionally significant vegetation community that is not well represented in conservation reserves, Northern Coast and Hinterland Moist Heath, and areas of Coastal Hinterland Ecotonal Gully Rainforest which has a restricted distribution.
- The reserves contain three species of plants identified as vulnerable under the TSC Act, *Eucalyptus sturgissiana*, *Eucalyptus langleyi* and *Genoplesium baueri* and three plant species identified as Rare or Threatened Australian Plants (ROTAP) (Briggs and Leigh, 1996), *Leptospermum epacridoideum*, *Acacia subtilinervis* and Jervis Bay grevillea (*Grevillea macleayana*). Parma Creek Nature Reserve also protects a population of the regionally rare pine (*Callitris rhomboidea*).
- The reserves contain populations of a number of threatened animal species including the eastern pygmy-possum (*Cercartetus nanus*), grey-headed flying-fox (*Pteropus poliocephalus*) heath frog (*Litoria littlejohni*), giant burrowing frog (*Heleioporus australiacus*), gang-gang cockatoo (*Callocephalon fimbriatum*) and sooty owl (*Tyto tenebricosa*), all listed as vulnerable under the TSC Act. The reserves are particularly important for conservation of the heath frog.
- The nature reserve is part of a habitat corridor identified in the Jervis Bay Regional Environmental Plan (1996), between the coast and reserves along the Great Eastern Escarpment, that aims to conserve biological diversity in the Jervis Bay area.
- Along with nearby Morton National Park, the reserves play an important role as an area of refuge and source of recolonisation to adjacent logged areas.
- The nature reserve protects a significant proportion of the Parma Creek catchment, which eventually flows into Jervis Bay, and the national park protects part of the Wandandian Creek catchment, which flows into St Georges Basin.

Cultural heritage values

- A number of Aboriginal heritage sites have been recorded within the national park and other sites could occur throughout both reserves.
- The remains of two charcoal burning sites used in the 1940s are located in the national park, including kilns and hut sites.

Scenic values

- The escarpment is a significant landscape feature visible from the coastal plain. The escarpment cliffs and associated vegetation changes are also very attractive at close range.
- Panoramic views of the coastal plain can be seen from Jerrawangala Lookout near the southern end of the park, and to a lesser extent from several other locations along the escarpment.
- The nature reserve contains scenic waterholes and waterfalls along Parma Creek gorge.

Recreation values

- The reserves have relatively low recreational use compared to nearby popular areas on the coast. However they are located close to Nowra, Main Road 92 and the Princes Highway, and provide opportunities for walking, scenic viewing and trail-based recreation activities.
- Several of the roads and trails in both reserves, along with those in surrounding state forest and Crown land, are part of a network of trails used for vehicle touring by 4WD vehicles and motorcycles. Wandean Road is an important link between the tablelands and coast.
- The roads and trails in both reserves are used for walking, cycling and nature observation, including bird watching and enjoyment of spring wildflowers. Some off-track bushwalking occurs in conjunction with the adjacent Yerriyong State Forest.
- Several roads in the reserves form part of regional horse riding circuits.
- Because it lies on the escarpment edge and provides views of the coastline, the park has the potential to provide an orientation point for visitors coming to the coast from the Southern Highlands.

3.2 MANAGEMENT DIRECTIONS

Jerrawangala National Park and Parma Creek Nature Reserve are relatively new reserves. Significant areas have been disturbed by activities such as quarrying, trail formation associated with logging, off-track recreational vehicle use, and construction of power lines, a water pipeline and a gas pipeline. Primary management emphasis will be given to conservation of significant values and rehabilitation of disturbed areas. These goals will be achieved primarily by closure of unnecessary vehicle trails, rehabilitation of former quarries, pest control and appropriate fire management.

A formal lookout has recently been constructed near the southern end of the park at Jerrawangala Lookout. The reserves have no other visitor facilities apart from vehicle trails and the long distance Two Rivers Walk, which passes through the park along a power line easement.

Walking opportunities will be enhanced by closure of some vehicle trails to public vehicle use and creation of a walk in the national park near Jerrawangala Lookout or the Peppers Gap and Butterbush Trails.

Opportunities for 4WD and motorcycle vehicle touring, cycling and horse riding will continue to be provided where appropriate in both reserves. In accordance with NPWS policy, horse riding will not be permitted on management trails in the nature reserve.

Interpretive information will be provided at Jerrawangala Lookout that highlights the values of the park and the array of parks and reserves that can be seen from the lookout.

4. CONSERVATION OF NATURAL AND CULTURAL HERITAGE

4.1 GEOLOGY AND LANDSCAPE

Jerrawangala National Park and Parma Creek Nature Reserve lie within the southern part of the Sydney Basin. The geology of the two reserves is relatively homogenous and is dominated by quartzose sandstone, minor siltstone and conglomerate beds of the Nowra Sandstone formation. There is a relatively small area of Berry Siltstone in the northwestern corner of the park (Department of Mines 1966).

Jerrawangala National Park is a long, narrow parcel of land located along the Turpentine Range, which is part of the Great Eastern Escarpment. Much of the terrain within the national park is flat or gently sloping plateau. It is bordered on its eastern side by the steep edge of the escarpment, most of which is outside the park. There are small areas of scree slope and gully in the park below the escarpment northwards from Cassia Road.

Elevation within the park is at its highest at approximately 490 metres above sea level in the southwestern section and gradually falls along the range to approximately 20 metres above sea level along Bollerang Creek in the northeastern part of the park. The park is drained by a series of creek lines that run from west to east, most of them ephemeral.

The Turpentine Range broadens out and disappears to the north where the nature reserve occurs. Here, the terrain is relatively flat to gently sloping and most of the reserve is located at an elevation below 200 metres. The highest point is on the south western edge at approximately 260 metres above sea level and the lowest point is on the eastern edge along a tributary of Parma Creek, at an elevation of approximately 30 metres above sea level.

The soils are generally sandy and quite shallow, except in the northwestern part of the national park, which has deeper clay soils supporting areas of tall forest. Areas of poor drainage are scattered across both reserves along the upper reaches of creeks. These support significant heath and swamp forest communities and it is important that the drainage not be altered, such as by road construction or use of earth moving equipment during fire suppression operations.

Scenic views across the coastal plain to the sea are available from a number of vantage points on the escarpment edge in the park, but particularly from Jerrawangala Lookout. The rocky face of the escarpment itself is also attractive, varying from relatively high cliffs at the southern end to a broken slope at the eastern end. The creeks through the park form waterfalls as they drop over the escarpment edge, but only run during and shortly after rain.

Within the nature reserve, Parma Creek forms a small gorge with a series of attractive waterholes and small waterfalls. The main waterfall is adjacent to an area

of private land and any clearing and development would significantly detract from the scenic value and isolated character of the area.

Desired Outcomes

- The geomorphological and scenic values of the national park and nature reserve are protected.

Strategies

- *Avoid altering natural drainage patterns, particularly in areas of poorly drained soils.*
- *Locate and design any management and visitor facilities to minimise their visual impact from public access roads and vantage points.*
- *Avoid any works that would detract from the natural character of Parma Creek Gorge and encourage retention of natural vegetation cover on the section of the gorge that is on private land.*
- *Liaise with neighbours and land use authorities as needed to minimise the impact of adjacent land use on views from the main vantage points in the park.*

4.2 NATIVE VEGETATION

The Comprehensive Regional Assessment (CRA) conducted for the Southern RFA and a subsequent more detailed survey identified a range of eight different vegetation assemblages occurring within Jerrawangala National Park and Parma Creek Nature Reserve.

Northern Coastal Hinterland Red Bloodwood-Scribbly Gum Heath Shrub Dry Forest is the most widespread vegetation community in both reserves, occurring on shallow well drained soils. It is a medium to low forest dominated by scribbly gum (*Eucalyptus sclerophylla*) with red bloodwood (*Corymbia gummifera*) usually present as a subdominant. It has a moderately dense heathy shrub layer dominated by broad-leaved hakea (*Hakea dactyloides*), swamp and hairpin banksias (*Banksia paludosa* and *B. spinulosa*), mountain devil (*Lambertia formosa*) and rough-barked tea-tree (*Leptospermum trinervium*). This community has been subject to frequent fire in many of the areas in which it occurs. The park and nature reserve together make a considerable contribution to targets for its conservation.

Lowland Red Bloodwood-Turpentine Dry Shrub Forest occurs on shallow sandy soils on low ridges and moderately dry slopes in both reserves and is the second most widespread vegetation community in the nature reserve. It is a medium forest dominated by red bloodwood, sometimes in association with white stringybark (*E. globoidea*), grey gum (*E. punctata*) and yertchuk (*E. considiana*) with a diverse dry shrub understorey and grassy groundcover.

