



Plan of Management



Moore Park Nature Reserve



Moore Park Nature Reserve Plan of Management

NSW National Parks and Wildlife Service

December 2012

This plan of management was adopted by the Minister for the Environment on 5th December 2012.

Acknowledgments

The NPWS acknowledges that Moore Park Nature Reserve is in the traditional country of the Githabul Aboriginal people.

This plan of management is based on a draft plan prepared by staff of the Northern Rivers Region of the NSW National Parks and Wildlife Service (NPWS), part of the Office of Environment and Heritage, Department of Premier and Cabinet, and Southern Cross University student intern Melanie Brown.

FRONT COVER: Part of Moore Park Nature Reserve and the Richmond River as seen from the north-west. Photo: Steve King, NPWS

For additional information or any inquiries about this park or this plan of management, contact the NPWS Kyogle Area Office, PO Box 174, Kyogle NSW 2474 or by telephone on 02-6632 0000.

Published by:
Office of Environment and Heritage
59–61 Goulburn Street
PO Box A290
Sydney South 1232

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ISBN 978 1 74293 950 6

OEH 2012/0977

Printed on recycled paper

Foreword

Moore Park Nature Reserve covers an area of around 15 hectares in three separate portions. It is located near the village of Old Grevillea, north-west of Kyogle, in the Northern Rivers Region of New South Wales.

The nature reserve contains an area of the endangered 'Lowland Rainforest on Floodplain in the NSW North Coast Bioregion' and a section of riverine corridor in the upper Richmond River catchment. Eleven threatened fauna species and two threatened flora species have been recorded in the reserve.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A draft plan of management for Moore Park Nature Reserve was placed on public exhibition from 21 October 2011 until 30 January 2012. The submissions received were carefully considered before adopting this plan.

The plan contains a number of actions to achieve the NSW 2021 goal to protect our natural environment. These include strategies to assist the recovery threatened species and ecological communities, restore the riverine vegetation, extend the rainforest, continue bush regeneration, control weeds and pest animals, and to minimise visitor disturbance to roosting flying-foxes. The plan also provides for continued maintenance of visitor facilities for picnicking, bushwalking and bird watching.

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

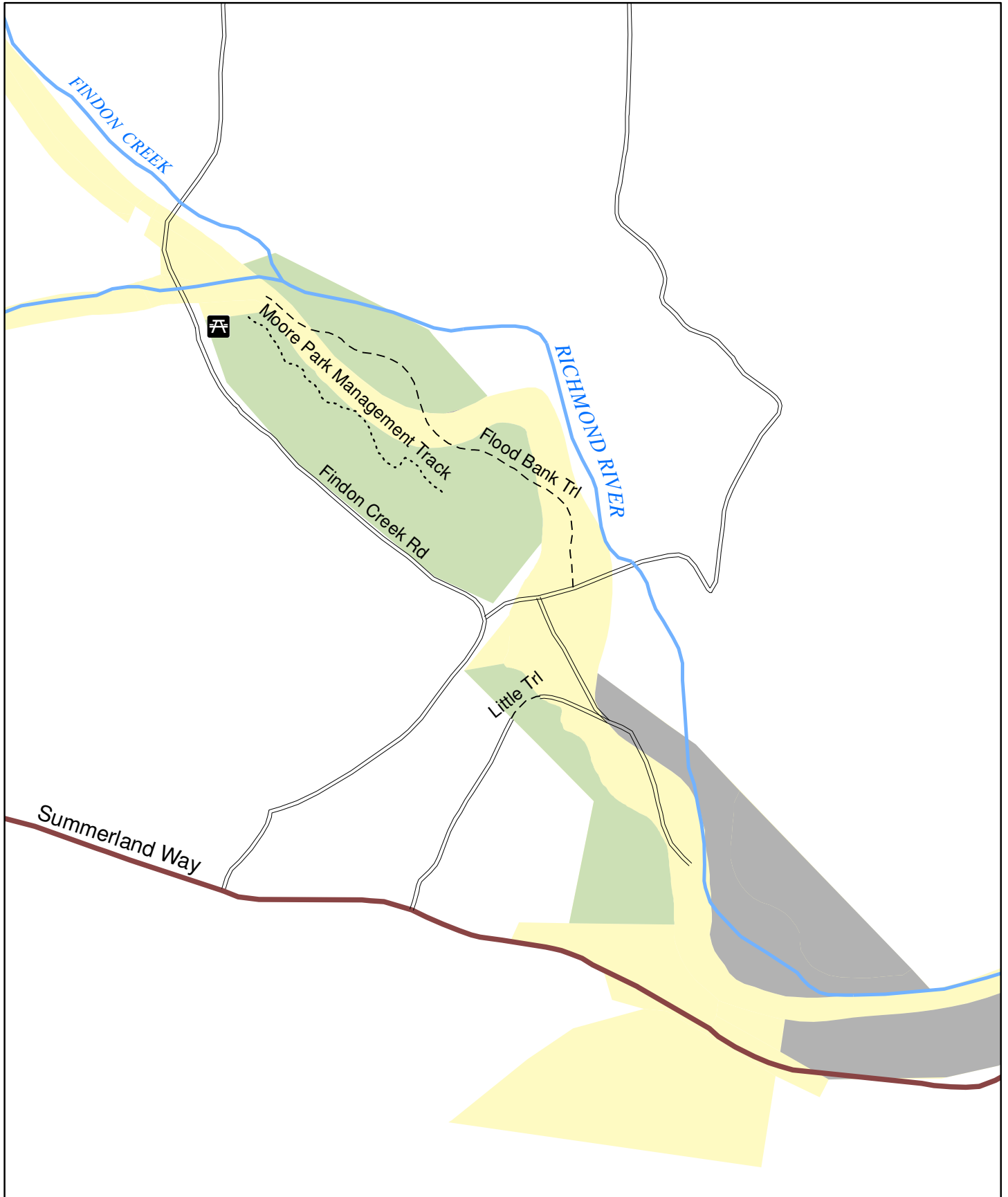


Robyn Parker MP
Minister for the Environment

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Map of Moore Park Nature Reserve



