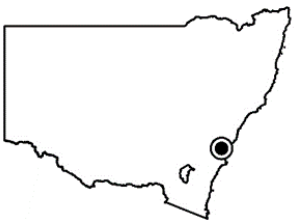
NSW NATIONAL PARKS & WILDLIFE SERVICE

Upper Nepean State Conservation Area

Plan of Management



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Acknowledgements: National Parks and Wildlife Service (NPWS) acknowledges that Upper Nepean State Conservation Area is in the traditional Country of the Dharawal Aboriginal People.

NPWS acknowledges Water NSW's contribution to the first plan for the park. Information and other data were kindly provided by Water NSW during and following the transfer of lands to NPWS.

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Environment, Energy and Science
Department of Planning, Industry and Environment
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
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Contents

List of tables

List of figures

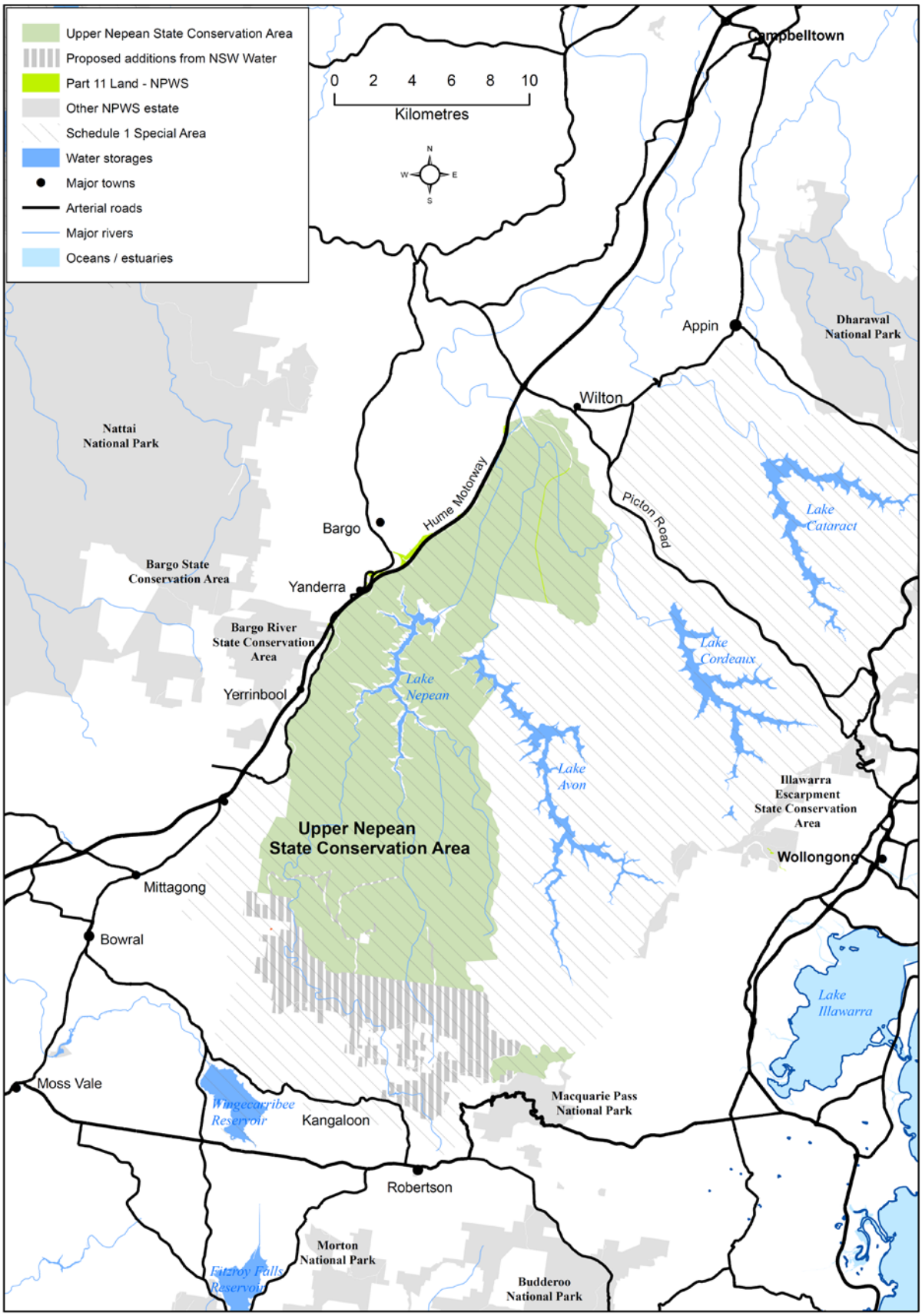

Figure 1 Location map

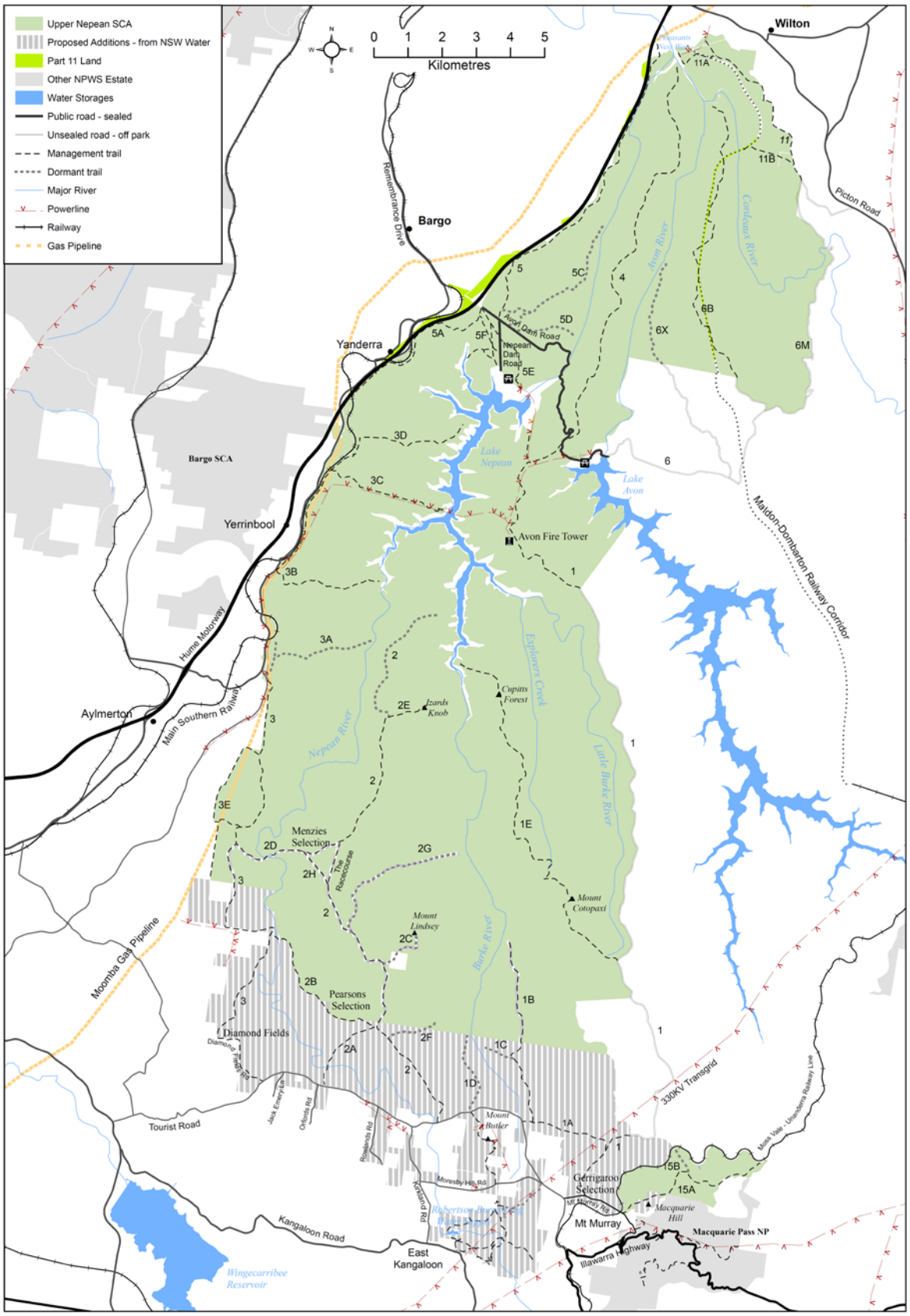

Figure 2 **Upper Nepean State Conservation Area and proposed additions**

1. Introduction

1.1 Location, reservation and regional setting

Features	Description
Upper Nepean State Conservation Area	
Location	Upper Nepean State Conservation Area is located approximately 20 kilometres west of Wollongong, between Wilton in the north, Mittagong in the west and Robertson in the south (see Figure 1), in the upper catchment of the Nepean River.
Area	Currently, it is 25,134 hectares, in two sections as shown in Figure 1. This plan of management also covers extensive areas of land proposed for addition to Upper Nepean State Conservation Area (see Figure 2), including: • approximately 5000 hectares, currently held by WaterNSW, at the southern end of the park • several parcels of unreserved lands west of the Hume Motorway that are vested in the Minister administering the *National Parks and Wildlife Act 1974* for the purposes of Part 11 of that Act. These lands acquired from WaterNSW are not yet reserved as part of the park. Those with substantial conservation values and/or those required for park management or emergency services purposes may be reserved as part of the park; those without will be considered for sale or transfer of ownership. The southern part of the corridor of the partially constructed Maldon–Dombarton Railway Line is also currently Part 11 land (see Figure 2). Reservation of these lands under the National Parks and Wildlife Act would make Upper Nepean State Conservation Area a single contiguous area of approximately 30,300 hectares. The existing state conservation area, the Part 11 lands and WaterNSW lands identified as proposed additions (see Figure 1) to the state conservation area are collectively referred to as 'the park' in this plan of management. The park's extent was determined largely by the requirement to exclude key water supply infrastructure and existing coalmining developments. It excludes Lake Nepean and Nepean Dam, which have been retained by WaterNSW up to the full supply level plus five metres, together with associated infrastructure. It also excludes the northern part of the Maldon–Dombarton Railway corridor.
Reservation date	28 February 2007, with a further 632 hectares between Nepean and Avon dams reserved on 15 August 2008.
Previous tenure	The park is part of the Metropolitan Special Area, initially proclaimed in 1880 under the *Metropolitan Water and Sewerage Act 1880* to protect the land of the Upper Nepean catchment. The metropolitan catchment area is now a declared 'special area' under the *Water NSW Act 2014* (and will be referred to as the Metropolitan Special Area in this plan). It was formerly administered by Sydney Water Board, before Sydney Catchment Authority was formed in 1999 to manage and protect Sydney's catchment areas. WaterNSW, established in 2014, now undertakes the catchment management roles formerly undertaken by Sydney Catchment Authority. WaterNSW retains a joint management role with NPWS for the park.
Regional context	
Biogeographic region	The park is located within the Cataract, Cumberland, Moss Vale and Burragorang subregions of the Sydney Basin Bioregion. To the east of the park are extensive areas of naturally vegetated land managed by WaterNSW as the remainder of the Metropolitan Special Area (see Figure 1). The park also abuts Macquarie Pass National Park at its south-east corner, along the edge of the Illawarra Escarpment. At a broader scale, the park and other parts of the Metropolitan Special Area contribute to a chain of reserves that protects conservation values in the rugged

Features	Description
	coastal hinterland between the Hunter Valley and the Victorian border. The park and the remainder of the Metropolitan Special Area, therefore, perform an important role in linking parks such as Macquarie Pass, Budderoo and Morton national parks to the south with Bargo River State Conservation Area, Bargo State Conservation Area, Nattai National Park and the rest of the Greater Blue Mountains Area World Heritage site to the north-west. The park is also linked to Heathcote and Royal national parks in the north-east via the Metropolitan and Woronora special areas, Illawarra Escarpment State Conservation Area, Dharawal National Park and Dharawal Nature Reserve.
Surrounding land use	Along its western edge, the park is bordered by the Hume Motorway and the villages of Bargo, Yanderra and Yerrinbool. To the north is Picton Road and the village of Wilton, and to the south is Robertson. Rural residential development and grazing occur on the fringes of these settlements. A substantial residential development is planned to immediately adjoin the north-eastern boundary of the park. There are also areas of Crown land within and adjacent to the park. Rich volcanic soils around Kangaloon and Robertson to the south of the park have a long history of agriculture, and little native vegetation remains outside the park boundary in this part of the catchment.
Other authorities	The majority of the park is in the Wingecarribee Local Government Area (LGA). The portion north of Nepean Dam is in Wollondilly LGA, and a fragment of the south-east corner is in Wollongong LGA. The park is within the areas of the Illawarra and Tharawal local Aboriginal land councils and falls within the areas of South East Local Land Services and Greater Sydney Local Land Services. WaterNSW has ongoing roles related to catchment protection and water supply, including access control and infrastructure maintenance.