Morton Plateau Mallee Swamp Low Forest occurs on shallow sandy soils subject to poor drainage. It is found throughout the national park, particularly at the southern end, and there are several small pockets in the nature reserve. The community is a low forest dominated by a variety of mallee eucalypts adapted to low fertility skeletal soils, in particular mallee ash (*E. dendromorpha*), with an understorey of mixed heaths, sedges and grasses. Some areas of this vegetation assemblage include the threatened albatross mallee (*E. langleyi*) and Ettrema mallee (*E. sturgissiana*).

Northern Foothills Spotted Gum-Blackbutt Moist Shrub Forest is found on deeper soils in sheltered locations at the northern end of the national park, with a large stand in the northwestern corner. It occurs more extensively below the escarpment to the east of the park. This community is a tall forest with a tree canopy dominated by turpentine (*Syncarpia glomulifera*) and Sydney blue gum – bangalay hybrid (*E. saligna* x *E. botryoides*). Grey ironbark (*E. paniculata*) is also found as a sub-dominant canopy species. The understorey species include *Synoum glandulosum*, *Elaeocarpus reticulatus*, *Notelaea longifolia*, *Pittosporum revolutum* and *Goodenia ovata*. A variable ground cover of sedges is intertwined with vines, and ferns such as *Calochlaena dubia* and *Doodia aspera* form small patches.

Lower Shoalhaven Spotted Gum Herb/Grass/Shrub Forest occurs in a few patches in the north east sections of both reserves and the southern block of the nature reserve. It is a moderately tall forest comprising spotted gum (*C. maculata*) and Sydney peppermint (*E. piperita*) with a patchy tall shrub layer of black she-oak (*Allocasuarina littoralis*) and Sydney golden wattle (*Acacia longifolia*), and a grassy ground cover.

Coastal Lowlands Spotted Gum-Burrawang Cycad Dry Shrub Dry Forest occurs in a small area in the central eastern section of the park. It is a medium to tall forest, dominated by spotted gum (*Corymbia maculata*) with grey ironbark (*E. paniculata* ssp. *paniculata*) and yellow stringybark (*E. muelleriana*) as occasional co-dominants. The shrub layer consists of burrawang (*Macrozamia communis*) with patches of black she-oak (*Allocasuarina littoralis*), breynia (*Breynia oblongifolia*) and narrow-leaf geebung (*Persoonia linearis*). The community has a smaller shrub layer and a groundcover of grasses, herbs and sedges.

Coastal Hinterland Ecotonal Gully Rainforest occurs in sheltered gullies in the north east of the national park. The greatest extent of this community occurs adjacent to the park along the escarpment but small patches extend into the park. The tree layer is a mixture of lilly pilly (*Acmena smithii*) and scentless rosewood (*Synoum glandulosum*) with an intermediate tree layer of blueberry ash (*Elaeocarpus reticulatus*), mountain water gum (*Tristaniopsis collina*) and black wattle (*Callicoma serratifolia*). The community has a shrubby and ferny understorey and ferny groundcover. Rainforest has a restricted distribution in NSW and occurrences in the park are significant.

Northern Coast and Hinterland Moist Heath occurs in small pockets in both conservation areas in poorly drained sites. This community is a tall shrubland with a varied species mix, but generally dominated by flax-leaved paperbark (*Melaleuca linariifolia*) together with yellow tea-tree (*Leptospermum polygalifolium*) and native currant (*Leptomeria acida*). The ground layer comprises mainly sedges, small herbs

and grasses. It is considered a regionally significant vegetation community as it has a restricted distribution in the region and is not well represented in formal conservation reserves.

Significant species

The vulnerable Ettrema mallee (*E. sturgissiana*) occurs in the northwest and southern sections of the national park while the vulnerable albatross mallee (*E. langleyi*) occurs in the north west of the national park and at a number of locations in the nature reserve. Both species are in areas of Morton Plateau Mallee Swamp Low Forest and their primary need will be for appropriate fire management and maintenance of existing drainage patterns. A substantial proportion of the total occurrence of albatross mallee is conserved within the two reserves along with nearby Colymea State Conservation Area.

The vulnerable Bauer's midge orchid (*Genoplesium baueri*) occurs in a number of small colonies along the verges of Yarran Road. It is vulnerable to disturbance during road maintenance work and possibly from vehicle traffic using the road.

Strategies for promoting the recovery of most threatened plant (and animal) species are set out in a Threatened Species Priorities Action Statement prepared under the TSC Act. Individual species recovery plans may also be prepared to consider management needs in more detail. Specific management actions may be undertaken in the park and reserve to assist the survival of threatened species. Both the threatened mallees have a restricted range and population size and are therefore very vulnerable to disturbance. Their primary management requirement is protection of individual populations.

Several species identified as Rare or Threatened Australian Plants (ROTAP) have been recorded in both the park and nature reserve. *Leptospermum epacridoideum* and *Acacia subtilinervis* occur within both reserves and Jervis Bay grevillea (*Grevillea macleayana*) is found in the nature reserve. Little is known about the management needs of these species. Some plants of *L. epacridoideum* and *A. subtilinervis* are located adjacent to Parma Creek Fire Trail and Yarran Road and care is needed to avoid them during road maintenance work.

A new species of leek orchid (*Prasophyllum sp.*) has recently been found in the national park and is known to occur at only a few locations in the area. The population in the park is on the power line easement and is likely to be favoured by the lack of tree cover. It could potentially be affected by heavy machinery use and will need to be protected.

A number of regionally rare orchid species also occur along Yarran Road and in other locations in the park. Because of the restricted occurrence of these species, management activities must specifically consider and protect them and checks need to be made for significant species prior to any ground disturbance.

A population of the regionally rare pine (*Callitris rhomboidea*) occurs in the nature reserve, near Parma Creek. This species has a sporadic distribution and its occurrence in the nature reserve is one of only two known reserved populations in

the Shoalhaven. Much of the nature reserve population was killed during an extensive bushfire in 2001 but regeneration is occurring. A vehicle trail through this population places it at risk of damage and it needs to be closed to public vehicle use.

A number of other significant plant species may occur in the reserves, in particular *Acacia bynoeana* which is found close to the nature reserve along the Braidwood Road, and *Pultenaea villifera*, *Myoporum bateae* and *Typhonium eliosurum*.

Appropriate fire regimes will be an important factor in long term conservation of significant vegetation values and protective measures are included in the fire management strategies for the park and reserve. The significant plant species and communities are monitored through fire monitoring plots (see section 5.3).

Disturbances and links

Selective logging occurred in the spotted gum communities in areas of the national park and nature reserve that were previously part of Yerriyong State Forest. These forests have a considerable amount of relatively young regrowth and a paucity of old growth trees. Old trees are important as they contain hollows that provide nesting sites for a variety of native birds and mammals. With time, the arboreal fauna habitat values will improve.

The reserves' vegetation communities have also been disturbed by utility construction and trail creation, including recreational vehicle use. These impacts are addressed in later sections.

The park and reserve lie close to Morton, Conjola and Jervis Bay National Parks as well as a number of smaller conservation areas, but are separated from them by Crown land, state forest and freehold land. Maintaining habitat links between the park and nature reserve and to other reserves across the region is important for ensuring the long term survival of native flora and fauna species. The network of informal reserves in adjacent state forest, including stream exclusion zones and wildlife corridors, assists wildlife conservation.

Much of the Crown land adjoining the park and reserve is subject to Aboriginal land claims. NPWS will seek to work with any successful claimants to manage the conservation values of the land.

Desired Outcomes

- The full range of native plant species found in the park and reserve is conserved.
- The significant vegetation communities and species are conserved.
- Vegetation structural diversity and habitat values are conserved, and are restored where subject to past logging and clearing.
- Neighbours support conservation of significant areas of privately owned native vegetation near the park and nature reserve, particularly land providing connections between reserves.