Day Use Area

Moore Park Nature Reserve

Crown Reserve

Crown Land

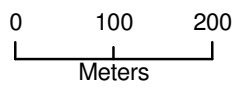
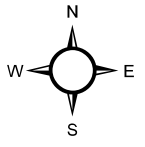
Highway / Major Road

Unsealed Road - Off Park

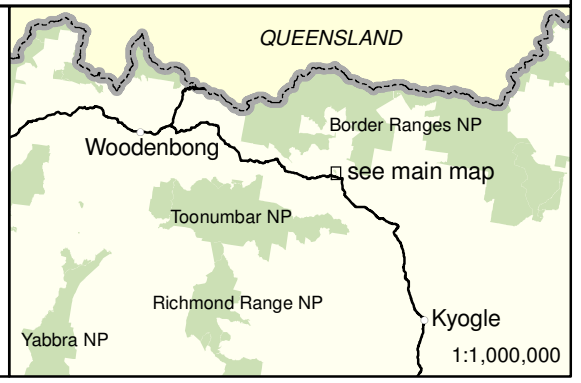
Management Trail

Management Track

River / Creek



1:7,500



1. Introduction

1.1 Location, gazettal and regional setting

Features	Description
Moore Park Nature Reserve	
Location	Moore Park Nature Reserve (referred to as 'the reserve' in this plan) is located at the confluence of the Richmond River and Findon Creek near the village of Old Grevillea in the Northern Rivers Region of NSW (see Map 1). Access is via the Summerland Way and Findon Creek Road, 30 kilometres north-west of Kyogle.
Area	The reserve is comprised of three separate portions, occupying approximately 15 hectares in area.
Reservation Date	Main portion (8.979 hectares), June 1989. Northern addition (2.7 hectares), March 1999. Southern addition (3 hectares), December 1999.
Previous Tenure	<p>The NPWS acknowledges that the lands now constituting Moore Park Nature Reserve would have been part of the traditional lands of the Githabul native people.</p> <p>Since European settlement the lands were part of Roseberry Station, the main portion of land was sold at auction in 1924 before purchase by Kyogle Council in 1929. It was dedicated as a Reserve for Public Recreation (No. 71132) named Moore Park, after the then Shire President, Mr R.J. Moore. In November 1967 the land was surrendered to the Department of Lands.</p> <p>Reservation of the area as a nature reserve was to protect a rainforest remnant of the extensively cleared Boyd's Scrub.</p> <p>The North-East Regional Forest Agreement provided for major additions to the park system, including the addition of two parcels in 1999 to the Moore Park Nature Reserve. The first addition included highly degraded and weed infested land on the left bank of the Richmond River, north of the original reserve. The second addition contains a Boyd's Scrub rainforest remnant of considerable conservation value at its southern end and a cleared paddock in the north, previously leased under Permissive Occupancy for cropping and cattle.</p>
Regional Context	
Biogeographic Region	Located in the South Eastern Queensland bioregion (DECCW, 2010a), the reserve forms part of a wildlife corridor linking the Richmond River to Mount Grevillia and the Border Ranges National Park. It is part of a system of protected areas in north-eastern NSW, including the Border Ranges, Tooloom, Richmond Range, Koreelah, Yabbra and Toonumbar National Parks.
Surrounding Land Use	Land use in the surrounding area is predominantly freehold or leasehold beef and dairy cattle and cropping. Forestry, both public and private, is another important land use in the area.
Other Authorities	The reserve is located within the geographical areas of the Githabul Aboriginal people, the Gugin Guddaba Local Aboriginal Land Council, Northern Rivers Catchment Management Authority and Kyogle Shire Council.

1.2 Statement of significance

Moore Park Nature Reserve is considered to be of significance for:

Biological Values:

- Vegetation communities of state significance occur within the reserve, including what is described by Floyd (1990b) as the best example of the black bean – silky oak (*Castanospermum – Grevillea robusta*) suballiance in NSW.
- An endangered ecological community, eleven fauna species and two flora species listed as threatened under the *Threatened Species Conservation Act 1995* (TSC Act) are found within the reserve.
- The reserve provides an essential habitat for a significant flying-fox maternity camp (DECCW, 2009).

Landscape/Catchment Values:

- Set against the forested backdrop of Border Ranges National Park, the reserve protects a section of riverine corridor in the upper Richmond River catchment.

Research and Educational Values:

- Significant vegetation communities and animal populations in the reserve provide opportunities for scientific research and education.
- The reserve is an important example of long-term rehabilitation and of the success of bush regeneration techniques.

Community Values:

- The local community has had a long association with the reserve, predating its gazettal as a nature reserve. It has a history of local significance as a focal point for day use recreation, functions and family gatherings.

2. Management Context

2.1 Legislative and policy framework

The management of nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act) and Regulation, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS).

Other legislation, strategies and international agreements may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) may require assessment of environmental impact of works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) may apply in relation to actions that impact on matters of National Environmental Significance, such as migratory and threatened species listed under that Act.

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 in relation to the lands to which the plan relates unless the operations are in accordance with the plan. This plan will also apply to any future additions to Moore Park Nature Reserve. Should management strategies or works be proposed in future that are not consistent with this plan, an amendment to the plan will be required.

2.2 Management purposes and principles

Nature Reserves

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

Under the Act (section 30J), nature reserves are managed to:

- conserve biodiversity, maintain ecosystem functions, and 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 reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

The primary purpose of nature reserves is to conserve nature. Nature reserves differ from national parks in that they do not have the provision of visitor use as a management purpose or principle.

2.3 Specific management directions

In addition to the general principles for the management of nature reserves (refer section 2.2), the following specific management directions apply to the management of Moore Park Nature Reserve:

- protection of threatened plant species, significant vegetation alliances, and of gallery rainforest which is identified as an endangered ecological community *Lowland Rainforest on Floodplain in the NSW North Coast Bioregion* (Schedule 1 Threatened Species Conservation Act 1995);
- protection of a significant flying-fox maternity camp and threatened animal species from disturbance and inappropriate works and activities;
- habitat rehabilitation and reconstruction including replanting;
- control of significant occurrences of introduced plant species; and
- low key visitor use within the day use area.