Name of the park

Under the *Park Names Policy* (DPIE 2018), naming of parks will be used to recognise and acknowledge natural values and cultural connections to places. Parks will usually be named after prominent natural features and the local Aboriginal name of the feature is preferred. Upper Nepean State Conservation Area is within freshwater Dharawal Country, and consultation with Aboriginal people to date has led to the following suggestions for the name of the park:

- **Illillawatta** – this is a word from the Tharawal language used by the Dharawal people. A traditional owner of the park lands has advised that *illillawatta* is a long-standing traditional name for the land now covered by the water catchments.
- **Kurrilwa** – the word for ‘koala’ in the Tharawal language, first transcribed by RH Mathews, an early ethnographer, in 1902. There is evidence to suggest that Europeans may have first sighted koalas in the Bargo area. Today, Upper Nepean State Conservation Area and adjoining natural areas support one of the largest remaining koala populations in the Sydney Basin.

1.2 Statement of significance

The park protects an area that is regionally and nationally significant for its biodiversity, landscape and water catchment values. The Metropolitan Special Area, together with adjoining lands, forms a large parcel of contiguous bushland that has been protected for over a century. This long-term protection has helped maintain significant biodiversity and Aboriginal cultural heritage values in a relatively undisturbed state and allowed collection of high-quality water.

Natural values

- The park has diverse vegetation, with 34 separate communities including seven threatened ecological communities.
- The park supports a significant population of koalas (*Phascolarctos cinereus*) and populations of another 32 threatened terrestrial native animal species and nine threatened plant species.
- A series of upland swamps occurs across the southern end of the park.

Drinking water catchment values

- The park contributes high quality raw water to the drinking water supply for Greater Sydney, the Illawarra and Wollondilly Shire.
- The area provides a long-standing example of an integrated catchment management and water supply regime.

Landscape values

- The park forms part of the Woronora Plateau, listed as a Landscape Conservation Area by the National Trust of Australia in recognition of its significant natural heritage values, and is part of an important link to other protected areas, including the World Heritage-listed Greater Blue Mountains.
- The undisturbed landscape is of regional and state significance in terms of its size, proximity to major urban populations, historical tenure over 130 years as part of the metropolitan catchment area and relative absence of damaging land uses.
- The park's diverse topography and landscape features, including river gorges, exposed scarps, closed valleys and forests, clearly display the geomorphological and ecological processes taking place.

Shared heritage values

- The region is of significance to freshwater Dharawal (or Tharawal) People and inland Gundungurra Aboriginal People, providing a physical and cultural link between them.
- The park's undisturbed landscape protects a rich and diverse sample of Aboriginal cultural heritage.
- The park adjoins important State Heritage-listed examples of dam building and associated water infrastructure dating from the late 19th and early 20th century, at Pheasants Nest Weir, Nepean Dam and Avon Dam.
- The park has numerous potential archaeological and historical sites, associated with dam building, former agricultural use, mining and other activities.

2. Management context

2.1 Legislative and policy framework

The management of state conservation areas in New South Wales is in the context of the legislative and policy framework of NPWS; primarily the National Parks and Wildlife Act, the National Parks and Wildlife Regulation, the *Biodiversity Conservation Act 2016* and NPWS policies.

Other legislation may also apply to the management of state conservation areas. In particular, the NSW *Heritage Act 1977* may apply to excavation in known archaeological sites or in sites with potential to contain historical archaeological relics. The *Environmental Planning and Assessment*

Act 1979 may require the assessment and mitigation of the environmental impacts of any works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* may apply in relation to actions that impact on matters of national environmental significance, such as threatened communities or species listed under that Act.

Catchment special area

As part of a catchment special area, Upper Nepean State Conservation Area is also subject to additional legislation and policy, including the Water NSW Act and Regulation. The Water NSW Act empowers WaterNSW to enter the park and carry out catchment infrastructure works. The Water NSW Act and Regulation also contain specific controls to protect stored drinking water quality, including the exclusion of general public access.

The Minister for Energy and Environment is empowered under s.153B of the NPW Act to issue easements, leases or licences to enable water and power authorities to exercise their functions within a park that is part of a catchment special area. This power does not extend to the impoundment of water, permanent inundation or the construction of flood mitigation structures.

The NSW Government's *2017 Metropolitan Water Plan* (Metropolitan Water 2017) outlines measures to ensure that Sydney, the Illawarra and the Blue Mountains have enough water now and for the future. The plan includes measures to be implemented in extreme drought to slow the depletion of the dams adjacent to the park. As identified in Section 5.1, several of these proposals involve works in the park. All development for water supply purposes within the park require an environmental impact assessment and, for lands that are reserved or already acquired under the National Park and Wildlife Act, authorisation under that Act.

WaterNSW has a concurrence role in relation to certain activities carried out or proposed to be carried out within the park, including the granting of any lease, licence, easement or right of way under the National Parks and Wildlife Act. The Water NSW Regulation authorises WaterNSW to issue penalty infringement notices and undertake prosecutions in the park in relation to activities that affect or may affect water quality.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 requires that a public authority must, before it carries out or consents to any activity in the catchment, consider whether the activity would have a neutral or beneficial effect on water quality.

Plans of management

A plan of management is a statutory document under the National Parks and Wildlife Act. Once the Minister has adopted a plan, the plan must be carried out and only those operations that are in accordance with the plan may be undertaken within the park. This plan will also apply to any future additions to Upper Nepean State Conservation Area or to the same park under a new name. Should management strategies or works be proposed in future that are not consistent with the plan, an amendment to the plan will be required.

The matters to be considered in the preparation of a plan of management are listed in section 72AA of the National Parks and Wildlife Act. These have been considered in the preparation of this plan, together with the regulations and controls under water catchment legislation and NPWS policies related to nature conservation, cultural heritage conservation, fire management, research and communication.

This plan of management recognises that WaterNSW retains a statutory and operational role in the park. All activities, operations and works undertaken by WaterNSW in accordance with its statutory responsibilities for water quality protection and drinking water supply will remain unaffected by this plan. Section 153B of the NPW Act requires that in special catchment areas the plan of management describes and locates activities and infrastructure that require a license, lease, easement or right of way.

The park is subject to the *Special Areas Strategic Plan of Management* (Water NSW & OEH 2015), which covers all special areas declared under the Water NSW Act. It was prepared by WaterNSW

and NPWS as joint sponsors under section 52 of the Water NSW Act. A service level agreement articulates the mutual and shared responsibilities of the two agencies across jointly managed special areas.

This plan of management applies to any future land acquired and added to Upper Nepean State Conservation Area, noting the significant areas proposed for transfer from WaterNSW, and any proximate Part 11 lands (see Figure 2).

2.2 Management purposes and principles

State conservation areas

State conservation areas are reserved under the National Parks and Wildlife Act to protect and conserve areas that:

- contain significant or representative ecosystems, landforms or natural phenomena or places of cultural significance
- are capable of providing opportunities for sustainable visitor or tourist use and enjoyment, the sustainable use of buildings and structures, or research
- are capable of providing opportunities for uses permitted under other provisions of the National Parks and Wildlife Act.

Under the National Parks and Wildlife Act (section 30G), state conservation areas are managed to:

- conserve biodiversity, maintain ecosystem functions, protect natural phenomena and maintain natural landscapes
- conserve places, objects and features of cultural value
- provide for the undertaking of uses permitted under other provisions of the National Parks and Wildlife Act (including uses permitted under section 47J such as mineral exploration and mining), having regard to the conservation of the natural and cultural values of the state conservation area
- provide for sustainable visitor or tourist use and enjoyment that is compatible with conservation of the area's natural and cultural values and with uses permitted in the area
- provide for sustainable use (including adaptive re-use) of any buildings or structures or modified natural areas having regard to conservation of the area's natural and cultural values and with other uses permitted in the area
- provide for appropriate research and monitoring.

Land is reserved as a state conservation area primarily where mineral values do not allow for reservation as another category. The National Parks and Wildlife Act requires a review of the classification of state conservation areas every five years in consultation with the Minister administering the *Mining Act 1992*. The review considers whether each state conservation area should or should not be reserved as either a national park or nature reserve. Reviews of Upper Nepean State Conservation Area were undertaken in 2008 and 2013 without any change in classification of the park.

Catchment special area

In addition to functions under the National Parks and Wildlife Act, the Upper Nepean State Conservation Area has the added purpose of protecting water quality in the Nepean Dam and Pheasants Nest Weir catchments and in part of the Avon Dam catchment.

The *Special Areas Strategic Plan of Management* (SASPOM) sets out principles and objectives for management of catchment special areas in New South Wales, which take into account the complementary purposes of protecting water quality and conserving natural and cultural heritage values. It also outlines processes for WaterNSW and NPWS to jointly develop management priorities and works programs to achieve the objectives.

This park plan of management is consistent with the objectives of the SASPOM. Its management responses will assist in implementing the SASPOM along with the requirements of the National Parks and Wildlife Act.

State heritage

Several structures associated with historic water supply infrastructure in or adjacent to the park are listed on the State Heritage Register. NPWS policy requires that all items listed on the State Heritage Register have a conservation management plan and be maintained in accordance with best practice management principles. Actions other than those conforming to the site-specific or standard exemptions made under section 57(2) of the Heritage Act trigger the need for additional statutory approvals under that Act.

2.3 Specific management directions

The park will be managed for the joint purposes of conservation and water quality protection. Uses and activities not aimed at conservation of natural and cultural values or protecting the catchment and its water quality will be discouraged, and recreational activities will generally not be permitted. Management of the park will build on the approach applied to the Metropolitan Special Area over the past 130 years.

In addition to the general principles set out in Section 2.2 of this plan, the following specific management directions will be applied:

- maintain the high-water quality and yield of waterways within the park, consistent with water quality and environmental flow objectives
- maintain a regime of restricted access to the park
- seek to ensure that the adverse impacts of adjoining land uses, and alien uses within the park, are minimised
- integrate the management of the park with the management of the remainder of the Metropolitan Special Area.