Strategies

- *Close to public vehicle use the trail in the nature reserve passing through the Callitris pine community.*
- *Avoid disturbance of populations of the *Ettrema mallee* and *albatross mallee*.*
- *Identify colonies of Bauer's midge orchid along Yarran Road to prevent disturbance by road works. If necessary, erect barriers to prevent damage by vehicles using the road.*
- *Ensure that the *L. epacridoideum* and *A. subtilinervis* plants adjacent to roads and trails are protected during road maintenance work.*
- *Ensure that any new management and visitor facilities are not located in areas of threatened or regionally significant plant species or communities and avoid disturbance of significant plant species, including rare orchids, during any ground disturbance works.*
- *Undertake vegetation surveys to check for additional threatened and significant plant species.*
- *Continue to monitor the status of the significant communities and rare and threatened plant species and to evaluate the success of management programs.*
- *Implement relevant priority actions set out in the Priorities Action Statement and any recovery plans prepared for species that occur in the reserves*
- *Liaise with neighbours, Landcare, Forests NSW, Southern Rivers Catchment Management Authority and Shoalhaven City Council to encourage retention of areas of native vegetation close to the national park and nature reserve, and in corridors linking to other conservation reserves. Encourage establishment of voluntary conservation agreements for significant naturally vegetated private land, particularly areas containing threatened plant species or important wildlife corridors.*

4.3 NATIVE ANIMALS

Jerrawangala National Park and Parma Creek Nature Reserve have high fauna habitat values even though parts have been logged or otherwise disturbed. A total of nineteen mammal species, fifty-seven bird species, twenty-three reptile species and fourteen amphibians have been recorded in and adjacent to the reserves. A number of fish species may also be present.

A number of species listed as vulnerable under the TSC Act have been recorded within the two reserves. The eastern pygmy-possum (*Cercartetus nanus*) and grey-headed flying fox (*Pteropus poliocephalus*) have been observed on the western edge of the park, the gang-gang cockatoo (*Callocephalon fimbriatum*) has been seen in several areas of the park and the sooty owl (*Tyto tenebricosa*) and giant burrowing

frog (*Heleioporus australiacus*) occur in the southern and central areas of the nature reserve respectively. The heath frog (*Litoria littlejohni*) is found in the north east and southern areas of the park and the central and southern areas of the nature reserve.

A survey in 2001 (Gaia Reserch Pty Ltd 2001) and follow-up surveys have found that the reserves support a significant heath frog population, apparently with a greater density than in other parts of this species' range. In addition, the population in the nature reserve is at a lower altitude than any other known heath frog populations. The heath frog, along with the other frog species in the reserves, requires clear water and permanent pools for breeding. A potentially significant threat to the population is sedimentation of streams and pools from silt washed off the unsealed roads. A high standard of sediment control is needed near creek crossings, both permanently and during road works, particularly at Bollerang Creek and across Parma Creek and its main tributaries, in order to protect habitat for heath frogs and other riverine frogs.

Several threatened fauna species have been recorded in close proximity to the reserves and are likely to occur within them including the endangered southern brown bandicoot (*Isoodon obesulus obesulus*), brush-tailed rock-wallaby (*Petrogale penicillata*), broad-headed snake (*Hoplocephalus bungaroides*) and eastern bristlebird (*Dasyornis brachypterus*), and the vulnerable Rosenberg's goanna (*Varanus rosenbergi*), yellow-bellied glider (*Petaurus australis*), large-eared pied bat (*Chalinolobus dwyeri*), glossy black-cockatoo (*Calyptorhynchus lathami*), striated fieldwren (*Calamanthus fuliginosis*), spotted-tailed quoll (*Dasyurus maculatus*) and white-footed dunnart (*Sminthopsis leucopus*). In addition, habitat modelling conducted for the Southern CRA indicates that both reserves may provide significant suitable habitat for the threatened regent honeyeater (*Xanthomyza phrygia*), swift parrot (*Lathamus discolor*), masked owl (*Tyto novaehollandiae*), greater broad-nosed bat (*Scoteanax rueppellii*) and smoky mouse (*Pseudomys fumeus*).

Vehicle trails in the park and reserve have a number of environmental impacts including habitat fragmentation through posing barriers to wildlife movement, sedimentation of creeks and provision of routes along which introduced predators can travel. It is desirable to minimise the number of trails in conservation reserves and for this reason, trails should be closed and rehabilitated (allowed to revegetate) where they serve no significant management, recreation or essential private access purpose. The presence of apiary licences over almost the whole park and reserve limits the ability to close and rehabilitate roads at present but this is a longer term aim (see section 7). As well as closing and rehabilitating trails where possible, those that provide no significant recreational vehicle access should be closed to public vehicle use (management trails) in order to minimise impacts such as erosion, wildlife kills and the incidence of activities such as rubbish dumping. Public access roads, management trails and trails to be closed are further discussed in section 6 and are shown on the park and reserve maps.

Desired Outcomes

- The full range of native animal species found in the park and nature reserve is conserved.

- The habitat and populations of all threatened fauna species are protected and maintained.

Strategies

- *Close to public use trails that do not serve a significant recreation purpose. Close and rehabilitate roads and trails that serve no significant management, recreation or essential private access purpose (see also section 6 and Maps).*
- *Protect the habitats of threatened fauna species and undertake specific management programs where needed to conserve habitat.*
- *Develop and carry out a program of installing sediment control works along roads near creek crossings and take any necessary steps during road maintenance activities to minimise sediment contribution to waterways, particularly near heath frog habitat.*
- *Continue to monitor heath frog populations and undertake additional conservation works if needed.*
- *Undertake other measures as needed to assist protection of threatened fauna including implementation of priority actions set out in the Priorities Action Statement and any recovery plans prepared for species that occur in the reserves.*
- *Undertake targeted surveys for threatened animal species that are predicted as likely to occur in the national park and nature reserve but have not yet been recorded.*

4.4 ABORIGINAL HERITAGE

Aboriginal people of the Dharawal-Dhurga language group occupied the area incorporating the park and nature reserve. They would have had a diverse economy, with trade and cultural links with neighbouring groups. Today the landscape and the plants, animals and physical features within the landscape are all an integral part of Aboriginal cultural heritage. Within the reserves there may be places that are significant to Aboriginal people such as archaeological sites and resource sites. Some sites may not contain any physical evidence of past use or occupation. Aboriginal sites and places are also important to non-Aboriginal people as they provide information about the past lifestyles of all people.

Several Aboriginal heritage sites have been recorded within the park, comprising camp sites, a scarred tree, an axe grinding groove and a rock shelter with an occupation deposit. There is potential for similar sites to occur throughout both reserves, particularly along cliff and creek lines.

While NPWS presently has legal responsibility for the protection of Aboriginal sites and places, it acknowledges the right of Aboriginal people to make decisions about their own heritage. It is NPWS policy that Aboriginal communities be consulted and

involved in the management of Aboriginal sites, places and related issues and the promotion and presentation of Aboriginal culture and history.

There are a number of Aboriginal community organisations and individuals who may have an interest in use and management of the reserves. These include the Nowra, Ulladulla and Jerrinja Local Aboriginal Land Councils, the Arwon, Shoalhaven and Ulladulla Elders and members of traditional custodian families.

Desired Outcomes

- Aboriginal sites and places are protected from damage by human activities.
- Aboriginal people are involved in management of Aboriginal cultural values in the park and reserve.

Strategies

- *Manage Aboriginal heritage in consultation with relevant Aboriginal community organisations and individuals.*
- *Ensure that any visitor facilities are not located close to significant Aboriginal sites and places.*
- *Undertake an archaeological survey and cultural assessment prior to all works with the potential to impact on Aboriginal sites and places.*
- *Do not publicise the location of Aboriginal sites and places except where the agreement of relevant Aboriginal community organisations and individuals has been obtained. Prior to any promotion of a site or place, prepare a conservation study and undertake any management work necessary to protect the site or place.*

4.5. HISTORIC HERITAGE

As stated in section 2.1, most of Jerrawangala National Park and the southern section of the Parma Creek Nature Reserve were formerly part of Yerriyong State Forest. Selective logging occurred in areas of the forest over the last three decades, leaving a series of vehicle trails.

Two permissive occupancies for grazing were granted over the former Crown land sections of the nature reserve during the 1970s, one of which lasted until the mid 1990s. A number of former gravel quarries are located in both reserves and were presumably used to gain material for construction of nearby roads.

The remains of two charcoal burning sites can be found in the northern part of the park. One site contains seven galvanised iron charcoal pits and two brick kilns together with the remains of a hut. The second site contains two brick kilns and hut remains. Charcoal burning at both locations primarily took place in the 1940s, during the Second World War. At this time charcoal gas was used on converted trucks and

cars as a cheap alternative fuel and to cover petrol shortages. Kilns were generally located adjacent to timber supplies and the charcoal produced was mostly used locally (Shoalhaven Historical Society, 2001).