3. Values

This plan aims to conserve both natural and cultural values of Moore Park Nature Reserve. The location, landforms and plant and animal communities of an area have determined how it has been used and valued by both Aboriginal and non-Aboriginal people. These 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.

3.1 Landscape / Catchment

The reserve occurs on the basalt alluvium soils of the upper Richmond River (Floyd, 1990b). Extending three kilometres along the south-western bank of the river, downstream from the junction with Findon Creek (Holmes, 1983), the reserve is located on floodplain at an altitude of 100 metres (Central Mapping Authority of NSW, 1980). It contains riverine corridor habitat, identified as inadequately reserved and a priority for management in the Northern Rivers Catchment Action Plan (NRMCA, 2005).

Issues

- Past gravel extraction along the banks of the Richmond River and periodic flooding has caused erosion, degraded the riparian vegetation and encouraged the invasion of noxious weeds (see 4.1 Pests).

Desired outcomes

- The integrity of the riverine landscape is improved.

Management response

- Improve the integrity of the riverine landscape by restoring vegetation communities (refer to 3.2 Native Plants) and implementing bush regeneration programmes to control weed species (refer to 4.1 Pests).

3.2 Native plants

Despite exposure to a range of disturbances, the reserve has maintained the unique assemblage of a well developed and viable black bean (*Castanospermum australe*) rainforest (Holmes, 1983). Comprehensive surveys conducted by Baur in 1957, Floyd in 1977 and Holmes in 1981 identified 139 native plant species within the reserve (Holmes, 1983). Currently, the NSW Wildlife Atlas data base maintained by NPWS lists 127 native species. Most species are distributed widely throughout NSW or beyond (Holmes, 1983) however, four threatened and significant species occur in the reserve (see Table 1).

Two vegetation communities are recognised within the reserve: open woodland and dry gallery rainforest (Floyd, 1990b; Joseph, 1995). Moderately intact open woodland occurred on the floodplain prior to a major flood event in 1954. Island remnants of the open woodland survive today and are expanding. Key species in this community include the senescing river she-oak (*Casuarina cunninghamiana*), drooping bottlebrush (*Callistemon viminalis*) and black paperbark (*Melaleuca bracteata*) (Joseph, 1995).

Dry gallery rainforest occupies approximately 6 hectares, which is almost 50% of the park. The vegetation type fits the specifications for a *Lowland Rainforest on Floodplain in the NSW North Coast Bioregion*, listed as an endangered ecological community (EEC) under the TSC Act (NSW Scientific Committee, 2008). Black bean is the dominant plant species, in an alliance with weeping lilly pilly (*Waterhousea floribunda*). There is also a black bean – silky oak (*Grevillea robusta*) suballiance which is considered the best example of this suballiance in NSW (Floyd, 1990b).

Table 1: Threatened and significant plant species recorded in Moore Park Nature Reserve.

Common name	Scientific name	TSC Act status	EPBC Act status	ROTAP
Rough-shelled bush nut	<i>Macadamia tetraphylla</i>	Vulnerable	Vulnerable	2VC-
Native wisteria ^	<i>Callerya australis</i>	n/a	n/a	3RC
Northern clematis ^	<i>Clematis fawcetti</i>	Vulnerable	Vulnerable	3VC-
	<i>Pararistolochia laheyana</i>	n/a	n/a	2RC-

^ Denotes species listed as a Rare or Threatened Australian Plant (ROTAP) according to Briggs and Leigh (1996):

2 = Geographic range in Australia less than 100km

3 = Geographic range in Australia more than 100km

E = Endangered - at serious risk in the short term (one or two decades)

R = Rare

V = Vulnerable - at risk over a longer period (20-50 years)

C = Occurs within a conservation reserve

i = Species is considered to be inadequately reserved. Less than 1000 plants occur within a proclaimed reserve

- = Species is recorded from a reserve but the population size is unknown

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a state-wide Threatened Species Priorities Action Statement (PAS). Individual recovery plans may also be prepared for threatened species to consider management needs in more detail. At present, no recovery plans have been completed for the threatened plant species listed in Table 1.

Issues

- The most significant threats to vegetation structure and health are periodic flooding and infestation by weed species (see 4.1 Pests).
- Recurrent habituation of the canopy by roosting flying-foxes results in the degradation of the foliage, threatening the longevity of the camp site (Pallin, 2000 in DECC, 2009) and the recovery of the endangered rainforest community (Joseph, 1995). However it is not practicable or desirable to relocate the flying-foxes.
- Regular slashing of the rainforest undergrowth in the 1970s significantly retarded rainforest regeneration and has resulted in a two storey structure in some areas (Floyd, 1990b; Joseph, 1995).
- Opportunities exist to rehabilitate ecological communities and to implement strategies to recover threatened flora species and the EEC. The requirements of listed EEC should be considered when developing and undertaking management programmes.

Desired outcomes

- Threatened and significant plant species and ecological communities are conserved.
- Negative impacts on threatened and significant species and ecological communities are minimised.
- The habitats of all threatened and significant plant species are protected and maintained.
- Structural diversity and habitat values are restored in degraded areas.

Management response

- Restore vegetation communities through replanting in disturbed areas and the continuing implementation of the bush regeneration program to control weed species in the reserve (refer 4.1 Pests).
- Implement relevant strategies and actions in the PAS and recovery plans to conserve and recover threatened species and ecological communities.

3.3 Native animals

As part of a wildlife corridor extending from the Richmond River to Mount Grevillea and the Border Ranges National Park, the reserve provides an important connection between distinct habitat types. The diversity of fauna in the reserve is impacted by its small size and isolation from other habitats. A comprehensive fauna survey has not been conducted however, substantial populations of the long-nosed bandicoot (*Perameles nasuta*), short-eared possum (*Trichosurus caninus*), bush

rat (*Rattus fuscipes*) and grey-headed flying-foxes (*Pteropus poliocephalus*) are known to occur within the rainforest (Holmes, 1983).