WaterNSW will continue to be responsible for perimeter fencing and access control, and for the installation and operation of drinking water infrastructure within the park. NPWS will undertake management operations for natural and cultural heritage and catchment protection, including pest control, fire management, erosion control and specific programs for threatened species.

3. Values

To make this plan clear and easy to use, various aspects of natural heritage, cultural heritage, threats and ongoing use are dealt with individually, but their interrelationships are recognised.

3.1 Geodiversity

Geodiversity is the natural diversity of rocks, minerals, fossils, soils and landforms, and the processes that have shaped these features over time.

The park is located on the Woronora Plateau. This broad physiographic region lies to the east and south of the Cumberland Plain and forms part of the Sydney Basin. The Woronora Plateau is listed as a Landscape Conservation Area by the National Trust of Australia in recognition of its significant natural heritage values.

The Woronora Plateau is dominated by Triassic Hawkesbury sandstone, with the underlying Narrabeen Group (sandstone, siltstone and shale) exposed in the river gorges (Hazelton & Tille 1990). In places, the Hawkesbury sandstone is overlain by thin lenses of Wianamatta Group shales. Wianamatta shale covers the majority of the southern end of the park, in the vicinity of Tourist Road. There are Tertiary volcanic necks of basalt at Cupitts Forest and Izards Knob, an area of volcanic trachyte at Mount Cotopaxi, and small areas of Robertson basalt at Macquarie Hill and Mount Butler.

The Illawarra Coal Measures is a group of sedimentary rocks up to 150 metres thick occurring in the Sydney Basin. While no coalmining has occurred within the park to date, leases for coalmining and licences for coal and petroleum exploration have been granted over the park (see Section 5.2).

The park's diverse topography and landscape features, including river gorges, exposed scarps and closed valleys, clearly display the geomorphological processes taking place. The general landform follows the geological feature known as the Nepean Ramp. This refers to the gentle slope aligned on a south-east to north-west axis that caused the area's rivers to flow away from the Illawarra Escarpment and incise the gorges that were dammed to provide a water supply for Sydney (Fuller & Badens 1980).

The majority of the park consists of broad, flat ridges incised by deep gorges along the Nepean, Avon, Cordeaux, Burke and Little Burke rivers and their tributaries (see Figure 2). The gorges meet at the northern end of the park. The ridges have scattered rock outcrops and the above volcanic features.

Areas of upland swamp occur at the southern end of the park, north of Tourist Road. They have formed following the accumulation of coarse sandy substrate and heavy organic material in shallow depressions (NPWS 2003). As well has having important habitat value, these swamps play an important role in maintaining a more regular flow in the park's streams, by capturing and storing water and then slowly releasing it.

The upper reaches of the catchment, south of Tourist Road, is an undulating landscape of low hills and valleys with narrow streams.

The elevation of the park varies from the highest points of 720 metres above sea level at Mount Butler and 740 metres at Macquarie Hill in the south of the park, to approximately 130 metres above sea level at Pheasants Nest Weir in the north. The variation in elevation affects temperatures and vegetation type. The park generally experiences high rainfall, which is important to the water supply in Nepean Dam. Annual rainfall ranges from 1600 to 800 millimetres, decreasing with distance from the coast along a distinct gradient from the south-east to north-west.

Soils

Soils derived from Hawkesbury sandstone cover the majority of the park. These soils are typically thin, acidic and sandy. They are highly susceptible to erosion if disturbed and have low fertility.

This infertility is the main reason why the area remained largely uncleared by early settlers (Mills et al. 1985).

Soils formed on shale and basalt are more fertile. This has led to the past clearing of several locations in the park for agriculture (see Sections 3.3 and 3.5). These more fertile soils often support threatened vegetation communities as they have been extensively cleared outside protected areas. They are susceptible to sheet erosion and mass movement on steep slopes.

Issues

- The volcanic features, swamps and gorges are important landscape features that contribute to geodiversity.
- The areas of shale and basalt support rare vegetation communities (see Section 3.3) and should be protected from disturbance.
- Most of the park's soils are highly erodible if disturbed. This can affect water quality (see Section 3.2) and other park values. Soil susceptibility to erosion should be considered before maintaining or installing infrastructure.
- There are a large number of small borrow pits located alongside park trails. These were formerly used to provide gravel for trail construction but are now regenerating.
- Cleared former agricultural or forestry areas (see Section 3.3) generally have good ground cover and most are unlikely to be subject to erosion.
- Any future mining operations or gas extraction beneath the park could damage water courses and upland swamps, with consequent impacts on water supply and quality, plant and animal communities, and cultural sites (see Section 5.2).

Desired outcomes

- The park's landscapes and scenic qualities are protected and maintained.
- Volcanic features and upland swamps are protected.
- Soil erosion hazards are managed as far as possible to ensure soil conservation and to minimise sediment entering rivers and water storages (see also Section 3.2).

Management response

3.1.1 Minimise disturbance of significant landforms, particularly the volcanic features, upland swamps and gorges, in order to protect geodiversity and the park's natural landscapes.

3.1.2 As far as practicable, avoid earthworks in areas and soils identified as having very high erosion hazards. Apply appropriate erosion and sediment controls for all works, including maintenance activities. Revegetate disturbed areas where appropriate.

3.1.3 Confine any new infrastructure to previously disturbed sites wherever possible.

3.2 Water supply and water quality

The park covers most of the Nepean Dam catchment and a small part of the Avon Dam catchment. It also includes the majority of the Nepean and Avon river corridors downstream from the dams to the junction of these two rivers, and part of the Cordeaux River corridor downstream of the Cordeaux Dam. These rivers drain to Pheasants Nest Weir on the Nepean River, another point in the Upper Nepean water supply system from which drinking water is collected, and thence to the lower Nepean and the Hawkesbury River (see Figures 1 and 2).

Drinking water supply and environmental flows

The Upper Nepean system is an important part of the drinking water supply for metropolitan Sydney and the sole source of supply to the Picton–Bargo area, Macarthur area and the Illawarra region. This plan of management enables suitable and appropriate water projects to support these requirements within the State Conservation Area.

Nepean Dam has the largest catchment of the reservoirs in the Upper Nepean system but the smallest storage capacity. The water in Nepean Dam is therefore used to top up Avon Dam via an interconnecting tunnel, approximately two kilometres in length.

Natural ecosystems are adapted to variable river flows from very low flows to floods. Dams change downstream flow patterns and consequently affect water quality, temperature, sediment movement, plants and animals. WaterNSW releases environmental flows, seeking to maintain variable flows while at the same time providing for water supply.

A licensing package, including the water licences and approvals for four water sources, including the Nepean River, was issued to WaterNSW under the *Water Management Act 2000* in 2012. The water licences and approvals contained in the licensing package define the authority's water access rights and obligations including releases for environmental and other purposes and monitoring and reporting requirements in accordance with the provisions of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* (NSW Government 2011).

Environmental releases are delivered from the Nepean storages with the aim of mimicking natural flows and to assist in maintaining ecological processes and water-dependent ecosystems. Daily variable flows for environmental purposes were introduced in July 2010. In 2014–15, approximately 21,210 ML (megalitres or 1 million litres) were discharged as environmental flows from Nepean Dam. The releases ranged from a minimum of 0 ML per day up to 578 ML per day in April 2015. The average release over the 12 months was 58 ML per day (Water NSW 2015).

Water releases must be carefully controlled to avoid adverse impacts on the ecology of the Nepean River valley downstream of the dam, which provides habitat for platypus (*Ornithorhynchus anatinus*) and other species that require relatively slow-flowing conditions for part of their life cycle. The timing and rate of releases are subject to operating and environmental criteria that take into account the demand for water, balancing flows between the various component parts of the supply system to meet water and energy efficiencies, and constraints such as limited channel capacities.

During times of drought, the Nepean River can also be used for water transfers from the Shoalhaven water supply system to the south. The transfer operations have had both adverse and positive effects on water quality. WaterNSW is considering options for construction of a pipeline or tunnel for water transfer between Fitzroy Falls Reservoir and Lake Avon to reduce the use of rivers to transfer water between dams, which will help to restore natural flows to creeks and streams, and reduce their exposure to flooding and erosion.

To protect against drought, WaterNSW is also developing two other projects for implementation at a suitable time in the future. They aim to supplement river flows with groundwater, extracted from a borefield in the proposed park addition at Kangaloon and access deep water from Lake Avon.

The deep-water project involves constructing a pumping station at Lake Avon, a pipeline to the Illawarra Water Filtration Plant and electricity supply upgrades. Accessing this deep water will extend the available water supply by up to two years for the Illawarra region and will significantly increase long term yield.

Groundwater extraction

The *Metropolitan Water Plan 2017* outlines the mixture of measures to ensure that Sydney, the Illawarra and the Blue Mountains have enough water now and for the future. The plan includes measures to be implemented in extreme drought to slow the depletion of dams. In response to this plan WaterNSW may in the future develop a groundwater extraction borefield in the proposed addition to the park at Kangaloon. The borefield would include a system of pipelines and

associated pumping stations, water treatment facilities and powerlines. Treated water would be discharged into the Nepean River system upstream of Lake Nepean (see Section 5.1).

Water quality

High water quality is important for both drinking water supply and biodiversity. The special areas around Sydney's drinking water storages are critical to protect water quality. The 1998 Sydney Water Inquiry, held after pathogens were discovered in the water supply, found that protecting the catchment was the best long-term safeguard for Sydney's drinking water, and identified the need for a comprehensive approach to catchment management (McClennan 1998).

The water quality of the Upper Nepean supply system is influenced by:

- the geology and shallow soils of the Woronora Plateau, which contribute to elevated levels of aluminium
- the integrity of native vegetation cover in the catchment, which influences sediment inflow
- bushfires, which may initiate the release of additional nutrients and sediment from the surrounding catchment, particularly after rainfall
- land uses in the catchment, including rural residential and agricultural use, which may contribute nutrients and other pollutants
- runoff from rural residential properties and cleared land, including faecal matter from cattle grazing in the privately-owned lands at Kangaloon, Mount Murray and north of Robertson, which affects water quality and contributes to turbidity in the storages
- floodwaters, which can introduce high turbidity and sediment-laden water into the water storages or water supply system
- algal blooms that can occur in summer and autumn due to increased nutrient levels in the water column
- the narrow, deep-sided gorges that form the walls of the reservoirs, which create thermal stratification, and may result in cooling and deoxygenation of the water stored at depth.

Water quality is also influenced by water transfers from the Shoalhaven system and pumping of deep water from Lake Nepean.

Water quality monitoring is undertaken by WaterNSW for inflow streams, water storages and water filtration plants across the Greater Sydney water supply system. The results are publicly available and used to inform management. Annual water quality monitoring reports indicate generally good environmental quality, but there have been some occasions when the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000) have been exceeded (SCA 2013).

The operation of de-stratifiers in the storages, and selection of water from different reservoirs in the system and different levels in the storages all assist in maintaining a high level of raw water quality. Subsequent processes undertaken at filtration plants are able to correct water quality exceedances and ensure a high-quality supply. Maintenance of vegetation cover and the application of other protective measures in the park and the remainder of the special area are the key to preventing adverse impacts on water quality.