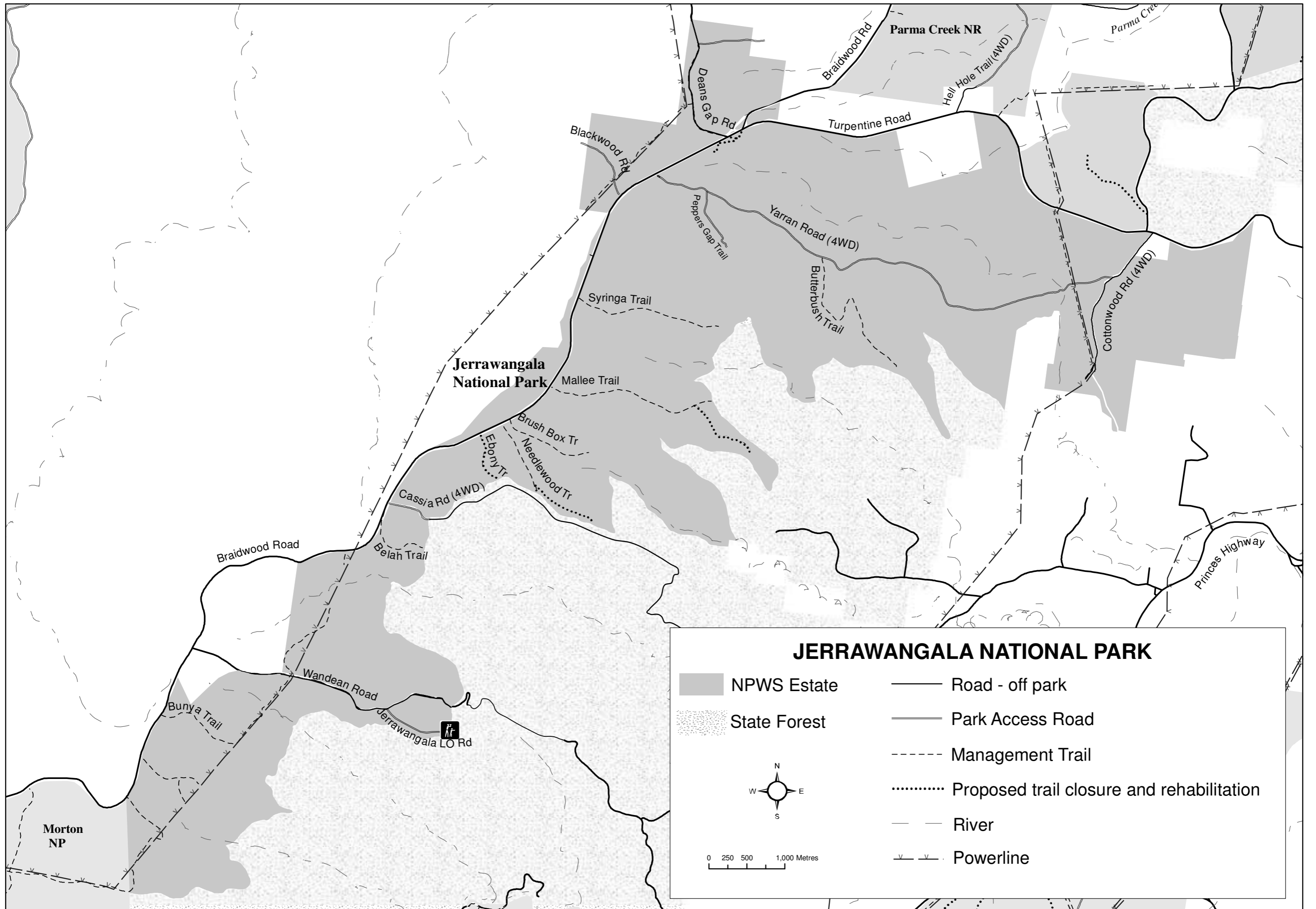
The current Braidwood and Wandean Roads follow the route of what was once The Wool Road through the southern part of the national park. The Wool Road was originally a dray route and ran from Nerriga to the coast, descending the escarpment through Wandean Gap. It was built in 1841 using convict labour and was used to transport wool from the Southern Tablelands to Jervis Bay. The road is regionally significant as it represents development in the transportation of rural produce. It is unlikely that there is any evidence of the original construction within the park since the road has been widened and upgraded, however the remains of a stone embankment can be seen immediately outside the park on Wandean Road.

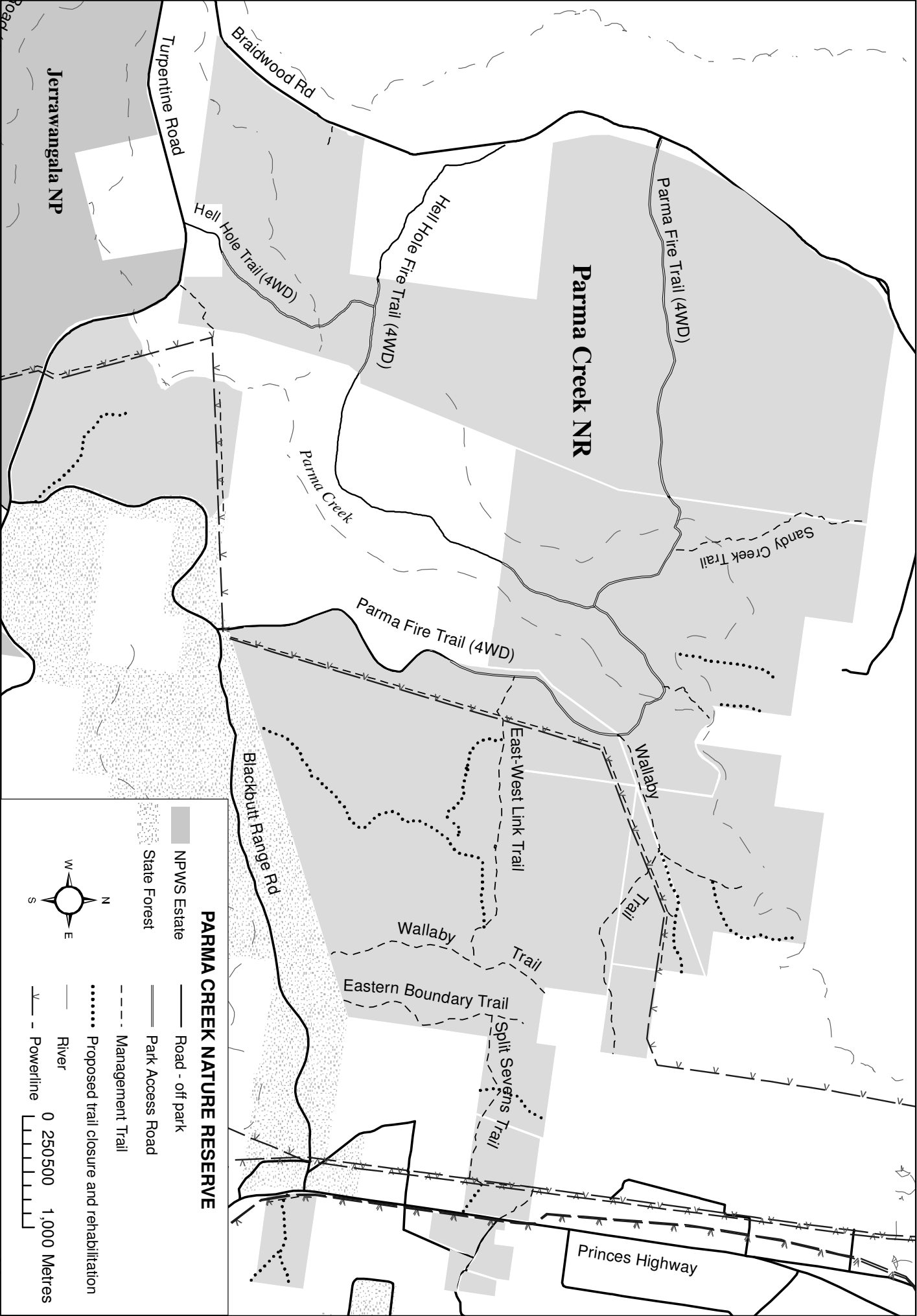
Desired Outcomes

- Significant historic features are appropriately conserved and managed.

Strategies

- *Manage historic places and features in accordance with the Burra Charter.*
- *Retain the historical route of The Wool Road (now Wandean Road) through the park. Support protection of features remaining from the original construction on adjacent land.*
- *Assess the significance of the charcoal burning sites. Determine a management strategy and undertake any necessary conservation works.*





Jerrawangala NP

Turpentine Road

Braidwood Rd

Hell Hole Trail (4WD)

Hell Hole Fire Trail (4WD)

Parma Creek

Parma Creek NR

Parma Fire Trail (4WD)

Sandy Creek Trail

Parma Fire Trail (4WD)

Blackbutt Range Rd

East-West Link Trail

Wallaby Trail

Wallaby Trail

Eastern Boundary Trail

Split Sevens Trail

Princes Highway

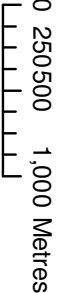
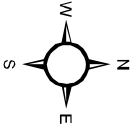
PARMA CREEK NATURE RESERVE

- NPWS Estate
- State Forest

- Road - off park
- Park Access Road
- Management Trail

- Proposed trail closure and rehabilitation

- River
- Powerline



5. PARK PROTECTION

5.1 SOIL EROSION, WATER QUALITY AND CATCHMENT MANAGEMENT

The sandstone and siltstones that occur within the reserves produce highly erodible soils when disturbed. Erosion is not a significant issue, however, because of the generally level terrain within Jerrawangala National Park and Parma Creek Nature Reserve. Minor erosion occurs where roads cross steeper terrain such as at creek crossings.