Over the past 20 years a flying-fox maternity camp has settled within the reserve. The colony establishes every year between spring and autumn, remains for six to eight months and contains between five to ten thousand bats. Grey-headed flying-foxes, listed as vulnerable under the TSC Act, are the dominant species in the colony, with recordings of the black flying-fox (*Pteropus alecto*), little red flying-fox (*Pteropus scapulatus*) and the vulnerable common blossom bat (*Scyonycteris australis*) (see Table 2). The reserve is considered habitat critical for survival of grey-headed flying-foxes (DECCW, 2009). Two microbat species listed as vulnerable under the TSC Act are also likely to occur in the reserve – the large-footed myotis (*Myotis macropus*) and the hoary wattled bat (*Chalinolobus nigrogriseus*) (NPWS, 2006).

The koala and quoll have also been recorded, but the reserve is not prime habitat for these species.

Bird species known in the reserve are generally well distributed throughout south-eastern Australia, however 7 species listed as threatened under the TSC Act have been recorded (see Table 2). Bush-hens occur along the Richmond River and have been recorded in the reserve. Other threatened bird species that are likely to occur in the reserve include the powerful owl (*Ninox strenua*), superb fruit dove (*Ptilinopus superbus*), and the critically endangered red goshawk (*Erythrotriorchis radiatus*) (NPWS, 2006). The reserve although small is likely to be an important stepping-stone or refuge for migratory bird species.

Table 2: Threatened and significant animal species recorded in Moore Park Nature Reserve.

Common name	Scientific name	TSC Act status	EPBC Act status
Barred cuckoo-shrike	<i>Coracina lineate</i>	Vulnerable	n/a
Black bittern	<i>Ixobrychus flavicollis</i>	Vulnerable	n/a
Bush-hen	<i>Amaurornis olivaceus</i>	Vulnerable	n/a
Common blossom bat	<i>Scyonycteris australis</i>	Vulnerable	n/a
Grey-headed flying-fox	<i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable
Koala	<i>Phascolarctos cinereus</i>	Vulnerable	n/a
Little lorikeet	<i>Glossopsitta pusilla</i>	Vulnerable	n/a
Rose-crowned fruit dove	<i>Ptilinopus regina</i>	Vulnerable	n/a
Spotted-tailed quoll	<i>Dasyurus maculates</i>	Vulnerable	Endangered
Varied sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable	n/a
White-eared monarch	<i>Monarcha leucotis</i>	Vulnerable	n/a

A national recovery plan for the grey-headed flying-fox is currently in draft form (DECCW, 2009) and is used in combination with relevant strategies from the PAS to manage threatened fauna species in the reserve.

Issues

- Habitat isolation and fragmentation and introduced species are the major threats to native fauna in the reserve (refer also 4.1 Pests, 4.2 Fire and 4.3 Fragmentation and isolation).
- Visitor access and management operations have the potential to disturb the flying-fox colony (refer 3.5 Visitor use).
- Canopy degradation by the flying-fox colony impacts upon rainforest habitat, but it is not practicable or desirable to relocate these species.
- Opportunities exist to rehabilitate and expand habitats and to implement strategies to recover threatened fauna species.

Desired outcomes

- Populations of significant animal species are conserved.
- Negative impacts on threatened species are minimised.

- The habitat and populations of all threatened animal species are protected and maintained.
- Habitat values are restored in degraded areas.

Management response

- Improve habitat values of the reserve through appropriate fire and pest management and increasing habitat connectivity (refer 4.1 Pests and 4.2 Fire).
- Implement relevant strategies and actions in the PAS and recovery plans to conserve and recover threatened species.
- Minimise visitor disturbance to roosting flying-foxes (refer 3.5 Visitor Use).
- Schedule NPWS management activities near the flying-fox colony to avoid disturbance of roosting flying-foxes between spring and autumn.

3.4 Aboriginal heritage

The reserve lies within the traditional country of the Githabul people. The land, water, plants and animals within a landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable and need to be managed in an integrated manner across the landscape.

The native title rights of the Githabul people have been recognised in nine national parks and thirteen state forests in northern NSW. Previous freehold tenure excludes the reserve from the Githabul Indigenous Land Use Agreement (ILUA), signed on 27th February 2007, however the Githabul Community is consulted about management of the reserve. No Aboriginal sites have been recorded within the reserve.

Issues

The reserve is located within the traditional country of the Githabul people.

Desired outcomes

- Aboriginal people are involved in management of the Aboriginal cultural values of the reserve.
- Understanding of the cultural values of the reserve is improved.

Management response

- Continue to consult the Githabul community about management of the reserve.

3.5 Visitor use

NPWS parks and reserves provide a range of visitor opportunities. NPWS aims to ensure that visitors enjoy, experience and appreciate the parks while park values are conserved and protected. The reserve has a long history of visitor use, pre-dating its gazettal as a nature reserve. While nature reserves in NSW do not generally provide for recreational use as a priority, current management of the reserve has allowed for low-key nature-based recreation.

The reserve generally experiences low levels of visitation, estimated at around 500 people each year. Basic visitor facilities include a mown day use area, four picnic tables, three barbecues, a galley and a pit toilet. Moore Park Management Track, a short walking track of approximately 300 metres, commences from the picnic area and leads into the rainforest. Current visitation is centred around low impact recreation such as picnicking, bushwalking and bird watching, mostly within the cleared day use area overlooking the river and creek.

To allow extension of the rainforest and in response to low visitation rates to the reserve, the provision of visitor facilities will be scaled back, including the removal of two picnic tables and two barbecues, but other existing facilities including the covered galley, toilet, two picnic tables and a barbecue will continue to be provided.

Due to the small area and conservation focus of the reserve, recreational pursuits such as camping, horse riding, cycling and vehicle access are not appropriate. Swimming was once a popular pastime in the nearby Richmond River and Findon Creek, however the impact of past floods and the proliferation of weeds along both watercourses has reduced the amenity and opportunity for water activities within the reserve.