On-ground practices contributing to water quality throughout the catchment that should be maintained in the park include:

- perimeter fencing and access control by WaterNSW (see Section 5.1)
- prevention and mitigation of any soil erosion and sediment build up in streams, particularly during development of new infrastructure (see Section 3.1)
- avoidance and containment of any chemical spills
- control of pests and weeds (see Section 4.1)
- fire management (see Section 4.2).

As stated in Section 3.1, former borrow pits and formerly cleared areas are regenerating naturally or have good ground cover and are unlikely to be contributing significant sediment loads.

Unsealed roads and road shoulders are a source of sediment and contaminants that can adversely impact water quality. Management trails north of Tourist Road are fitted with concrete causeways and culverts where they cross rivers. A causeway has recently been installed on the Nepean River crossing at East Kangaloon, east of Robertson Burrawang Water Supply. Some unsealed roads in the south of the park require work to further reduce the risk of sediment transport.

The ongoing restrictions on authorised vehicular access to these unsealed roads during and after rainfall events also limits their erosion and sedimentation potential.

Land use on private land outside the park can adversely impact water quality through contributing nutrients, sediment and pesticides. WaterNSW works in cooperation with private landholders to address water quality through improvements such as excluding stock from streams, reinstating protective riparian vegetation, bank stabilisation and weed control. There may also be scope through initiatives developed by Greater Sydney Local Land Services and South East Local Land Services to address existing land uses that affect water quality in the park.

Issues

- Fires, vegetation disturbance and management operations, including the use and maintenance of management trails, can affect water quality.
- While necessary to support communities with water supply, water transfers can affect habitat values for aquatic species by altering temperature, river height and flow rate.
- Any future mining operations could affect water quality and yield.

Desired outcomes

- Water flow in park streams and groundwater sources sustain natural systems and habitats, including water-dependent ecosystems.
- Water quality for drinking water supply and ecological purposes is protected, monitored and maintained or improved over time.
- WaterNSW and Sydney Water Corporation operations maintain the ecological integrity of the catchment while providing safe drinking water for their customers.

Management response

3.2.1 Ensure management operations are planned and undertaken to avoid adverse impacts on water quality using best practice and up-to-date knowledge, including the results of WaterNSW water quality monitoring. Include in any environmental assessment for an activity in the park an assessment of whether it will have a neutral or beneficial effect on water quality and water-dependent ecosystems.

3.2.2 Maintain and, where necessary, upgrade drains, causeways and culverts on management trails.

3.2.3 Continue to adhere to the WaterNSW access policy and protocol that restricts vehicular access for authorised stakeholders during and immediately following threshold rainfall events.

3.2.4 In conjunction with WaterNSW, encourage neighbouring landowners to participate in programs like the Healthy Catchments Program to help protect water quality.

3.2.5 Participate in the development of water sharing plans or other initiatives as appropriate, to ensure the needs of water-dependent ecosystems are adequately protected through environmental flow regimes.

3.3 Native plants

As a result of protection to maintain water quality in the Upper Nepean storages, much of the park has intact native vegetation cover. Variations in geology, topography and climate have created a rich and diverse vegetation assemblage.

Bioregional assessments (NPWS 2002, 2003) identified 34 vegetation communities in the park, in eight broad structural groups (Table 1). A complete list of vegetation communities and their extent can be found at Appendix A.

Table 1 Vegetation structural groups

Structural group (greatest to lowest extent)	Location
Exposed sandstone woodlands and heath	Widespread across majority of park on sandstone plateaus
Sandstone gully forests	Common on lower slopes and along creeks on sandstone plateaus
Tall open grassy forest	Moist soils along central Nepean Gorge and southern end of the park
Shale sandstone transition forest	Northern and western edges of the park
Upland swamp complex	Mostly scattered across plateaus in the southern third of the park
Elevated Mittagong sandstone woodland –heath	Small areas in the south-west corner of the park
Sandy scrubs	Main rivers and a small number of poorly drained sites
Rainforests and moist eucalypt forest	Sheltered gullies and fertile soils in the southern end of the park

Sandstone-derived communities dominate the park's vegetation, consistent with the underlying geology. The species assemblages show distinctive patterns, in response to gradual changes in rainfall and elevation, as well as underlying geological changes (NPWS 2003). Where shale and basalt occur, rarer vegetation communities have developed.

Tall open grassy forests represent a significant proportion of vegetation in the park (11%), occurring on shale-derived soils in the west and south where the higher elevation results in cooler temperatures (NPWS 2003). The park also contains small rainforest remnants in the south-east, reflecting the higher rainfall and the increased availability of soil nutrients in this part of the park.

Upland swamps are a distinctive feature of sandstone plateaus and are extensive on the Woronora Plateau. They occur primarily in the higher rainfall band of the park towards the south-east, on periodically waterlogged soils associated with quaternary alluvial deposits and humic matter (Hazelton & Tille 1990; Hazelton 1992). In addition to their botanical interest and habitat values, these vegetation communities are important in maintaining stream flow and filtering runoff from other parts of the catchment.

Flora of high conservation significance

Many of the park's less abundant vegetation communities are of high conservation significance. Thirteen vegetation communities in the park are, or may be, components of seven threatened ecological communities listed under the Biodiversity Conservation Act or Environment Protection and Biodiversity Conservation Act (see Appendix B).

The park protects some 4380 hectares of vegetation listed as threatened: nearly 15% of the total park area. Threatened ecological communities are concentrated in the south and south-west of the park, along the western boundary and along rivers.

Threatened ecological communities recorded in the park occur on enriched soils. This increased soil fertility, compared to sandstone-derived soils, has led to their extensive clearing and fragmentation in the Sydney Basin Bioregion. In the agricultural areas outside the special area, those vegetation communities with an open grassy understorey have been heavily impacted by grazing. In the Kangaloon and Robertson area to the south, logging of tall canopy species followed by intensive agriculture such as dairying and potato-growing have severely reduced the original vegetation. Rural residential development is also an increasing threat to these vegetation communities beyond the park.

Nine threatened plant species listed under the Biodiversity Conservation Act have been recorded in the park: the endangered Bynoe's wattle (*Acacia bynoeana*), Bargo geebung (*Persoonia bargoensis*), hairy geebung (*Persoonia hirsuta*) and Mittagong geebung (*P. glaucescens*), and the vulnerable spiky shrub *Epacris purpurascens* var. *purpurascens*, small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), Woronora beard-heath (*Leucopogon exolasius*), Deane's paperbark (*Melaleuca deanei*) and brown pomaderris (*Pomaderris brunnea*). Each of these species is extremely reduced in abundance and range. Their small population size makes them especially vulnerable to natural and human disturbances, such as increased fire frequency. A description of these species and their conservation status is provided in Appendix C.

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (OEH 2017a). These actions are currently prioritised and implemented through the *Saving our Species* program, which aims to maximise the number of threatened species that can be secured in the wild in New South Wales for 100 years (OEH 2013a). Individual recovery plans may also be prepared for threatened species to consider management needs in more detail.

Other significant species known to be present in the park are five rare or poorly known species: Christmas bells (*Blandfordia cunninghamii*), a guinea-flower (*Hibbertia nitida*), native cranberry (*Lissanthe sapida*), a raspwort (*Gonocarpus longifolius*) and the narrow-leaved mallee ash (*Eucalyptus apiculata*).

Disturbed vegetation and cleared areas

Native vegetation cover plays a vital role in providing native animal habitat, protecting against soil erosion and maintaining water quality. Park management aims to maintain maximum vegetation cover to protect ecological integrity, water quality and catchment values.

An assessment of vegetation disturbance in the Woronora, O'Hares and Metropolitan special areas using aerial photo interpretation found that over 97% of the park had a low level of disturbance (NPWS 2003). While the majority of the park's vegetation is in very good condition, it is fragmented by roads and trails and the sections south of Tourist Road are interspersed with cleared land. The small sections west of the Hume Motorway are isolated from the rest of the park and other areas of bushland.

The assessment identified a total of 428 hectares of cleared land in the park. Clearing of vegetation has been a result of:

- historic settlements such as those at Cupitts Forest, Izards Knob, Pearsons Selection, Macquarie Hill and other locations (see Section 3.5)
- former grazing along the northern boundary near Wilton
- former turf farm and agricultural clearings east of Robertson Burrawang Water Supply
- former pine plantations (see Section 3.5)
- establishment of utilities, rail corridors and management trails
- former gravel extraction for construction and maintenance of management trails
- illegal clearing at border locations.

The former Kangaloon Depot site has been recently cleared of all infrastructure. Although this site is currently being allowed to revegetate naturally, activities to promote regeneration may be utilised in future.

Clearing and other disturbance has occurred in a number of threatened ecological communities, including Shale Sandstone Transition Forest, Robertson Basalt Tall Open-forest, Southern Highlands Shale Woodlands, Cumberland Plain Woodland, and Robertson Rainforest.

Issues

- A significant proportion of the park's vegetation consists of threatened ecological communities. Some of these communities have been cleared or disturbed in the past and are likely to take a very long time to return to native vegetation without active intervention to assist natural regeneration.
- Future disturbance to native vegetation may occur as a result of development of third-party infrastructure (e.g. powerlines) or water supply infrastructure (see Section 3.2). As far as possible, riparian vegetation, upland swamps and other threatened ecological communities and the habitat of threatened species should be protected from disturbance by new infrastructure.
- Upland swamps are highly sensitive to disturbance, particularly changes in hydrology and frequent fire.
- The sections of park west of the Hume Motorway are isolated from large expanses of native vegetation and are therefore more vulnerable to disturbance. Edge effects may also be significant at locations in the south of the park where the boundary is highly fragmented.
- Some locations within the park along its boundary with private lands have been disturbed by illegal clearing of trees and or shrubs, firewood collection and other uses associated with unauthorised entry.
- Some areas south of Tourist Road are subject to unauthorised vehicle access (see Section 5.1).

Desired outcomes

- Vegetation cover and biodiversity (species, populations, communities and their habitats) are maintained.
- Threatened ecological communities and populations of threatened plants are conserved.
- Cleared and disturbed areas not required for park management or other infrastructure are restored where practicable as resources allow.

Management response

3.3.1 Implement relevant actions in the *Biodiversity Conservation Program* and recovery plans for threatened plants and communities occurring in the park.

3.3.2 As far as possible, protect threatened ecological communities and other priority habitats, such as riparian vegetation, from disturbance.

3.3.3 Prioritise the restoration of those cleared and disturbed areas where threatened ecological communities occur.

3.4 Native animals

Comprehensive surveys and assessment of native animals throughout the Woronora Plateau catchments, including the park, have been undertaken as part of the SASPOM Research and Development program (DEC 2005a, 2005b; DECC 2007) and more recently the Southern Highlands Koala Conservation Project (OEH 2017b).

The diversity of vegetation in the park provides a corresponding variety of habitats for native animals. Distinctive habitats include sandstone formations and surface rock found throughout the drier vegetation communities, tall moist eucalypt forests occurring in the wetter conditions and more fertile soils of the southern parts of the park, and upland swamps at various locations. Some

native animal species may be specific to a few habitat types, for example greater gliders (*Petauroides volans*) in tall open forest, while other species, such as sugar gliders (*Petaurus breviceps*), occur through a wide range of vegetation communities.

The south-east extremity of the park connects to the moist forests of the Illawarra Escarpment, which have been identified as an important corridor for wildlife movement (NPWS 2002). On its western edge, the park is connected via Bargo River State Conservation Area and other land to large areas of native vegetation on the Nattai Plateau and the southern Blue Mountains. These linkages are critical to the area's native animal populations (DECC 2007). However, roads present significant impediments to the movement of many species.