The reserves play an important role in protecting water quality in the catchments in which they are located. The national park predominantly lies within the catchment of Wandandian Creek, which flows into St Georges Basin. The nature reserve covers a significant proportion of the Parma Creek catchment, which flows into Currumbene Creek and then Jervis Bay.

Water quality in the reserves is likely to be reasonably high as streams mainly begin within the reserves or cross forested catchments. Previous land uses prior to declaration of the national park and nature reserve, however, resulted in vehicle trails and former gavel quarries that contribute sediment to waterways. This impacts on water quality as well as creek profiles and habitat values. Closure of unnecessary trails and implementation of sediment control measures on remaining trails is addressed in section 4.3.

Rehabilitation of the former quarries will be a significant task. Some parts are revegetating but a number of areas are being used by off-road vehicles. Access control, some re-shaping, ripping and other work to promote plant growth and reduce erosion are needed.

An operating quarry (Hell Hole quarry) located near Parma Creek outside the nature reserve may also contribute sediment and other pollutants to the creek.

Desired Outcomes

- Human induced soil erosion in the park and reserve is minimised and disturbed areas are rehabilitated.
- The catchment values, water quality and ecological health of streams in the park and reserve are maintained.

Strategies

- *Design and undertake all works in a manner that minimises soil erosion and water pollution.*
- *Rehabilitate the former quarries to minimise sediment input into waterways and promote vegetation growth.*

- *Liaise with Shoalhaven City Council regarding monitoring of the Hell Hole quarry and seek amelioration of any water quality impacts if needed.*

5.2 INTRODUCED SPECIES

An introduced species is defined in this plan as any plant or animal species not native to the reserves. Introduced species within the reserves and on adjoining land are of concern because they have the potential to have detrimental effects on ecological values and can spread to and from neighbouring land. In addition, the *Noxious Weeds Act 1993* places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands.

The occurrence of introduced plant species in Jerrawangala National Park and Parma Creek Nature is generally low. Most of the weeds occur along roadsides and in soils derived from Berry Silstone or on areas that have been disturbed in the past such as former quarries and informal campsites. The weed species are primarily pasture and disturbance weeds such as inkweed (*Phytolacca octandra*), Parramatta grass (*Sporobolus indicans*) and fleabane (*Conyza* sp.). There are some occurrences of blackberry (*Rubus fruticosus*) and lantana (*Lantana camara*) in the national park below the escarpment edge and these are of greater concern. Blackberry and lantana are declared noxious in the Shoalhaven Local Government Area.

Foxes, wild dogs and rabbits are known to occur in both reserves, and dingoes have been reported in the nature reserve. All appear to be in low numbers. Some fox and dog baiting has occurred. Wild dogs, including dingoes, are a declared pest under the *Rural Lands Protection Act 1998* (RLP Act), due to their impacts on livestock, and NPWS has a statutory obligation to control wild dogs on its estate. The dingo however is also considered to be part of the native fauna of NSW, and Jerrawangala National Park and Parma Creek Nature Reserve have been listed as providing high quality habitat for dingoes. Under the RLP Act, wild dog control activities in areas of high quality dingo habitat must be preceded by the development of a wild dog management plan that addresses both control and conservation objectives.

Sections of both the national park and nature reserve lie adjacent to agricultural properties and some incursions of domestic stock, including goats, have occurred. This is a significant concern as, if goats became established in the park, they could spread along the escarpment and do significant damage to the uncommon plants that occur in these locations.

The introduced eastern gambusia *Gambusia holbrooki* is present in some lower sections of Parma Creek and may predate native frogs including the vulnerable heath frog. Unfortunately there is at present no feasible control method for gambusia.

Desired Outcomes

- The impact of introduced species on native plants and animals is minimised.

Strategies

- *Monitor the presence, extent and abundance of introduced species. If necessary, develop programs for control and, if possible, eradication.*
- *Control introduced species in accordance with best management practices and relevant threat abatement plans. Undertake control programs in cooperation with neighbours, and authorities such as Shoalhaven City Council and the relevant Rural Lands Protection Board.*
- *Undertake a survey for blackberry and lantana in the park and treat priority occurrences.*
- *Undertake programs for the control of wild dogs and foxes as needed, in accordance with relevant wild dog management plans when prepared.*
- *Monitor the reserves for the presence of feral goats and if necessary undertake control programs with the aim of eradicating them.*
- *Liaise with neighbours as needed regarding boundary fencing to prevent domestic stock from entering the national park and nature reserve.*

5.3 FIRE MANAGEMENT

Fire is a natural feature of the environment and is essential to the survival of some plant and animal communities. Inappropriate fire, however, can damage natural and cultural heritage and endanger reserve visitors and neighbours. Management of bushfire in the reserves is a complex issue. Management must aim to achieve both long-term conservation of native plant and animal communities and ongoing fire management obligations that contribute to the protection of life, property and community assets within and adjacent to the reserves.

Fire history

Available records indicate that small wildfires have burnt pockets of Jerrawangala National Park and Parma Creek Nature Reserve every few years since the early 1950s, and that there have also been several larger wildfires. Wildfires burnt the southern half of the national park in 1964-65, the north eastern section in 1975-76 and most of the park in 1980-81. The eastern section of the nature reserve burnt in 1975-76 and 1998-99. A large wildfire burnt most of both reserves in the summer of 2001-02. Hazard reduction burning undertaken by Forests NSW occurred at several locations in the then state forest, including a burn in what is now the southern part of the park in 1973-74 and a burn in 1986-87 that burnt the western section of the nature reserve.

Ecological requirements

Bushfire regimes are a major determinant of the distribution and abundance of plants and animals in the park. They also affect nutrient cycles, erosion patterns and hydrological regimes. Ecological and hazard reduction burns should be planned within a broad, long-term fire management framework and with a central objective of conserving biodiversity.

Ecological research suggests the following requirements for biodiversity conservation:

- variability of fire intervals and area burnt is important to conserve floristic diversity and provide diversity of habitat for animals; fire at regular or too frequent intervals will lead to loss of species and should be avoided;
- most plant species and communities require infrequent fires of moderate to high intensity to achieve regeneration but patchy burns are better for fauna as they retain shelter and food refuges. Adequate refuge areas should be available for fauna during any prescribed burn;
- where known, the fire requirements of threatened species and other significant animal and plant species should be considered and specific fire management strategies applied to ensure their protection;
- the appropriate mix of fire frequency and intensity is influenced by a range of factors including land uses, topography and climate; for example drought may delay recovery following a fire.

A fire frequency of between 5 and 30 years is generally appropriate for most of the reserves' vegetation communities. Species decline is predicted if successive fires occur less than 5 years apart, if there are no fires for more than 30 years, or if fires occur too frequently or regularly. Successive fires can prevent the regeneration of many species if the fire interval is too short. A long interval between fires can result in smaller shrubs and herbs disappearing, especially those with regenerative processes that require fire for seed preparation or dispersal.

Most canopy species in the dry open forests of the reserves are adapted to infrequent high intensity fires, which may stimulate regeneration. The timing of prescribed burning in these forests should aim to achieve a balance between promoting and inhibiting regeneration of understorey species and reducing fuel levels so as to minimise the risk of successive intense wild fires.

The fire regime requirements in the low woodlands, heath and scrub found in the reserves are broadly similar. These vegetation types tends to grow rapidly after fire, quickly accumulating fuel, and then becoming fire prone again after two to four years. Frequent fires could lead to decline of fire-sensitive shrubs such as banksias, hakeas and some casuarinas. Conversely, medium to long-term fire intervals may lead to the decline of some herbs and shrubs. Species with heat-stimulated seed banks stored in the soil, such as wattles and pea-flowers, depend on sufficiently intense fires for seed germination. The timing and intensity of burning is critical in the long-term management of these vegetation types.

Wildfires at infrequent intervals are necessary for canopy species regeneration in the tall open forests, but prescribed burning would be likely to be detrimental to the moist understorey and should be avoided.