Other areas managed by NPWS, other authorities and commercial operators in the region provide opportunities for a wide range of recreation activities.

Issues

- Although recreation is not a priority for nature reserves, there has been a history of recreation in Moore Park which predates its gazettal.
- The provision of visitor facilities in the reserve has encouraged continued visitor use, but use levels are low.
- The walking track allows visitor access to the flying-fox colony, which creates an undesirable disturbance to the threatened species (DECCW, 2009).
- Mowing the large day use area inhibits natural regeneration of native plant species and the expansion of native vegetation communities.
- Opportunities exist to scale back the provision of visitor facilities to enhance the biological values of the reserve.
- Part of the existing maintained picnic area (including the car park and part of the grassed area) extends into adjacent Vacant Crown Land.

Desired outcomes

- Visitor use of the reserve is appropriate and ecologically sustainable.
- Negative impacts of visitors on reserve values are minimised.
- Visitor opportunities encourage appreciation and awareness of the reserve's values and their conservation.
- The boundary of the current picnic area be rationalised by addition to the reserve.

Management response

- Provide signage in the day use area that promotes appropriate visitor behaviour to minimise impacts on the flying-fox colony.
- Close the Moore Park Management Track to public access to reduce disturbance to the flying-fox colony and manage as a walking track for bush regeneration / pest management purposes.
- The provision of visitor facilities will be scaled back, including the removal of two picnic tables and two barbecues.
- Reduce the mown section of the day use area by approximately 30% to reduce maintenance and increase the area of native vegetation.
- That part of the car park and picnic area that occurs on Vacant Crown Land be considered for addition to the reserve (see also 4.3).

4. Issues

4.1 Pests

Pest species are plants and animals that have negative environmental, economic and social impacts and are most commonly introduced species. Pests can have impacts across the range of reserve values, including impacts on biodiversity, cultural heritage, catchment and scenic values. Pest species are recognised as a major threat to the reserves most important values.

The overriding objective of the pest management strategy is to minimise adverse impacts of introduced species on biodiversity and other reserve and community values. The NPWS also has a legislative responsibility with respect to the control of certain declared noxious species. The Northern Rivers Region Pest Management Strategy (DECC, 2007) identifies pest species across the region's reserves and details priorities for control (including actions listed in the PAS and Threat Abatement Plans (TAPs) prepared under the TSC Act). The pest management strategy also identifies where other site or pest specific plans or strategies need to be developed to provide a more detailed approach.

High priority pest species for the reserve are listed below (Table 3).

Table 3: Pest plant and animals recorded in the Moore Park Nature Reserve.

Common name	Scientific name	Comment / status in the reserve
Weeds		
Annual ragweed	<i>Ambrosia artemisiifolia</i> #	Widespread
Anoda weed	<i>Anoda cristata</i>	Widespread
Arsenic bush	<i>Senna septemtrionalis</i>	Widespread
Asthma plant	<i>Chamaesyce hirta</i>	Widespread
Balloon vine	<i>Cardiospermum grandiflorum</i> # ~	Dominant weed on the floodplain and present on edge and within rainforest. Climbs and smothers young trees and blankets ground blocking secondary succession.
Bella sombre	<i>Phytolacca dioica</i>	Scattered
Calico flower	<i>Aristolochiaceae littoralis</i>	Widespread
Cape Gooseberry	<i>Physalis peruviana</i>	Minor weed in rainforest areas of high light.
Carpesium	<i>Carpesium cernuum</i>	Widespread
Cat's claw creeper	<i>Macfadyena unguis-cati</i> # ~	Established in individual and clumps of trees on floodplain and along rainforest edge.
Chinese celtis	<i>Celtis sinensis</i> #	Widespread, young plants occurring throughout the rainforest and on the floodplain.
Climbing nightshade	<i>Solanum seaforthianum</i> ~	Minor weed in rainforest areas of high light.
Common passionflower	<i>Passiflora edulis</i>	Climbing over young rainforest trees in area of high light.
Corky passionfruit	<i>Passiflora suberosa</i>	Climbing over young rainforest trees in area of high light.
Ground cherry	<i>Physalis ixocarpa</i>	Minor weed in areas of high light.
Hawaiian snow bush	<i>Breynia nivosa</i>	Scattered
Lantana	<i>Lantana camara</i> * # ~	Straggling outbreaks in rainforest and floodplain.
Madeira vine	<i>Anredera cordifolia</i> # ~	Serious infestation throughout the floodplain and adjacent forest edge, climbing into trees and carpeting the ground. Also present on the eastern edge of the rainforest.
Moth vine	<i>Araujia sericifera</i> # ~	Common around day use area, western edge and within forest in higher light conditions.
Needle burr	<i>Amaranthus spinosus</i>	Widespread
Ochna	<i>Ochna serrulata</i> #	Widespread
Oxalis	<i>Oxalis debilis</i> var. <i>corymbosa</i>	Widespread
Palm Setaria	<i>Setaria palmifolia</i>	Widespread
Potato tree	<i>Solanum erianthum</i>	Scattered on floodplain.
Pumpkin	<i>Cucurbita maxima</i>	Embankment near day use area.
Red salvia	<i>Salvia coccinea</i>	Within rainforest in high light conditions and along embankment near day use area.