A total of 254 terrestrial vertebrate native animals have been recorded, dispersed throughout the park (see Table 2). This diversity reflects the range of habitats, the high level of connectivity with other protected areas and the relative absence of human disturbance. Features such as intact understorey vegetation across the majority of the park, standing dead timber and fallen timber enhance habitat value for a range of native animal species.

Bats, owls and arboreal mammals occupy a significant place in the overall census. This may be due to the availability of preferred forage species and tree hollows, the extent of unbroken canopy available, the network of drainage lines and the presence of standing water. The large expanse of vegetation may also provide an adequate territory size for birds of prey.

Table 2 Terrestrial vertebrate native animals recorded in the park

Faunal group	No. species	Threatened species
Mammals	56	14
Birds	143	15
Reptiles	35	1
Amphibians	20	2
Total	254	32

Fauna of high conservation significance

Threatened terrestrial native animals recorded from the park are listed in Appendix D. Other threatened species that may be present within the park include the vulnerable giant burrowing frog (*Heleioporus australiacus*) and Rosenberg's goanna (*Varanus rosenbergi*). Both are known to occur in the section of the Metropolitan Special Area immediately east of the park.

Several of the threatened species recorded are known from only single records, including the eastern pygmy-possum (*Cercartetus nanus)*, olive whistler (*Pachycephala olivacea)* and grey-headed flying-fox (*Pteropus poliocephalus)*. The rarity of these records may be due to the timing or adequacy of survey effort.

Spotted-tailed quolls (*Dasyurus maculatus)* are known in the park from only five records: one north-west of Mount Lindsey (in 1998), two north of the former Gerrigaroo Pine Plantation (in 1999) and two from the Nepean Gorge near Pheasants Nest (in 2010). The species has been declining across its range and is now extremely rare, although it is still regularly recorded from sites in the upper Blue Mountains to the west and Kangaroo Valley to the south.

One of the most important species in the area is the koala. There have been numerous sightings distributed over most of the park south of Nepean and Avon dams. The koalas residing in the park are a distinct population but retain linkages with other known subpopulations (such as those in Dharawal National Park in the north, Nattai National Park and Bargo and Bargo River state conservation areas in the west, and Morton National Park in the south). Within the park, koalas have been observed using a number of different browse species including white stringybark (*Eucalyptus globoidea*), silvertop ash (*E. sieberi*), grey gum (*E. punctata*), Sydney peppermint (*E. piperita*), red bloodwood (*Corymbia gummifera*) and blue-leaved stringybark (*E. agglomerata*).

There appears to be a preference towards trees associated with richer soils, consistent with research on koalas in nearby populations (Phillips & Callaghan 2000).

The Macquarie perch (*Macquaria australasica*) has been recorded in the Upper Nepean River system. This species is listed as endangered under the *Fisheries Management Act 1994*. While management of fish is the responsibility of the Department of Primary Industries, NPWS aims to protect fish habitat within parks. An important consideration is facilitating fish movement along waterways, including appropriate design of creek crossings on management trails.

The platypus has been observed regularly in the Nepean River and its tributaries above the drinking water storages. Although not considered threatened, this species has declined significantly in the Sydney Basin Bioregion (Grant 1998). Isolation from public access has protected important habitat features in the Upper Nepean such as stable earth banks, which are important for resting and nesting burrows, and overhanging riparian vegetation, which provides shelter for foraging near the bank and safe access to burrow entrances.

Managing significant species

The viability of native animal populations in the park is greatly enhanced by being part of a large area of native vegetation across the Woronora Plateau. The long-standing protection of the catchments has contributed significantly to the continued survival of many threatened species so close to large urban centres at Campbelltown and Wollongong.

The park and the broader Woronora Plateau provide habitat critical to the continued survival in the Sydney region of threatened and rare species, including the koala, eastern pygmy-possum, beautiful firetail (*Stagonopleura bella*), southern emu-wren (*Stipiturus malachurus*), broad-headed snake (*Hoplocephalus bungaroides*), red-crowned toadlet (*Pseudophryne australis*) and Littlejohn's tree frog (*Litoria littlejohni*) (DECC 2007). These species are therefore a high priority for conservation management.

Several species have become locally extinct, including the ground parrot (*Pezoporus wallicus*), eastern bristlebird (*Dasyornis brachypterus*) and possibly the long-nosed potoroo (*Potorous tridactylus*). In the longer term there may be potential to reintroduce such species if the reasons for their local extinction no longer exist.

Any rediscovered populations of the ground parrot, eastern bristlebird or long-nosed potoroo or of other threatened species such as the bush stone-curlew (*Burhinus grallarius*), brush-tailed rock-wallaby (*Petrogale penicillata*), Parma wallaby (*Macropus parma*), southern brown bandicoot (*Isoodon obesulus obesulus)*, stuttering frog (*Mixophyes balbus*) and green and golden bell frog (*Litoria aurea*) would also be a high priority for management.

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (OEH 2017a). These actions are currently prioritised and implemented through the *Saving our Species* program which aims to maximise the number of threatened species that can be secured in the wild in New South Wales for 100 years (OEH 2013a). Individual recovery plans have been prepared for some threatened species, including koalas and large forest owls, to consider their management needs in more detail.

The most important habitats in the park for threatened animals are grassy box woodlands, upland swamps and alluvial forests and woodlands (DEC 2005a). Small areas of grassy box woodlands (Transitional Shale Dry Ironbark Forest community) occur on the north-west edge of the park near Yerrinbool, Yanderra and Wilton, and are important for declining woodland birds. Upland swamps are scattered across the southern end of the park. Alluvial woodlands (Highlands Alluvial Red Gum Woodland) occur in only a few small areas along tributaries of the upper Nepean River. Each of these important vegetation communities has been extensively cleared in the region and are priorities for protection and restoration (see Section 3.3).

Issues

- Disturbance of high-quality habitat on more fertile soils has occurred through past clearing and ongoing illegal access.
- Notwithstanding the mitigation measures currently implemented by WaterNSW, there remains potential for impacts on platypus and other aquatic species from water transfers (see Section 3.2).
- Any future mining and gas extraction activities could impact on natural flow regimes, creek bed pools and upland swamps, and therefore on frogs and other aquatic species in the park (see Section 5.2).
- The native animals of the park may be adversely affected by predation by or competition from feral animals (see Section 4.1), and frequent or high intensity fire (see Section 4.2).
- Cleared routes, such as management trails and pipelines, facilitate access by introduced predators.
- The apparent disappearance of several threatened frog species from the area and the decline in abundance of Littlejohn's tree frog may be due to infection by chytrid fungus (DECC 2007).
- It is vital to maintain habitat linkages to other parks and special area lands.
- The small areas of land west of the Hume Motorway are isolated from the rest of the park. Areas of moist forest habitat in the south of the park are fragmented by cleared private land.
- While current management of the park largely prevents potential threats such as track creation, rubbish dumping and bushrock or firewood collection, some impacts associated with illegal access and activities occur on the southern and western edges of the park.

Desired outcomes

- Native animal biodiversity (species, populations and their habitats) is protected.
- The habitat and populations of threatened and regionally significant native animal species are maintained.

Management response

3.4.1 Implement relevant actions from the *Biodiversity Conservation Program* and recovery plans for threatened native animal species occurring in the park.

3.4.2 Liaise with WaterNSW, local councils and adjoining landholders to encourage catchment and land management practices that protect and conserve threatened native animal species and enhance habitat connectivity across the landscape.

3.4.3 In liaison with WaterNSW, encourage research that improves understanding of the significance of the park for platypus and informs future management of the headwaters of the Nepean River within the park.

3.4.4 Investigate the feasibility and suitability of reintroducing species to the park that have become locally extinct.

3.4.5 Replace creek crossings on management trails with crossings that will improve fish-passage when the crossings need to be upgraded or replaced.

3.5 Aboriginal connections to Country and shared heritage

Cultural heritage comprises places and items that may have historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance.

Aboriginal heritage

Aboriginal communities have an association and connection to the land. Natural values within a landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. NPWS recognises the significance of Aboriginal cultural heritage and the need to ensure that it is managed in an integrated manner across the landscape.

The park lies mainly within freshwater Dharawal Country but is also on the edge of Gundungurra Country to the west. These groups traditionally enjoyed close cultural connections, including intermarriage, trade and shared ceremonies. Contemporary Aboriginal groups that have an interest in the park include the Tharawal and Illawarra local Aboriginal land councils.

Research suggests that Aboriginal occupation of the Woronora, O'Hares and Metropolitan special areas was sporadic, and populations were small (Godden McKay 1993). Factors such as the availability of water and reliability of food resources influenced the frequency and density of Aboriginal occupation. It is likely the major ridgelines running north–south between the river systems allowed relatively easy travel between the coast, the Cumberland Plain and the southern tablelands.

In the first half of the 19th century small groups are known to have been centred south-west of the park around Mittagong and south-east of the park near Albion Park. There is also evidence that groups moved from Kangaroo Valley through the park area to attend ceremonies at Camden in the 1830s. The declaration of the Metropolitan Special Area excluded all public access from 1880 onwards.

Within the park, almost 300 Aboriginal sites have been recorded, including:

- **Sheltered occupation sites** which occur in weathered overhangs or recesses in sandstone cliffs and boulder outcrops of Hawkesbury and Narrabeen sandstone formations, with a general preference for northerly or north-westerly aspects, and may include potential archaeological deposits and art.
- **Sheltered art sites** which occur on suitable surfaces of overhangs and rock shelters in Hawkesbury sandstone formations (which weather to a smoother surface than Narrabeen sandstones) and may include surface artefact scatters and occupation deposits.
- **Rock engravings** are produced by abrasion or by direct or indirect percussion on flat rock surfaces in exposed or sheltered situations.
- **Grinding grooves** are grooves on fine-grained sandstone surfaces resulting from the manufacture of ground-edge tools and are usually associated with creeks or pools.
- **Open artefact scatters** are located on dry, relatively flat landforms near water or stone resources, and are the result of hunting and gathering activities, camping or maintenance and manufacture of stone tools. These may be difficult to detect where there is dense surface vegetation or accumulated alluvium.
- **Modified trees** are often formed by removal of a section of bark to create a storage container.
- **Stone arrangements** are distinguishable patterns that may be difficult to locate unless exposed by fire or drought.

Other sites include a quarry at Mount Cotopaxi where chalcedony, a type of quartz, was extracted to form stone tools (Illawarra Prehistory Group 2000). There may also be mythological sites that have no archaeological evidence.

Nearly 60% of the archaeological sites in the park have art. Notable features include unique examples of koalas drawn in charcoal and atypical abstract frontal human figures (Illawarra Prehistory Group 2000).

The high level and long-term protection afforded the special areas has also protected the Aboriginal sites and the great majority are thought to be virtually intact (Godden McKay 1993). These sites represent an extremely valuable landscape sample and there is great potential to learn more about local and regional Aboriginal history, particularly from little-disturbed occupation sites.

Historic heritage

A number of places of historic significance from the time of European arrival are present in the park, mostly associated with small-scale agriculture, mining, railway construction and water supply infrastructure (see Appendix E). Some sites associated with water supply infrastructure in the park are listed on the State Heritage Register. Other sites in the park may be potential archaeological sites that contain 'relics' as defined under the Heritage Act.