Rainforest is damaged by fire, whether it be wildfire opening up the canopy and destroying the stand structure, or frequent cool burns drying the margins and encouraging the encroachment of grasses and other plants that create more fuel load around the edges. In rainforest areas on the edge of the escarpment, past logging activity may have opened up the canopy and increased the density of the understorey in some areas, making them more vulnerable to wildfires. Avoiding prescribed burning in and around rainforest vegetation is important for maintenance of these communities.

Based on the above, fire frequency in most parts of the park and reserve appear to have been appropriate for maintenance of vegetation communities. The eastern part of the nature reserve, however, was affected by fire in 1998-99 and again in 2001-02 and could have suffered long term damage.

Areas of significant Moist Heath and Mallee Swamp Low Forest occur on poorly drained soils in both reserves and, as stated in section 4.1, impacts on the natural drainage of these areas should be avoided, including use of earth moving machinery during fire suppression.

A number of monitoring plots have been established in both reserves to monitor the fire response and requirements of significant plants species as well as a range of plant communities. A survey of *E. langleyi* conducted in both reserves following the 2001-02 bushfire found that it survived well, with evidence of new growth from existing plants but few seedlings (Mills 2002).

Impacts on cultural heritage

Fire can damage some types of Aboriginal sites and historic places. Features such as scarred trees and old buildings can be permanently damaged or lost by wildfire while other sites can be damaged by use of heavy machinery for fire suppression operations. Scarred trees, artefact scatters and the charcoal burning sites in the park could all be at risk.

Strategies and cooperative arrangements

Under the *Rural Fires Act 1997* the NPWS is a fire authority that may undertake fire suppression within reserves and under cooperative arrangements with other fire authorities. As a land management agency, the NPWS is responsible for managing fire on the park and nature reserve, including activities that contribute to the protection of life, property and community assets. An important part of NPWS fire management is participation in local cooperative fire management arrangements as a member of the Shoalhaven District Bush Fire Management Committee. This committee coordinates fire management and fire control on a district wide basis.

Fire Management Strategies have been prepared for the national park and reserve that address two main objectives; protection of life and property and maintenance of

biodiversity. They identify bushfire threats and provide guidelines for the conservation of significant plants and animals and cultural features. They also identify NPWS commitments in meeting its obligations to limit the spread of fire from land that it manages, including strategic fire advantage zones along the Braidwood Road and the eastern side of the nature reserve. This will contribute to mutually cooperative arrangements that enhance the protection of life, property and assets on adjoining lands and within the reserves.

Jerrawangala Lookout provides a vantage point for spotting fires in the state forests and reserves on the coastal plain.

Desired Outcomes

- Fire regimes are appropriate for long-term maintenance of the park and reserve's plant and animal communities.
- Bushfire mitigation measures contribute to the cooperative protection of persons and property on or immediately adjacent to the park and reserve.
- Aboriginal sites, historic places and culturally significant features are afforded protection from damage by bushfires and fire suppression activities.

Strategies

- *Implement the Fire Management Strategies for the national park and nature reserve.*
- *Use prescribed burns or other means to achieve fuel management as needed in strategic areas and to achieve a variety of fire regimes that maintain ecological fire thresholds for each vegetation community.*
- *As far as possible, avoid fire within rainforest communities.*
- *Limit the use of heavy machinery for fire suppression and avoid its use in areas of rainforest, poorly drained sites, threatened or rare plants, Aboriginal sites and the former charcoal burning sites. Rehabilitate areas disturbed by fire suppression operations as soon as practical after fire.*
- *Continue to monitor the ecological effects of fire in the park and nature reserve, particularly the response of significant plant species to fire.*
- *Continue to actively participate in the Shoalhaven Bush Fire Management Committee. Maintain close contact and cooperation with neighbours, the Rural Fire Service, volunteer bush fire brigades and Forests NSW.*
- *Where appropriate, carry out fuel management in cooperation with neighbours for mutual protection.*
- *As far as possible, manage visitor activities to limit human caused bushfires within the park and reserve. This may require closing the reserves to public use during periods of extreme fire danger.*

6. VISITOR OPPORTUNITIES AND EDUCATION

Visitor opportunities provided in the natural and undeveloped settings afforded by national parks and nature reserves are generally those at the low key end of the spectrum. Uses that are considered appropriate are those that are ecologically sustainable and which directly contribute to the visitor's understanding and appreciation of the area. Under the NPW Act, provision for visitor use is an important objective of national parks. Nature reserves, while providing for appreciation of reserve values, place greater emphasis on conserving natural environments. For this reason, planning for visitor use of Jerrawangala National Park and Parma Creek Nature reserve focuses primarily on providing a range of opportunities within the national park while still permitting low key use of the nature reserve.

Provision for visitor use of the reserves has been considered in a regional context. Public land managed by NPWS and other authorities in the region provides diverse opportunities for a range of recreation activities. Morton National Park to the south and west is a well known bush walking and camping destination and has a range of visitor facilities. Picnicking, walking and in some cases camping opportunities, are also provided on the coast at Jervis Bay National Park, Conjola National Park, Council reserves, the Commonwealth Booderee National Park and Department of Defence land on the Beecroft Peninsula.

Jerrawangala National Park is used mainly for scenery viewing from Jerrawangala Lookout and for vehicle touring, including trail bike riding, together with the road systems in adjacent Crown land and state forest. A small amount of bushwalking occurs along the park's vehicle trails and the long distance Two Rivers Walk (see below). Parma Creek Nature Reserve is primarily used for vehicle touring and by the local community for swimming in Parma Creek. Unlike other more well known visitor destinations in the region the park and reserve do not receive high levels of visitor use. Once current upgrading of the Braidwood Road (Main Road 92) is completed between Nerriga and Nowra, however, visitation is likely to increase.

Vehicle access

The national park is primarily accessed from Braidwood, Turpentine and Wandean Roads and is crossed by several roads leading to the escarpment edge, all of which are unsealed. The nature reserve is primarily accessed from unsealed roads leading off Braidwood, Turpentine and Blackbutt Roads and is crossed by several vehicle trails. Most of the roads in both the national park and nature reserve are of 4WD standard.

As discussed in section 4.3 it is a long-term aim to reduce the number of roads and trails in the reserves in order to minimise habitat fragmentation and other environmental impacts. The value of the through-roads for vehicle touring is recognised and these will be kept open for use i.e. Wandean, Cassia, Yarran, Deans Gap, Blackwood, Hell Hole and Parma Trail. It is intended to close dead-end trails in order to prevent inappropriate activities such as logging and car and rubbish dumping. Closure of the dead-end trails to public vehicle use will enhance their value

for activities such as walking and cycling as well as minimising environmental impacts.

Roads and trails to be kept open for use and those to be closed or rehabilitated are shown on the park and reserve maps. Gates have been installed on some trails as part of the works for upgrading Main Road 92 but not all of these are proposed for closure. The trails to be rehabilitated are generally short and/or overgrown.

Trail bike riding occurs within both reserves, on formed trails and within bushland. This activity is appropriate on roads open for vehicle touring. Riding off formed vehicle trails is not an appropriate activity in conservation reserves and causes considerable erosion and habitat disruption. Trail bike riding by unlicensed riders or by riders on unregistered bikes is illegal anywhere within reserves.

Cycling and horse riding

A small amount of cycling occurs along roads and trails through the reserves. The level terrain provides relatively easy cycling, except at the escarpment on the eastern edge of the park.

The roads through both the national park and nature reserve had an established use for recreational horse riding prior to reservation. Horse riding on most roads and trails through these reserves has minimal environmental impact because of the level terrain and poor soils, although there is potential for damage at creek crossings if horses move off the roads. Horse riding is not normally permitted in nature reserves because of their focus on conservation but can be permitted on roads open to public vehicles where there is a history of use and the impacts are low.

Jerrawangala Lookout

Jerrawangala Lookout provides a panoramic view of the coast, the cliff faces and the moist forests below the cliffline, and is the primary visitor attraction in the park. The site is relatively high and prominent compared to the rest of the park and provides a view stretching from Gerroa to Milton, taking in several national parks and nature reserves. It could be used to orient visitors travelling from the west to Jerrawangala National Park and other reserves in the region.

The area immediately around the lookout is not particularly attractive because of vegetation clearing and the presence of a communications tower compound (see section 7). Planting has been undertaken in association with recent re-design of access and provision of lookout fencing and this will progressively improve amenity. Installation of interpretive information is needed to introduce visitors to the park and the region.

Bushwalking

In general, the flat topography and low forests of much of the national park and nature reserve do not provide varied landscapes for walking. The spring wildflower displays are excellent, however, and the northern end of the park along Yarran Road has relatively tall and diverse forests and woodlands.