Common name	Scientific name	Comment / status in the reserve
Silver-leaf desmodium	<i>Desmodium uncinatum</i>	Scattered around day use area and in high light conditions within the forest.
Small-leaved privet	<i>Ligustrum sinense</i>	Widespread on floodplain.
Tall abutilon	<i>Abutilon grandifolium</i>	Colonizing clearer ground on floodplain.
Tomato	<i>Lycopersicon esculentum</i>	Scattered on floodplain.
Wandering jew	<i>Tradescantia fluminensis</i> #	Forms dense mats on the rainforest floor, blocking the process of secondary succession. Also occurs on floodplain.
White passionflower	<i>Passiflora subpeltata</i>	Climbing over young rainforest trees in area of high light.
Wild tobacco bush	<i>Solanum mauritianum</i>	Scattered throughout floodplain and rainforest.
Pest Animals		
Cane toad	<i>Bufo marinus</i> ~ >	Sightings recorded
Cat	<i>Felis catus</i> ~ > ^	Sightings recorded
Common mynah	<i>Acridotheres tristis</i>	Sightings recorded
Common starling	<i>Sturnus vulgaris</i>	Sightings recorded
House mouse	<i>Mus musculus</i>	Sightings recorded
House sparrow	<i>Passer domesticus</i>	Sightings recorded
Nutmeg mannikin	<i>Lonchura punctulata</i>	Sightings recorded
European red fox	<i>Vulpes vulpes</i> ~ > ^	Sightings recorded
Rock dove	<i>Columba livia</i>	Sightings recorded
Spotted turtle-dove	<i>Streptopelia chinensis</i>	Sightings recorded

* Declared Weed of National Significance

Declared "noxious" under the *Noxious Weed Act 1993*

~ Key threatening process under *TSC Act*

> Key threatening process under *Commonwealth Environment Protection and Biodiversity Act 1999*

^ Threat Abatement Plan endorsed for this species

~ Declared "pest" under the *Rural Lands Protection Act 1989*

Weeds

Several factors contribute to the high incidence of weeds in the reserve. The small, narrow shape of the reserve results in a high edge to area ratio, allowing increased wind and light penetration that eliminates many native rainforest species and enables weed species to establish (Winter *et al*, 1984 in Joseph, 1995). Canopy damage caused by the flying-fox colony increases light penetration into the rainforest core, aiding the spread of weed species. Furthermore, location on the floodplain exposes the reserve to periodic flooding that disperses weed propagules resulting in constant weed re-invasion (Joseph, 1995).

Lantana (*Lantana camara*) is declared a noxious weed in NSW and is listed as a Weed of National Significance. It is a vigorous invader of disturbed areas, often forming dense thickets, is spread mainly by birds, and thrives in warm environments with high rainfall. Distribution of lantana within the reserve is scattered, occurring along the reserve edges and in areas of high light. Its establishment and spread is considered a key threatening process (KTP) under the TSC Act. A draft national Plan to Protect Environmental Assets from Lantana has been developed which establishes national conservation priorities for the control of lantana. It identifies the research, management and other actions needed to ensure the long-term survival of native species and ecological communities affected by the invasion of lantana.

Other weed species such as madeira vine (*Anredera cordifolia*), balloon vine (*Cardiospermum grandiflorum*) and wandering jew (*Tradescantia fluminensis*), have been identified as having an impact on biological and landscape values of the reserve (see section 3.1, 3.2 and 3.3). The 'invasion and establishment of exotic vines and scramblers', another KTP listed under the TSC Act, is also occurring in the reserve. The EPBC Act lists the 'loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' as a KTP.

A systematic bush regeneration program is currently in place to control weed species in the reserve. Bi-monthly bush regeneration days focus on the control of noxious weeds in the rainforest core and along reserve edges.

Pest animals

KTPs identified under the TSC Act and the EPBC Act that are relevant to the management of pest animals in the reserve include the invasion and establishment of cane toads (*Bufo marinus*) and predation by feral cats (*Felis catus*) and European red fox (*Vulpes vulpes*). Threat abatement plans (TAPs) for cats and foxes have been endorsed under the EPBC Act and a draft cane toad TAP is currently under review (DECCW, 2010b; DSEWPC, 2010).

Cane toads were introduced to Queensland from South America in 1935 in an unsuccessful attempt to control cane beetles, a pest of the sugar cane industry. Cane toads are a major threat to native animals on the far north coast of NSW with their range now extending along the coast from the Queensland border to the Evans Head and inland to Casino, with isolated populations in the Clarence Valley.

The cane toad impacts on native species include predation of native invertebrates, competition with native wildlife for food and habitat and killing native predators by poisoning when they feed on cane toads. The biological effects, including lethal toxic ingestion, caused by cane toads is listed as a KTP under the EPBC Act. Invasion and establishment of the cane toad is also listed as a KTP under the TSC Act.

A Cane Toad Management Strategy (DECC 2008) has been prepared to guide the management and control of cane toads in Northern NSW parks. At present, the status of cane toads in the reserve is uncommon and the reserve is not listed as a priority for control.

Foxes suppress native animal populations, particularly medium sized ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Foxes have also been implicated in the spread of a number of weed species and are known to prey on domestic stock, including lambs and poultry.

Predation by the European red fox was declared a key threatening process in 1998 under the TSC Act. The NSW Fox Threat Abatement Plan (Fox TAP) was initiated in 2001 (and revised in 2010) with the primary objective of establishing long-term control programs to protect priority threatened fauna species and populations. Foxes are being controlled at priority sites across NSW to protect biodiversity. Currently the reserve is not a priority site for fox control. Native species most likely to be impacted by foxes in the reserve include the bush hen (*Amaurornis olivaceus*) and the long-nosed bandicoot but is not considered a major threat at present.

Introduced pathogens

Myrtle rust is a plant disease caused by the exotic fungus *Uredo rangelii*. It is known to affect plants in the Myrtaceae family and was first detected in Australia on the Central Coast of NSW in April 2010. Infection occurs on young, soft, actively growing leaves, shoot tips and young stems, resulting in shoot death. Early symptoms appear as small purple flecks and leaf spots on young leaves, which later develop into the characteristic bright yellow pustules (Gollnow, B. *et al*, 2010).

Myrtle rust is spread by the transport of spores by wind, water splash, insects and human activity. It can be spread in bushland by people moving infected plant material, dirty equipment including containers and tools, contaminated clothing and vehicles. Risk evaluation and appropriate planning of bushland works are advised and bushland workers and visitors should take reasonable measures to prevent the spread of myrtle rust between and within areas of bushland. Hygiene measures recommended before visiting each bushland site include washing vehicles inside and out, laundering of clothing including protective equipment, cleaning tools and equipment, appropriate disposal of plant waste and showering of personnel (Department of Industry and Investment, 2010).