Agriculture and settlement

The rugged terrain and infertile soils of much of the Woronora Plateau discouraged early European explorers and colonists. Explorers George Evans (1812) and Charles Throsby (1815 and 1817) favoured routes to the east and south, which were easier to traverse and more amenable to future agricultural use.

Development of agricultural land around the park land took place in the early 19th century. Orcharding began in the Appin district to the north and the Cordeaux area to the east, and grazing occurred at Bargo and further south in the Southern Highlands.

There were a few isolated attempts at agriculture on the plateau within the southern half of the park in the early and mid-19th century. Examples occur at Mount Lindsey, Pearsons and Menzies selections, Izards Knob, Cupitts Forest and Mount Cotopaxi. Homesteads were formerly located in at least the first four locations. Sandstone blocks are reported to remain at Izards Knob, bricks at Menzies Selection and an old well at Pearsons Selection. Clearings persist at all locations, and a few have exotic trees.

The Kangaloon area to the south became a thriving dairying and potato-growing region centred on Mount Murray from about the 1860s. Clearings and house sites occur within the park north-east of Kangaloon Road. In the south-east of the park, the floor of a postal shed is reported to remain. There is also the site of the former Mount Murray School which operated until after construction of the Moss Vale to Unanderra Railway in the late 1920s.

In the north, several former farm sites with shed floors, dams, fence remains, and a brick well are located along Fire Road 11. Some of these may be relatively recent. A farm site with a split-rail fence is reported downstream from Nepean Dam.

The homesteads, Mount Murray School and other buildings in the special area were demolished after resumption of the land by Sydney Water Board in the early 20th century (Godden McKay 1993) and now may only exist as archaeological sites.

The earliest known road in the park was a trail formed in the early 1820s between Dapto on the coastal plain and Bong Bong on the highlands, referred to as Five Islands Road. There is no known evidence of this trail today.

Mining and quarrying

Between 1884 and 1896, industrial diamonds were mined with little success at Diggers Creek, a tributary of the Nepean River close to the south-west boundary of the park. This 'Diamond Fields' area is dotted with partially collapsed shafts and mullock heaps along some two kilometres of the creek. A 2.5-metre diameter iron washing wheel and a communal stone fireplace remain at the site.

Small-scale alluvial gold mining was undertaken at the head of Diggers Creek near Pearsons Selection during the 1940s. During World War II, exploration for gold occurred at Mount Cotopaxi, with a small shaft sunk into the side of the mountain west of Fire Road 1E.

A sandstone quarry in the south-west of the park is reported to have been used to supply stone for construction of early homesteads (Godden McKay 1993).

Water supply

Development of Sydney's water supply infrastructure from 1880 to 1935 accounts for the most significant aspects of European history in the vicinity of the park.

The Metropolitan Special Area was proclaimed under the Metropolitan Water and Sewerage Act and was one of the earliest protected areas in New South Wales. The area is now a special area under the Water NSW Act.

Pheasants Nest Weir and the associated Nepean Tunnel in the north of the park were constructed between 1880 and 1888 and are listed on the State Heritage Register as part of the Upper Canal Scheme. These heritage items are current working assets for WaterNSW and the management of their heritage values is the responsibility of WaterNSW.

Some elements of these items, such as the sandstone tunnel markers and associated airshafts for the Nepean Tunnel, are not current WaterNSW working assets. These elements are managed by NPWS under this plan in accordance with the requirements of the Heritage Act.

Avon Dam and Nepean Dam were completed in 1928 and 1935 respectively. These two dams are listed on the State Heritage Register in recognition of their technical and aesthetic historic significance. The listing includes the dam walls, reservoirs, picnic areas and access roads. The dam walls, reservoirs and picnic areas and sections of the access roads are excluded from the park. Parts of the access roads are located within the park.

A number of archaeological sites associated with construction of the dams have been identified in the park (Godden McKay 1993) including:

- a post-World War 1 tent/campsite located south of Avon Dam Road near Nepean Dam ('No. 2 camp')
- a tip from the construction of Nepean Dam located off Fire Road 5E/Avon Dam Road
- a 1920s sewerage system that includes an early design of a 'trickling sand filter'
- a sawmill on the eastern side of Avon Dam used to produce timber for the construction of the dam
- Fire Road 5E, located on the old rail corridor connecting the Nepean Dam construction site with Bargo
- the 1930s model of the Nepean Dam spillway at the Nepean River bridge on Avon Dam Road. A heritage assessment report (Extent Heritage Advisors 2016) has proposed protective actions, including vegetation management, for this site.

Robertson Burrawang Water Supply, a former Wingecarribee Shire Council water supply reservoir at East Kangaloon, is enclosed by the park. It was built in 1971 but no longer serves as a water supply. A weir, water treatment plant site, sludge lagoons and a pump station were formerly located on the southern side of the reservoir.

Railways

A group of sites associated with construction and early operation of the Moss Vale to Unanderra Railway in the late 1920s is clustered north of Macquarie Hill. These include a horse camp, workers camps and Summit Dam. Water was pumped from the dam to Summit Tank, outside the park, to supply steam trains.

The Maldon–Dombarton Railway corridor, which was under construction in the 1970s and 1980s, passes through the north-east of the park. Although construction was not completed, most of the formation, cuttings and ballast are present from Pheasants Nest in the north to the incomplete Dombarton tunnel in the south-east. Only that section north of Fire Road 11B is excluded from the park; the rest of its corridor lies within the park.

Forestry and turf

Remnants of several former pine plantations reflect the past policy and practices of the former Metropolitan Water Sewerage and Drainage Board. In the 1950s the forestry section of the board managed the catchment areas and propagated radiata pine (*Pinus radiata*) for commercial production at Mount Lindsey. Pines and other conifers were planted at the Pearsons, Menzies and Gerrigaroo selections and east of Robertson Burrawang Water Supply. In the past 25 years almost all the conifers have been removed and the sites managed to promote regeneration by native vegetation.

Turf farming also took place in a large clearing east of Robertson Burrawang Water Supply. The period of operation is unknown.

Other heritage

Near Yerrinbool, the sites of the so-called Bargo Brush 'Gaol' and Bargo tip are reported to occur in the park. In the early 19th century the Bargo area was covered in thick scrub and was notorious for harbouring escaped convicts who became bushrangers. The gaol site may have been an early police station. While there are no known remains, they may exist as archaeological sites.

Four large charcoal burning pits are located adjacent to Fire Road 5 near Bargo. The pits are approximately 15 metres long and lined with a mixture of stone, brick and concrete, with pipes in the walls. While no specific information is known about these pits, charcoal burning primarily took place in the 1940s during the petrol shortages of World War II when charcoal gas was used as an alternative fuel on converted trucks and cars.

Issues

Aboriginal heritage

- The park's archaeological record is rich and significant and there are likely to be many more Aboriginal sites and values than those formally recorded.
- Although the long-standing exclusion of general public access has afforded a high level of protection, it has also largely excluded Aboriginal people from heritage places.
- Some activities have the potential to impact on Aboriginal heritage values. These include use and maintenance of infrastructure corridors and management trails, changes in water levels in the storages, bushfires, hazard reduction works and illegal access.

Historic heritage

- Little material evidence remains at most of the sites of former use, but several have archaeological potential.
- The heritage significance of many of the historic sites in the park has not been assessed; most are likely to be of only local significance.
- Historic heritage values could be affected by management operations involving clearing or ground disturbance, by development of additional water supply infrastructure or by bushfire.
- Improved understanding is needed of the management requirements of several heritage items, including structures such as the charcoal pits, the Nepean Tunnel sandstone tower markers, Robertson Burrawang Water Supply infrastructure and Summit Dam.
- Partially collapsed mining shafts in the 'Diamond Fields' area and at Mount Cotopaxi pose a safety risk.

Desired outcomes

- Aboriginal cultural heritage values are protected and managed in consultation with the Aboriginal community.

- Understanding of the significance of the park's cultural heritage values is improved.
- Significant historic features are appropriately conserved and managed.

Management response

3.5.1 Consult and involve relevant groups, including Illawarra and Tharawal local Aboriginal land councils, in all aspects of management of Aboriginal cultural values.

3.5.2 Conduct a site assessment for Aboriginal or historic heritage before all new works involving ground disturbance.

3.5.3 Assess the condition of 5–10 Aboriginal sites each year. If needed, develop management strategies for Aboriginal sites to ensure their protection.

3.5.4 Seek to rename the park with an Aboriginal name in consultation with Aboriginal communities, in recognition of Aboriginal people's connections to the area.

3.5.5 Protect and conserve historic heritage values based on their heritage significance.

3.5.6 Prepare conservation management plans for heritage items in the park which are listed on the State Heritage Register.

3.5.7 Maintain safety fencing and signage in the 'Diamond Fields' area and at Mount Cotopaxi.

3.5.8 Undertake priority actions from the heritage assessment report for the Nepean Dam model spillway.

3.6 Public use and research

Access to the Metropolitan Special Area is controlled by WaterNSW. General public access and recreational use of the park are not permitted because of its status as a Schedule 1 special area.

Public entry is permitted only along the roads to Nepean and Avon dams and along Tourist Road and nearby public roads in the southern fringes of the park (Jack Emery Lane, Orfords Road, Rowlands Road, Kirkland Road, Moresby Hill Road and Mount Murray Road). Parts of the park can be viewed from the Hume Motorway, Old Hume Highway, Kangaloon Road, the Main Southern Railway and the Moss Vale to Unanderra Railway line.

Restriction of use is essential to minimise disturbance to Sydney's drinking water supply catchment and protect water quality. The Cooperative Research Centre for Water Quality and Treatment found that recreational access has negative impacts on water quality and recommended a precautionary approach be applied (CRC Water Quality and Treatment 2006).

Large picnic areas maintained by WaterNSW on its land at Nepean and Avon dams provide opportunities for recreation (see Figure 2). Nearby NPWS parks provide a broad range of recreational opportunities including bushwalking, picnicking and cycling in Bargo River and Illawarra Escarpment state conservation areas and Dharawal, Macquarie Pass and Budderoo national parks.

Extensive urban development is planned for the Wilton Growth Area, on the northern boundary of the park (DPE 2018). This may lead to increased levels of illegal access in the park, particularly where urban development adjoins the park. Additional resources may be required to manage such pressure and limit impacts on park values.

Access for research and other authorised activities

Access to the Metropolitan Special Area is controlled by WaterNSW. Under the WaterNSW Regulation and the National Parks and Wildlife Regulation there is provision to approve use of the park for a specific appropriate purpose, such as research, through the issue of a consent. NPWS and WaterNSW have agreed that all requests for access to the park will be assessed by WaterNSW under its access policy and related access documents. WaterNSW will only allow

access to the special area for individuals, companies or groups who can show their proposed activity meets all of the standard assessment criteria including:

- access is for an activity that cannot be carried out elsewhere
- access is for an activity or purpose that will benefit WaterNSW's management of the special area, or provide a broader public benefit
- the activity will not compromise the integrity, operation or management of any WaterNSW infrastructure or the catchment area
- the activity will not:
    - lower the quantity of water in the water storages or catchments
    - lower the quality of surface and groundwater inflows to water storages or catchments
    - have a negative impact on the ecological integrity of the special area.

A number of research projects have been undertaken in the park under the SASPOM and Metropolitan water plans, including native animal surveys, research into the impact of bushfires on water quality, environmental flows and relationships between groundwater and terrestrial ecosystems. Investigations such as these make an important contribution to understanding the values of the area and contribute to informed management.