A small amount of walking takes place along the park's vehicle trails and the Two Rivers Track (see below). Some off-track walking also takes place along the top of the escarpment, where rocky and open areas provide a relatively easy walking route and attractive scenery, sometimes combined with walking below the escarpment in state forests.

A relatively popular walking route is from the end of Peppers Gap Trail to the escarpment, and along the escarpment edge between Peppers Gap and Butterbush Trails. It would be possible to create a formal walk in this area by providing a walking track or tracks between the two vehicle trails. An extension east of Butterbush Trail towards Boongan Mountain would take in an excellent wildflower area and provide views over St Georges Basin. Alternatively, a short walk could be considered near Jerrawangala Lookout.

The Two Rivers Track, a long distance walking route, passes through the southern section of Jerrawangala National Park. The Two Rivers Track begins at the Shoalhaven River and runs through national park and Crown land to reach the Clyde River via a series of vehicle trails and walking tracks. The route follows a powerline trail to the west of Braidwood road, then cuts across Braidwood Road to enter Jerrawangala National Park just north of Cassia Road. The walk then follows a former route of the Braidwood Road for approximately 500 metres before re-joining the powerline through to the park's southern boundary. The length of former road parallel to the Braidwood Road has no park management purpose and should be closed and rehabilitated. Instead, the Two Rivers Track could follow the power line all the way to Braidwood Road.

The gorge along Parma Creek is an attractive area and receives a small amount of visitor use, particularly to a small waterfall and waterhole near the junction of Parma Creek and its main tributary. Vehicle access to this area is causing damage to a significant callitris pine community and section 4.2 provides for closure of the trail to public vehicles. Parma Fire Trail and Sandy Creek Trail cross the creeks just upstream from the gorge area and provide easy access to other features. Walking tracks will not be provided in the nature reserve but the management trails and gorge will be available for self-reliant walkers.

Camping

Some informal vehicle-based camping occurs in both reserves and has resulted in several clearings. A large informal camp is located in the north western section of the park, with numerous tracks radiating out from the cleared area. Camping is not generally appropriate in nature reserves and both reserves lack suitable attractive settings for provision of formal camping facilities. No vehicle-based camping is to be provided and the clearings will be closed and rehabilitated.

Some walk-in camping may occur in the national park as part of use of the Two Rivers Track walking route and this use is sustainable as long as levels remain low.

Signage

Both reserves have high edge to area ratios and the boundaries with adjacent state forest and Crown land are not always obvious. Directional and regulatory signs are needed in both reserves, to assist visitors to find their way and to facilitate awareness of the land tenure.

Desired Outcomes

- Visitor use is appropriate to the purposes of national parks and nature reserves and is ecologically sustainable.
- Low key visitor opportunities are available that encourage appreciation of the natural environment.
- Facilities are designed and managed to provide a satisfying visitor experience and minimise impacts.
- Visitors and the local community are aware of the reserve boundaries, conservation values and permissible activities.

Strategies

- *Provide orientation and interpretive information at Jerrawangala Lookout.*
- *Liase with the owner of the communications compound at the end of Jerrawangala Lookout Road to seek to improve visual amenity e.g. by screen planting.*
- *Construct a walking track in the park at Jerrawangala Lookout or between the Peppers Gap and Butterbush Trails, with an easterly extension to provide a view over St Georges Basin if feasible. Provide associated car parking and track information.*
- *Work with the Land and Property Management Authority and walking groups to redirect the Two Rivers Track along the power line west of Braidwood Road, or a suitable alternative route if available. Close the parallel former road section currently used by the Two Rivers Track and rehabilitate it. Provide directional signs for the Two Rivers Track where needed.*
- *Permit public vehicle use only on public access roads as identified on the plan of management maps.*
- *Install directional and boundary signs where needed on roads and trails.*
- *Allow cycling on public access roads, management trails and power line trails in the park and on roads and management trails in the nature reserve. Monitor the impacts of cycling along power lines and limit or prohibit it if needed*
- *Allow horse riding in the national park on public access roads, management trails and power line trails. Allow horse riding in the nature reserve on public access*

roads. Monitor the impacts of riding along power lines and limit or prohibit it if needed. Prohibit horse camping in the reserves.

- *Undertake educational campaigns and erect signs or barriers as needed to combat inappropriate activities such as off road trail bike riding.*
- *Prohibit all camping in the nature reserve and vehicle based camping in the national park. Allow walk-in camping in the park but not within 250 metres of a public access road or where the impacts on natural or cultural heritage are unacceptable. Permit wood camp fires in the park unless they need to be prohibited because of unacceptable impacts.*
- *Close and rehabilitate the informal camp sites in the north western section of the national park and other vehicle-accessible camp sites.*
- *Permit commercial and community group tours and activities that promote understanding and appreciation of natural and cultural values subject to the following:*
 - *environmental impacts being acceptable;*
 - *limits on group sizes and frequency of use where needed to minimise impacts and conflicts with other users; and*
 - *a licence for commercial use.*

7. OTHER USES

Jerrawangala National Park and Parma Creek Nature Reserve are crossed by a number of power lines and pipelines. One power line extends across the eastern sections of both reserves, a second runs along the southern and northwestern parts of the national park and a third crosses the far eastern section of the nature reserve. A water pipeline also follows this last power line and the Eastern Gas Pipeline is located in the national park along the Braidwood Road edge, near the junction of Turpentine and Braidwood Roads.

Power line routes have very high visual impact, form barriers to wildlife movement and facilitate unauthorised vehicle access. These impacts are minimised through maintenance agreements that provide for protection of threatened plants and habitats and retention of some vegetation cover for animal movement.

A radio communications facility is located adjacent to Jerrawangala Lookout Road. The site includes a small building, towers with radio antennas used by a number of authorities and a perimeter fence. The facility was installed under a State Forest occupation permit prior to reservation of the park and can continue under pre-existing use rights.

Apiarists maintain honey bee hives seasonally within the reserves. As stated in section 4.3, most of the vehicle trails have designated bee sites or licences along them and this is preventing the closure of trails that have limited reserve management value, with consequent environmental impacts. NPWS will aim to negotiate relocation of hives to sites that allow closure of non-essential trails and ensure that the impact of hives is minimised.

Several roads through Jerrawangala National Park and Parma Creek Nature Reserve provide access to state forest, Crown land or private property. These roads do not presently form part of the gazetted area of the reserves and are vested in the Minister for the Environment under Part 11 of the NPW Act. Under the provisions of the *National Park Estate (Southern Region Reservations) Act 2000* (NPE Act) under which the reserves were gazetted, Part 11 roads that provide the only practical means of access to a property cannot be closed but a decision must be made whether to add or exclude them from the national park or nature reserve. NPWS is consulting with the adjacent landowners to determine the use and future status of these roads. The plan maps show existing access and those roads and trails that NPWS expects to maintain.

Desired Outcomes

- Commercial and other non-park uses have minimal environmental impact.
- Appropriate access arrangements are in place for neighbouring lands.

Strategies

- *Monitor the implementation of power line maintenance agreements to ensure an adequate vegetation cover is maintained and erosion potential is minimised.*
- *Continue to permit necessary maintenance access to the power lines and water pipeline.*
- *Arrange an easement and negotiate a maintenance agreement with the owner of the Eastern Gas Pipeline.*
- *Manage bee keeping in accordance with NPWS policy. Where possible, relocate bee sites to roads and trails that have management value and sites that have minimal environmental impact. Close and rehabilitate any trails no longer needed. Check hive sites for significant plant species.*
- *Determine the use and status of Part 11 roads and enter into appropriate legal agreements for continued access and future maintenance if needed.*

8. MONITORING AND RESEARCH

The purpose of scientific study in national parks and nature reserves is to improve understanding of their natural and cultural heritage and the processes that affect them. Research helps to identify the management requirements for particular species, communities or features and provides information to underpin effective decision making and to evaluate the effectiveness of management initiatives. Some survey of plants, animals and cultural heritage features has been undertaken in the park and reserve but, as stated in earlier sections, further work is needed.

Under the Southern RFA all forest managers including Industry and Investment NSW, the Land and Property Management Authority and NPWS must demonstrate ecologically sustainable forest management (ESFM). ESFM aims to maintain or increase the full suite of forest values for present and future generations across the NSW native forest estate, including:

- ecosystem biodiversity, health, vitality, productive capacity and functional processes;
- soil and water productive capacity and functional processes;
- long term social and economic benefit; and
- natural and cultural heritage values.

ESFM will be applied to all ecosystem types. It will be implemented primarily through monitoring and reporting regimes to provide feedback on management programs and directions for on-going adaptive management. Criteria and indicators of ecologically sustainable forest management have been identified and monitoring programs are being introduced to demonstrate the impact of management actions on ecological values and processes. Remedial management actions will then be undertaken as required.