Myrtle rust poses a significant threat to the biological values of the reserve. Genera of myrtaceae species that occur in the reserve include *Syzygium*, *Callistemon*, *Eucalyptus*, *Lophostemon*, *Melaleuca*, *Rhodamnia* and *Tristaniopsis*.

Desired outcomes

- Pest plants, animals and pathogens are controlled and where possible eliminated.
- Negative impacts of introduced plant, animal and pathogen species on reserve values are minimised.

Management response

- Implement relevant control programmes from the Northern Rivers Region Pest Management Strategy.
- Continue to implement the bush regeneration programme to control weed species in the reserve, including as far as possible bi-monthly bush regeneration days focusing on the control of noxious weeds in the rainforest core and reserve edge.
- Develop a pest plant and animal management plan for the reserve.
- Establish a monitoring programme to assess habitat health and the effectiveness of weed control strategies.
- Practice appropriate hygiene protocols during bush regeneration and general maintenance work to reduce the risk of myrtle rust infection.

4.2 Fire

The primary fire management objectives of the NPWS are to protect life and property and community assets from the adverse impacts of fire, whilst managing fire regimes to maintain and protect biodiversity and cultural heritage.

Fire is a natural feature of many environments and is essential for the survival of some plant communities. However, inappropriate fire regimes can lead to loss of particular plant and animal species and communities, and high frequency fires have been listed as a key threatening process under the TSC Act.

There are no recently recorded fire events within the reserve. While some fires may have occurred before record keeping commenced, the rainforest and semi-mesic forest occurring on the flat to gently undulating floodplain are an indication that the reserve is not significantly prone to bushfire events. However, the small and isolated nature of these communities, and particularly the rainforest community, increases their vulnerability to fire and the vulnerability of threatened species within the reserve. Built assets, including visitor facilities, located at the western edge of the reserve are not considered vulnerable due to the low bushfire potential.

A separate Type 1 fire management strategy has been prepared for the reserve (NPWS, 2006). The fire management strategy outlines the recent fire history of the reserve, key assets within and adjoining the reserve including sites of natural and cultural heritage value, fire management zones which may include asset protection zones, and fire control advantages such as management trails and water supply points. It also contains fire regime guidelines for conservation of the reserves vegetation communities. For the reserve this involves exclusion of fire from the rainforest communities.

NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service (RFS) and is actively involved with the Northern Rivers Bush Fire Management Committee (BFMC). Cooperative arrangements include fire planning, fuel management and information sharing. Hazard reduction programs, ecological burning proposals and fire trail works are submitted annually to the BFMC.

Desired outcomes

- Negative impacts of fire on life, property and the environment are minimised.
- The potential for spread of bushfires on, from, or into the park is minimised.
- Fire regimes are appropriate for conservation of native plant and animal communities.

Management response

- Implement the Reserve Fire Management Strategy.
- Continue to be involved in the Northern Rivers BFMC and maintain cooperative arrangements with local RFS brigades and other fire authorities and surrounding landowners in regard to fuel management and fire suppression.
- Maintain the existing management trail for fire (and pest) management purposes.

4.3 Fragmentation and isolation

The area surrounding the reserve has been extensively cleared, which has resulted in a high loss of biodiversity and fragmentation of habitat (Holmes, 1983; DECC, 2007). The reserve itself is relatively small and isolated and subject to edge effects making it more vulnerable to disturbances and incursion of introduced plant and animal species.

Cooperative arrangements with neighbours are important for the management of access, fire, weeds and pest animals. Additionally, long term conservation of biodiversity depends upon the protection, enhancement and connection of remaining habitat across the landscape, incorporating vegetation remnants on both public and private lands. There is approximately 10 hectares of vacant crown land adjacent to the reserve which is a potential suitable addition to the reserve (see Map).

Desired outcomes

- The negative impacts of isolation and fragmentation are reduced.
- The boundary of the reserve is consolidated as far as possible.

Management response

- Seek cooperative arrangements with nearby landholders regarding access, fire and pest species management.
- Survey and permanently mark the boundary of the reserves southern addition.
- Encourage protection and enhancement of native vegetation on public and private lands in the vicinity of the reserve.
- Investigate the inclusion of adjacent vacant crown land (VCL) into the reserve (refer also 3.5).

4.4 Climate change

Anthropogenic climate change has been listed as a key threatening process under the TSC Act. Projections of future changes in climate for NSW include higher temperatures, increasing sea levels and water temperatures, more intense but possibly reduced annual average rainfall, increased temperature extremes 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 and increased erosion.

Climate change may significantly affect biodiversity by changing population size and distribution of species, modifying species composition, and altering the geographical extent of habitats and ecosystems. The potential impact of climate change is difficult to assess since it depends on the

compounding effects of other pressures, particularly barriers to migration and pressure from feral animals. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates. For the reserve it is likely that the incidence of flooding will increase and this has implications for management of weed species which will continue to be reintroduced into the reserve through floodwaters.

Programs to reduce the pressures arising from other threats, such as habitat fragmentation, invasive species and bushfires will help reduce the severity of the effects of climate change.

Desired outcomes

- The effects of climate change on natural systems are reduced.

Management response

- Continue existing fire, pest and weed management programs to increase the reserve's ability to cope with future disturbances, including climate change (refer 4.1 Pest and 4.2 Fire).
- Pursue consolidation of reserve boundary and tenure through acquisition of vacant crown land where available.

5. Management Operations And Other Uses

5.1 Non-NPWS uses/operations

The southern section of the reserve was previously held under lease by a neighbour and an area of approximately 1.5 hectares has been partially cleared and cropped. It is not appropriate to issue a lease or licence for the encroaching use as it is not consistent with the management purposes and principles of nature reserves or the management directions for the reserve.