Issues

- The need to maintain high levels of water quality requires prohibition of general public access. Some use and access are authorised, particularly:
    - management operations by NPWS and WaterNSW (see Section 5.1)
    - access for law enforcement, familiarisation by fire authorities and emergency incidents
    - authorised activities by holders of existing interests (see Section 5.2)
    - access to private land for those individual landowners adjoining the park who hold a current legal agreement with WaterNSW or NPWS (see Section 5.2)
    - appropriate environmental or cultural research conducted in accordance with the conditions of a consent.
- There are ongoing issues with illegal access and activities in parts of the park, particularly in the highly fragmented and largely unfenced areas south of Tourist Road and west of the Hume Motorway.

Desired outcomes

- There is community understanding and appreciation of the park's natural, cultural and water supply values and the need to prohibit general public access.
- Use does not affect water quality and conservation values.
- Research improves understanding of the park's values and management requirements.

Management response

3.6.1 WaterNSW will continue to manage access to the park in accordance with its access policy.

3.6.2 Liaise with WaterNSW regarding the provision of information at the Nepean Dam picnic area about the park and its natural, cultural and water quality values. Consider providing information at other locations if appropriate.

3.6.3 In conjunction with WaterNSW, permit research that is aimed at enhancing understanding of the park's values and informing future management. Research that is unrelated to the park or to water supply or water quality issues will not be permitted.

3.6.4 In conjunction with WaterNSW, implement measures to limit unauthorised access and associated impacts on park values.

4. Threats

4.1 Pests

Pest species are plants, animals and pathogens that have negative environmental, economic and social impacts and are most commonly introduced species. Pests can have impacts across the range of park values, including impacts on biodiversity, cultural heritage, catchment and scenic values.

The *Biosecurity Act 2015* and its regulations provide specific legal requirements for the response, management and control of biosecurity risks, including weeds and pest animals. These requirements apply equally to public and privately-owned land. Under this framework, Local Land Services has prepared regional strategic weed management plans and regional strategic pest animal management plans for each of its 11 regions, including the South East Region (South East LLS 2017 and 2018 respectively).

The LLS plans identify priority weeds and pest animals in each of the regions, plus the appropriate management response for the region (i.e. prevention/alert, eradication, containment or asset protection).

NPWS prepares regional pest management strategies which identify the operations and control actions undertaken by NPWS to meet the priorities from regional strategic pest and weed management plans. This also includes other important programs such as the *Biodiversity Conservation Program* (see Sections 3.3 and 3.4).

The overriding objective of the NPWS regional pest management strategies is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. These strategies are regularly updated. Reactive programs may also be undertaken in cooperation with neighbouring land managers, in response to emerging issues. Significant pest species recorded in the park are discussed below.

Pest species that are also key threatening processes may be managed under the *Biodiversity Conservation Program* where it includes key threatening processes strategies. The *Saving our Species* program has developed targeted strategies for managing key threatening processes using the best available information to minimise current and future impacts of key threatening processes on priority biodiversity values, including threatened species and ecological integrity.

Weeds

The overall degree of weed infestation in the park is minor given the low levels of disturbance to native vegetation and long-standing weed control programs. Outbreaks of weeds follow disturbance of native vegetation and are most likely to occur at the interface between the park and private land; the margins of management trails, boundary roads and railway lines; and along streams flowing into the park from agricultural and urban areas. Outbreaks may be more widespread following fire.

Targeted survey and regular surveillance have ensured that outbreaks of exotics have generally been treated before reaching problem proportions. There are, however, ongoing occurrences in some locations.

The main weeds in the park are blackberry (*Rubus fruticosus* agg.), gorse (*Ulex europaeus*), holly (*Ilex aquifolium*), St John's wort (*Hypericum perforatum*), fireweed (*Senecio madagascariensis*), pampas grass (*Cortaderia* sp.), whisky grass (*Andropogon virginicus*), Coolatai grass (*Hyparrhenia hirta*), bitou bush (*Chrysanthemoides monilifera*), broom (*Cytisus scoparius*), wild olive (*Olea europaea*), cotton bush (*Gomphocarpus* sp.), serrated tussock (*Nassella trichotoma*), crofton weed (*Ageratina adenophora*), mistflower (*Ageratina riparia*), privet (*Ligustrum* spp.), wandering creeper (*Tradescantia fluminensis*), Japanese honeysuckle (*Lonicera japonica*) and wild tobacco (*Solanum mauritianum*).

Cherry laurel (*Prunus laurocerasus*) occurs in several locations at the southern end of the park. This species is established as a roadside and bushland weed in higher rainfall parts of the Southern Highlands. It has potential to invade and detrimentally modify substantial areas of threatened ecological communities including Robertson Rainforest, Robertson Basalt Tall Open-forest and Southern Highlands Shale Woodlands (Douglas 2011; S Douglas pers. comm. 2016).

A former infestation of willows (*Salix cinerea*) along a 600-metre stretch of Doudles Folly Creek, a tributary of the Nepean River in the south-west corner of the park, has been controlled by WaterNSW. Infestation by willows is a particularly critical issue, requiring quick and effective remedial action due to their propensity for self-propagation and their destructive effects on watercourses.

Along roadsides adjoining the northern boundary of the park an infestation of purple broom (*Polygala virgata*) is being monitored as a potential threat to the native vegetation. Non-local native species including the wattles *Acacia saligna* and *A. baileyana* that have potential to become significant weeds have previously been planted on some roadsides in and beyond the park.

An infestation of the aquatic plant marsh hypericum (*Hypericum elodes*) has been identified near the southern edge of the park, on the Nepean River near the Tourist Road bridge. The infestation is being monitored by WaterNSW.

Some boundary areas in the southern part of the park are being invaded by exotic grass and pasture weeds from neighbouring properties. A number of weeds including serrated tussock occur along the western boundary of the park adjacent to public roads and the Main Southern Railway, along with some areas of rubbish dumping.

As stated in Section 3.5, former pine plantations (at Mount Lindsey, Pearsons, Menzies and Gerrigaroo selections and east of Robertson Burrawang Water Supply) have been cleared of radiata pine and allowed to regenerate naturally. Occasional pine wildings are destroyed as they occur.

Introduced animals

Introduced animal species recorded in the park include cats (*Felis catus*), wild dogs (*Canis lupus*), feral pigs (*Sus scrofa*), red foxes (*Vulpes vulpes*), rabbits (*Oryctolagus cuniculus*), black rats (*Rattus rattus*), fallow deer (*Cervus dama*), Rusa deer (*Cervus timorensis*) and feral goats (*Capra hircus*).

Introduced animal species can affect water quality through erosion and sedimentation and introduction of pathogens.

Red foxes suppress native animal populations, particularly medium-sized mammals, ground-nesting birds and freshwater turtles. They have also been implicated in the spread of a number of weed species such as blackberry and are known to prey on domestic stock including lambs and poultry. They are identified as a priority pest animal in the *South East Regional Strategic Pest Animal Management Plan* (South East LLS 2018). Predation by the European red fox is a key threatening process under the Biodiversity Conservation Act (NSW SC 1998a) and Environment Protection and Biodiversity Conservation Act (DoE 2009). The NSW fox threat abatement plan was initiated in 2001 (and revised in 2010; see OEH 2011) 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 New South Wales to protect biodiversity.

Wild dogs, including dingos (*Canis lupus dingo*), feral domestic dogs (*Canis lupus familiaris*) and their hybrids are known to occur within the park. Wild dogs may also have significant impacts on the distribution and abundance of native wildlife. The *NSW Wild Dog Strategy* (DoI 2017) promotes a balance between managing wild dogs in areas where they have negative impacts and preserving the ecological role of dingoes. The conservation of dingoes is listed as one of the goals of the strategy. It is achieved via wild dog management plans which focus control on areas where the risk of negative impacts are greatest, and not undertaking control in other parts of the landscape with a low risk of negative impacts from wild dogs, to allow dingoes to fulfil their natural ecological role.

Several threatened species that occur in the park are at risk of predation by feral dogs and red foxes, including koalas and spotted-tail quolls (NSW SC 2009a, 1998a). Fox control, in the form of 1080 ground baiting, has been undertaken within the park since 2001. Wild dog control programs have been implemented within the park since 2013. Wherever possible, feral animal control is undertaken in cooperation with neighbouring agencies and landowners.

Historically, areas of the park contained significant populations of rabbits. From the mid-1960s rabbits were extensively controlled in the Kangaloon, Tourist Road and Mount Murray areas, then during the mid-1970s in the Cupitts Forest area and most recently in the Pheasants Nest – Wilton area. Rabbits currently exist in very low numbers across the park.

Pigs are thought to have been introduced into the Pheasants Nest – Wilton area in the 1990s and were introduced to the southern part of the park near the former Kangaloon Depot in 1999 to 2000. These pigs were successfully controlled via trapping and shooting, and pigs are now either absent from the park or in very low densities.

Rusa and fallow deer exist in very low numbers and appear to be mostly confined to the edge of the park. Fallow deer have been known to exist in the park since the 1990s. Rusa deer have migrated into the park more recently. Deer are controlled by regular shooting programs.

Feral goats are known to be present in the gorges of the Avon and Cordeaux rivers. They can have a major impact through grazing, trampling and weed introduction and could degrade habitat for the endangered broad-headed snake.

Feral honeybees (*Apis mellifera*) may also be present and can impact native animals by competing for nectar or occupying tree hollows. This is of particular concern in the important grassy shale forests, which are deficient in tree hollows owing to past clearing. Competition from feral honeybees is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2006).

Desired outcomes

- Negative impacts of introduced species on park values, including significant native species and water quality, are minimised.
- Pest species management is planned, strategic and coordinated with other authorities and landowners.

Management response

4.1.1 Manage pest species in line with pest management strategies relevant to the park.

4.1.2 Continue to monitor pests and to undertake targeted pest control programs in collaboration with WaterNSW, owners of third-party infrastructure and adjoining landowners where relevant.

4.1.3 Liaise with road and rail authorities in relation to controlling weeds and rubbish dumping along the western boundary of the park.

4.2 Fire

Fire is a natural and recurring factor shaping the NSW environment, and continues to play a significant role in the evolution and maintenance of natural and cultural heritage values. The primary objectives of NPWS fire management are to protect life, property, community assets and cultural heritage from the adverse impacts of fire, while also managing fire regimes in parks to maintain and enhance biodiversity. NPWS also assists in developing fire management practices that contribute to conserving biodiversity and cultural heritage across the landscape and implements cooperative and coordinated fire management arrangements with other fire authorities, neighbours and the community (OEH 2013b).

As a water catchment special area, fire management regimes in the park also need to minimise the potential impact of wildfire on water quality.

Fire history

The park is an area of high bushfire hazard during summer months (SCA & NPWS 1999). According to fire records maintained by WaterNSW, there were extensive fires in the Metropolitan Special Area in 1951–52, 1957–58, 1964–65, 1968–69 and 2001–02. Large fires often follow extended dry periods. The fires of 2001–02 were particularly severe, covering the majority of the park. In spring 2013, a 6533-hectare wildfire burnt most of the park north of Nepean Dam. While surrounding catchment areas were affected by the widespread fires in the summer of 2019–20, the Upper Nepean State Conservation Area was not directly burnt.