Research and monitoring will be undertaken as part of Regional ESFM programs and also for specific purposes identified in this plan. NPWS monitoring and research efforts must be directed towards the areas of greatest need and will concentrate on:

- threatened species, populations and communities;
- introduced species monitoring;
- fire management, particularly fire responses of threatened and rare species; and
- Aboriginal and historic site survey and assessment.

Additional programs will be considered where they complement ESFM criteria and indicators. The results of research and monitoring will be used to guide management programs.

NPWS has begun a program of assessing and reporting on the condition and management adequacy of reserves through the State of Parks Program. This utilises a number of indicators related to the condition of natural and cultural heritage and visitor facilities, information availability and the management of threats such as fire and pests. Assessment of both the park and nature reserve indicates that overall they are in reasonably good condition.

Desired Outcomes

- Research is undertaken that enhances the information base and assists management of the park and reserve.
- Research causes minimal environmental damage.
- Monitoring programs are in place to detect any changes in the status of park or nature reserve values.

Strategies

- *Use ESFM principles to guide management operations. Develop ESFM monitoring programs where warranted and use the results to guide management programs.*
- *Undertake research as needed to provide information about the park and reserve's natural and cultural heritage and human use in order to facilitate management.*
- *Permit appropriate research by other organisations and individuals and promote research that is directly useful for management purposes, particularly on the topics mentioned above.*
- *Encourage contributions from park visitors to the information base about the park and reserve's natural and cultural heritage.*

9. NPWS MANAGEMENT FACILITIES AND OPERATIONS

The only NPWS management facilities in Jerrawangala National Park and Parma Creek Nature Reserve are vehicle trails; those open to public vehicle use (public access roads) and those to be retained for management purposes such as fire suppression and pest control (management trails).

Cottonwood Road is a Crown road excluded from the park but does not provide access to other land tenures as it ends at a cliff line within the park. Addition of this road to the park would be desirable and would clearly make NPWS the responsible maintenance authority.

There are a number of Crown and Council road reserves running through the national park and nature reserve that have not had roads constructed on them (see maps). NPWS will negotiate with relevant government agencies to add these road reserves to the park and nature reserve.

Many organisations and individuals have an interest in management of the park and reserve, particularly neighbours with regard to such issues as fire management, weed and pest control, fencing and public access. On-going communication with a range of individuals, community groups and agency representatives will be needed.

Desired Outcomes

- Management facilities adequately serve management needs and have acceptable environmental impact.

Strategies

- *Maintain the roads and management trails in the reserves.*
- *Negotiate with the Land and Property Management Authority and Shoalhaven City Council to add Crown and Council road reserves to the park and nature reserve that do not have roads constructed on them. Also seek addition of the road reserve along Cottonwood Road.*
- *Maintain close liaison with neighbours of the park to deal with matters of mutual concern, such as boundary issues and pest and fire management.*

10. PLAN IMPLEMENTATION

This plan of management establishes a scheme of operations for Jerrawangala National Park and Parma Creek Nature Reserve. It will remain in force until amended or replaced in accordance with section 73B of the NPW Act. The plan is part of a system of management that includes the NPW Act, management policies, established conservation and recreation philosophies, and strategic planning at corporate, directorate and regional levels. The latter may include development of related plans such as regional recreation plans, species recovery plans, fire management plans and conservation plans.

Relative priorities for activities identified in this plan are set out in the table below. These priorities are subject to the availability of necessary staff and funds, and to any special requirements of the Director General or Minister. High priority activities are those considered imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources. Medium priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent. Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

The environmental impact of proposed activities will be assessed at all stages in accordance with established environmental assessment procedures. If the impacts of any activity proposed in this plan are found to be unacceptable, the activity will not be undertaken or will be modified so as to comply with the environmental assessment outcomes.

Strategies

- *Undertake an annual review of progress in implementing this plan of management.*
- *Undertake an assessment after 5 years of the effectiveness of managing the park in accordance with this plan and of the degree of success in achieving the plan's objectives and desired outcomes. Base the evaluation on the monitoring programs set out in this plan and any others that may be developed.*

Implementation Table

Priority	Activity	Plan reference
High	Close to public vehicle use the trail in the nature reserve passing through the Callitris pine community.	4.2
	Identify colonies of Bauer's midge orchid along Yarran Road to prevent disturbance by road works. If necessary, erect barriers to prevent damage by vehicles using the road.	4.2
	Ensure that the <i>L. epacridoideum</i> and <i>A. subtilinervis</i> plants adjacent to roads and trails are protected during road maintenance work.	4.2
	Close and rehabilitate roads and trails that serve no significant management, recreation or essential private access purpose.	4.3
	Develop and carry out a program of installing sediment control works along roads near creek crossings and take any necessary steps during road maintenance activities to minimise sediment contribution to waterways, particularly near heath frog habitat.	4.3
	Monitor the reserves for the presence of feral goats and if necessary undertaken control programs with the aim of eradicating them.	5.2
	Implement the Fire Management Strategies for the national park and nature reserve.	5.3
	Use prescribed burns or other means to achieve fuel management as needed in strategic areas and to achieve a variety of fire regimes that maintain ecological fire thresholds for each vegetation community.	5.3
	Determine the use and status of Part 11 roads and enter into appropriate legal agreements for continued access and future maintenance if needed.	7
	Maintain the roads and management trails in the reserves.	9
Medium	Undertake vegetation surveys to check for additional threatened and significant plant species.	4.2
	Implement relevant priority actions set out in the Threatened Species Priorities Action Statement and any recovery plans prepared for threatened plant and animal species that occur in the reserves.	4.2, 4.3
	Continue to monitor the status of the significant communities and rare and threatened plant species and to evaluate the success of management programs.	4.2
	Close to public use roads and trails that serve no significant recreation purpose.	4.3

	Undertake targeted surveys for threatened animal species that are predicted as likely to occur in the national park and nature reserve but have not yet been recorded.	4.3
	Continue to monitor heath frog populations.	4.3
	Assess the significance of the charcoal burning sites. Determine a management strategy and undertake any necessary conservation works.	4.5
	Rehabilitate the former quarries to minimise sediment input into waterways and promote revegetation growth.	5.1
	Monitor the presence, extent and abundance of introduced species. If necessary, develop programs for control and, if possible, eradication.	5.2
	Undertake a survey for blackberry and lantana in the park and treat priority occurrences.	5.2
	Undertake programs for the control of wild dogs and foxes as needed, in accordance with relevant wild dog management plans when prepared.	5.2
	Continue to monitor the ecological effects of fire in the park and nature reserve, particularly the response of significant plant species to fire.	5.3
	Continue to actively participate in the Shoalhaven Bush Fire Management Committee. Maintain close contact and cooperation with neighbours, the Rural Fire Service, volunteer bush fire brigades and Forests NSW.	5.3
	Provide orientation and interpretive information at Jerrawangala Lookout.	6
	Liaise with the owner of the communications compound at the end of Jerrawangala Lookout Road to seek to improve visual amenity eg by screen planting.	6
	Install directional and boundary signage where needed on roads and trails.	6
	Close and rehabilitate the informal camp sites in the north western section of the national park and other vehicle-accessible camp sites.	6
	Arrange an easement and negotiate a maintenance agreement with the owner of the Eastern Gas Pipeline easement.	7
	Where possible, relocate bee sites to roads and trails that have management value and sites that have minimal environmental impact. Close and rehabilitate any trails no longer needed. Check hive sites for significant plant species.	7
Low	Encourage establishment of voluntary conservation agreements for significant naturally vegetated private land, particularly areas containing threatened plant species or important wildlife corridors.	4.2
	Liaise with Shoalhaven City Council regarding monitoring of the Hell Hole quarry and seek amelioration of any water quality impacts if needed.	5.1

	Construct a walking track in the park at Jerrawangala Lookout or between the Peppers Gap and Butterbush Trails, with an easterly extension to provide a view over St Georges Basin if feasible. Provide associated car parking and track information.	6
	Work with the Land and Property Management Authority and walking groups to redirect the Two Rivers Track along the power line west of Braidwood Road, or a suitable alternative route if available. Close the parallel former road section currently used by the Two Rivers Track and rehabilitate it. Provide directional signs for the Two Rivers Track where needed.	6
	Monitor the implementation of power line maintenance agreements to ensure an adequate vegetation cover is maintained and erosion potential is minimised.	7
	Negotiate with the Land and Property Management Authority and Shoalhaven City Council to add Crown and Council road reserves to the park and nature reserve that do not have roads constructed on them. Also seek addition of the road reserve along Cottonwood Road.	9

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