There is an unsealed access road (referred to as Little Trail) in the southern portion of the reserve that provides access for an adjacent landholder to leasehold crown land on the eastern side of the reserve and to the Richmond River (see map). This access road is not covered by a formal agreement and its use predates the gazettal of the reserve. It provides the only practical access to the leasehold land. The NPWS will seek to formalise use of the access road by the adjacent landholder in accordance with the NPW Act. If in the future the leasehold land becomes part of the NPWS estate then the private land holder access would no longer apply.

Issues

- Unauthorised use of part of the southern section the reserve for cropping has occurred since its gazettal in 1999.
- Landholder access to leasehold crown land adjacent to the Richmond River has been restricted by the gazettal of additions to the reserve.

Desired outcomes

- Discontinuation of non-NPWS uses of the southern section of the reserve and restoration of habitat values in degraded areas.
- Negotiation of an agreement that provides satisfactory access to the landholder without significant environmental impact and in accordance with the NPW Act.

Management response

- Undertake actions to restore the habitat values in the cleared southern section of the reserve including: removal of the unauthorised use; survey and fencing of the reserve boundary to prevent future incursions; and bush regeneration works. Removal of the unauthorised use will be in accordance with NPWS Policy, including “Private Encroachments Upon Reserved Land Policy” and the “Neighbour Relations Policy”.
- Seek to formalise private land holder access to crown land through the reserve through a licence under section 153C of the NPW Act and in accordance with the NPWS Property Management Manual and NPWS Policy on Access to Inholdings.

6. Implementation

This plan of management establishes a scheme of operations for the reserve. Implementation of this plan will be undertaken within the annual program of the NPWS Northern Rivers Region.

Identified activities for implementation are listed in Table 3. Relative priorities are allocated against each activity as follows:

- **High** priority activities are those 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.
- **Ongoing** is for activities that are undertaken on an annual basis or statements of management intent that will direct the management response if an issue that arises.

This plan of management does not have a specific term and will stay in force until amended or replaced in accordance with the NPW Act.

Table 4: Actions

Management response	Priority*
6.1 On-Park Ecological Conservation	Plan ref: 3.1/3.2/3.3/4.1/4.2/4.3/4.4/5.1
6.1.1 Improve the integrity of the riverine landscape by restoring vegetation communities and implementing bush regeneration programmes to control weed species (refer Pests).	High
6.1.2 Improve habitat values of the reserve through appropriate fire and pest management and increasing habitat connectivity.	High
6.1.3 Restore vegetation communities through replanting in disturbed areas and the implementation of the bush regeneration program to control weed species in the reserve (refer 4.1 Pests).	High
6.1.4 Seek cooperative arrangements with nearby landholders regarding access, fire and pest species management.	Ongoing
6.1.5 Encourage protection and enhancement of native vegetation on public and private lands in the vicinity of the reserve.	Medium
6.1.6 Continue existing fire and pest management programmes to manage key threatening processes and increase the reserves ability to cope with future disturbances, including climate change.	High
6.1.7 Undertake actions to restore the habitat values in the cleared southern section of the reserve including: removal of the unauthorised use; survey and fencing of the reserve boundary to prevent future incursions; and bush regeneration works. Removal of the unauthorised use will be in accordance with NPWS Policy, including "Private Encroachments Upon Reserved Land Policy" and the "Neighbour Relations Policy".	High
6.2 Threatened Species	Plan ref: 3.2/3.3/3.5
6.2.1 Implement relevant strategies and actions in the PAS and recovery plans to conserve and recover threatened species and ecological communities.	High
6.2.2 Minimise visitor disturbance to roosting flying-foxes (refer Visitor Infrastructure).	Medium
6.2.3 Schedule NPWS management activities near the flying-fox colony to avoid disturbing roosting flying-foxes between spring and autumn.	High

6.3 Aboriginal Cultural Heritage	Plan ref: 3.4
6.3.1 Continue to consult with the Githabul community about management of the reserve.	Ongoing
6.4 Visitor Infrastructure	Plan ref: 3.5
6.4.1 Provide signage in the day use area that promotes appropriate visitor behaviour to minimise the impact on the flying-fox colony.	Medium
6.4.2 Close the Moore Park Management Track to public access to reduce disturbance to the flying-fox colony and manage as a management track for bush regeneration / pest management purposes.	Medium
6.4.3 The provision of visitor facilities will be scaled back, including the removal of two picnic tables and two barbecues.	Medium
6.5 Weeds and Pest Animals	Plan ref:
4.1	
6.5.1 Implement relevant control programmes from the Northern Rivers Region Pest Management Strategy.	High
6.5.2 Subject to Regional priorities, continue to implement the bush regeneration programme to control weed species in the reserve including bi-monthly bush regeneration days focusing on the control of noxious weeds in the rainforest core and reserve edge.	High
6.5.3 Develop a pest management plan for the reserve.	Low
6.5.4 Establish a monitoring programme to assess habitat health and the effectiveness of weed control strategies.	Medium
6.5.5 Practice appropriate hygiene protocols during bush regeneration and general maintenance work to reduce the risk of myrtle rust infection.	Ongoing
6.6 Fire Management	Plan ref: 4.2
6.6.1 Implement the Reserve Fire Management Strategy.	High
6.6.2 Continue to be involved in the Northern Rivers BFMC and maintain cooperative arrangements with local RFS brigades and other fire authorities and surrounding landowners in regard to fuel management and fire suppression.	Ongoing
6.7 General Infrastructure And Maintenance	Plan ref: 3.5/6.6
6.7.1 Reduce the mown section of the day use area by approximately 30% to reduce maintenance and increase the area of native vegetation.	Medium
6.7.2 Maintain existing management trail for fire and pest management purposes.	High
6.8 Assessments, Acquisition And Establishment	Plan ref: 4.3/5.1
6.8.1 Investigate the inclusion of adjacent vacant crown land (VCL) into the reserve.	Medium
6.8.2 Seek to formalise private land holder access through the reserve through a licence under section 153C of the NPW Act and in accordance with the NPWS Property Management Manual and NPWS Policy on Access to Inholdings.	Medium

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