Arson is the single highest cause of fire ignition, accounting for 45% of all recorded fires in the catchments, with lightning another important factor (SCA 2001). The north–south orientation of the park exposes a long perimeter to fire originating from the west. Most wildfires exceeding 100 hectares have entered the park from the west during periods of hot weather and strong winds (SCA 2001).

Ecological impacts

Plants and animals have a range of mechanisms to survive individual fires. The long-term survival of plants and animals over repeated fires depends on the ability of species to maintain life cycle processes and on maintenance of the vegetation structure over time as habitat for animal species. When fires occur too frequently, both these key features can be disrupted.

High frequency fire is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000b). High frequency fire is defined as two or more successive fires close enough together in time to interfere with or limit the ability of plants or animals to recruit new individuals into a population, or for plants to build up a seedbank sufficient in size to maintain the population through the next fire. Sustained high frequency fire will consequently lead to a loss of plant species, a reduction in vegetation structure and a corresponding loss of animal species. Conversely, lack of fire may also disrupt plant and animal populations to the point of localised extinction.

The threatened ecological communities of Shale Sandstone Transition Forest and Cumberland Plain Woodland are likely to suffer a reduced diversity of native plant species if subject to repeated high frequency fires (NSW SC 2009b, 2014). Robertson Rainforest (NSW SC 2011) and Coastal Upland Swamp (NSW SC 2012) are also vulnerable to damage by fire.

Impacts of fire on native animals are varied. Fire can lead to the death of individuals, interrupt breeding cycles and lead to the loss of refuge resources (e.g. fallen timber, tree stags and understorey vegetation) and the loss of available food resources. This changes the suite of native animals that persist after a fire, at least in the short term.

Many threatened animals in the park, including those dependent on tree hollows and fallen timber for roosting or nesting and those dependent on particular vegetation types, are vulnerable to frequent fire. Frequent fire, combined with cat and fox predation, is implicated in the localised extinction or decline of several threatened animals in the area including the ground parrot and eastern bristlebird (DECC 2007).

The high level of biodiversity in the park suggests it is part of a relatively stable system in which most aspects of the native plant and native animal assemblages are not seriously affected by fire. The persistence of the koala population is one indication of this. It is considered critical that, as far as practically possible, a proportion of core habitat for koalas and other threatened species remains unburnt. Low intensity hazard reduction burns will be is an important tool in the protection of this habitat from large wildfires whilst adjacent bushland recovers to a point where it again provides habitat.

To conserve biodiversity, NPWS considers the fire thresholds for vegetation communities. These biodiversity thresholds define the range of fire intervals within which a vegetation community is adapted. Variability within the burning regime is essential, as it increases the diversity of available habitat. The park fire management strategy takes into account these fire intervals for vegetation communities and the fire responses of individual species.

Water quality impacts

The impact of fire on the water quality of the Nepean and Avon storages is a critical consideration in the park. The incineration of vegetation by fire, particularly riparian vegetation, can have serious consequences for water quality. The loss of vegetation affects important ecosystem services including water filtration, erosion protection, water storage in upland swamps, and sequestering and storage of carbon and nutrients. Burning vegetation creates ash, charcoal and sediment that can elevate turbidity and nutrient levels (particularly iron and manganese), adversely impacting on water quality.

Possibly the most significant impact on water quality occurs when exposed soil is mobilised by rainfall directly after fire. Soil erosion and increased sediment loads in watercourses are significantly worsened if rainfall is severe. For example, heavy rains following severe fires in Canberra's water catchment resulted in the post-fire flow of soil into Corin Dam being equal to 17 years' mean annual input, and the amount of organic matter (ash and charcoal) being equivalent to 27 years' input (ACT Commissioner for the Environment 2003).

WaterNSW conducted research to assess the impacts of the 2001–02 fires on water quality. Erosion rates were found to be higher but generally less than anticipated despite intense post-fire rainfall and effects were localised (Shakesby et al. 2003, 2004). Nevertheless, the intensity of post-fire rainfall is considered one of the most important factors contributing to adverse water quality impacts after bushfires.

Impacts on cultural heritage

Aboriginal and historic heritage values can be damaged directly by fire or fire suppression activities. For example, earth-moving machinery can damage stone arrangements, rock engravings, rock grinding grooves, artefact scatters and structures. To prevent damage, the nature and location of heritage values are considered during the planning and conduct of prescribed burns and fire suppression operations.

Fire management

Under the *Rural Fires Act 1997,* NPWS is a fire authority and is responsible for controlling fires in the park and ensuring they do not cause damage to other land or property. An important part of NPWS fire management is participation in local cooperative fire management arrangements. NPWS is a member of the Southern Highlands Bush Fire Management Committee that covers the Wollondilly and Wingecarribee local government areas.

NPWS aims to integrate fire management in the park with fire management in the remainder of the Metropolitan Special Area by WaterNSW and to incorporate catchment, water supply infrastructure and water quality considerations.

Fire management in the park is guided by the park fire management strategy (DECC 2009). The park fire management strategy identifies bushfire threats and provides guidelines for asset protection, the conservation of significant plants, animals and cultural features and water quality protection. The strategy aims to contain fire promptly before it can escalate into a major or widespread fire that could threaten the broader Metropolitan Special Area, with significant social and environmental costs. Fuel management programs including hazard reduction burns are developed based on the fire management strategy, fire history and biodiversity thresholds and seek to create a mosaic of burned and unburned areas in order to promote habitat diversity, improve protection during wildfires and minimise impacts on water quality.

Most of the park's management trails (see Section 5.1) are located along ridge tops and are vital for fire suppression and hazard reduction. The trails are maintained to standards consistent with their status under the Rural Fire Service's classification system. Several trails have been widened by regular slashing of the edges to form strategic fire control advantages. NPWS also uses a number of utility corridors, peripheral roads and dormant trails for fire control.

Fire management in the Metropolitan Special Area is aided by a network of fire towers maintained and staffed by WaterNSW during the fire season. One of these towers, Avon, is located in the park between Lake Nepean and Lake Avon. The fire towers provide an early warning system for the detection of fire and triangulation by the network allows for accurate identification of fire locations. The Avon tower also doubles as a communications tower for six hydro-meteorological stations and a seismic monitoring station in the catchments.

Early suppression of fire, where feasible, is a strategic means of preventing large fires developing. In order to achieve this early suppression, NPWS maintains the capacity to deploy specialised remote area fire teams to rapidly respond to new ignitions.

Desired outcomes

- Negative impacts of fire on life, property and cultural and community assets including water management infrastructure and water quality are minimised.
- Fire regimes are appropriate for the protection of biodiversity, with fire-sensitive plant communities such as rainforest protected from bushfire.
- Significant cultural heritage features are protected from damage by bushfires and bushfire suppression activities.
- Cooperative arrangements for fire management are maintained.

Management response

4.2.1 Undertake fire management in accordance with the park fire management strategy and integrate it with fire management for the remainder of the Metropolitan Special Area.

4.2.2 Prepare and implement annual fire management works schedules in accordance with the fire management strategy and in consultation with WaterNSW, Wollondilly and Wingecarribee shire councils, and other relevant regulatory authorities where needed.

4.2.3 During wildfire planning and suppression, seek to maintain a proportion of core habitat for koalas as unburnt.

4.2.4 Wherever possible, avoid the use of heavy machinery for fire suppression in wetlands, threatened ecological communities and areas with threatened plant species or archaeological sites.

4.2.5 Rehabilitate areas disturbed by fire suppression operations as soon as practical after fire to facilitate recovery and minimise impacts on water quality.

4.2.6 Support research to guide fire management in the park, including post-fire monitoring where needed.

4.2.7 Participate on the Southern Highlands Bush Fire Management Committee to ensure a coordinated approach to bushfire planning and management and practices that recognise the park's natural, cultural and water catchment values.

4.2.8 Continue to work collaboratively with WaterNSW to provide and support specialised rapid response remote area fire teams.

4.3 Climate change

Human-induced climate change is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000a) and the associated loss of habitat is listed under the Environment Protection and Biodiversity Conservation Act (TSSC 2001).

The latest information on projected changes to climate are from the NSW and ACT Regional Climate Modelling ('NARCliM') project (OEH 2014). The climate projections for 2020–39 are described as 'near future' (or as 2030) and projections for 2060–79 are described as 'far future' (or as 2070). This modelling divides New South Wales and the Australian Capital Territory into regions and provides climate change predictions for each region. Upper Nepean State Conservation Area includes three NARCliM regions: South East and Tablelands, which covers most of the park; Metropolitan Sydney, which covers the northern parts of the park; and Illawarra, which covers the southern section of the park. The snapshot shown in Table 3 is for the South East and Tablelands Region (OEH 2014). The climate change predictions for Metropolitan Sydney and Illawarra regions are similar to those shown in Table 3.

Table 3 South East and Tablelands climate change snapshot

Projected temperature changes	
Maximum temperatures are projected to **increase** in the near future by 0.5–1.0°C	Maximum temperatures are projected to **increase** in the far future by 1.8–2.5°C
Minimum temperatures are projected to **increase** in the near future by 0.4–0.7°C	Minimum temperatures are projected to **increase** in the far future by 1.4–2.3°C
The number of hot days will **increase**	The number of cold nights will **decrease**
Projected rainfall changes	
Rainfall is projected to **decrease** in spring and winter	Rainfall is projected to **increase** in summer and autumn
Projected Forest Fire Danger Index changes	
Average fire weather is projected to **increase** in summer and spring	Number of days with severe fire weather is projected to **increase** in summer and spring

Source: OEH 2014.

The projected increases in temperature, number of hot days and severe fire weather days (OEH 2014) are likely to influence bushfire frequency and intensity across the Illawarra region and result in an earlier start to the bushfire season. Higher rainfalls in summer and autumn are likely to increase runoff and accelerate all forms of soil erosion across the region, which may adversely impact water quality values in the drinking water catchment.

Climate change may significantly affect biodiversity by changing the size of populations and the distribution of species and altering the geographical extent and species composition of habitats and ecosystems. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or slow growth rates.

The specific impacts of climate change on the park are difficult to assess since they will depend on the compounding effects of other pressures, particularly barriers to migration and pressure from weeds and feral animals. However, it is likely that wetlands, moist open forest and rainforest will be under greater stress from fire and drought. In particular, threatened ecological communities including Robertson Rainforest, Robertson Basalt Tall Open-forest and Southern Highlands Shale Forest may be highly vulnerable to climate change (Eco Logical Australia 2010).

Landscape connections between Upper Nepean State Conservation Area and other large natural areas allow species migration and may assist to limit adverse impacts from climate change. Programs to reduce pressures arising from habitat loss, fragmentation and introduced species will help reduce the severity of the effects of climate change on native species.

Substantially increased runoff in summer (DECCW 2010) is expected to result in increased inflows into the Metropolitan Special Area storages. Projections of increased storm activity and high intensity rainfall in summer between extended dry periods are likely to result in more rapid and more extreme changes in water quality. Large, intense bushfires could result in large quantities of ash, phosphorous, nitrogen and organic matter being washed into storages with heavy rainfall following the fire. An increase in extreme wet weather events may result in an increased risk of major pollution incidents and increased nutrient loading.

WaterNSW and NPWS are collaborating with other agencies and research partners to better understand climate change impacts on biodiversity and water supply.

Desired outcome

- The impacts of climate change on water quality and natural systems, particularly threatened ecological communities, threatened species and wetlands, are minimised.

Management response

4.3.1 Continue fire, pest and weed management, public access restrictions and other programs, and adapt where required, to minimise climate change–induced threats and protect water quality.

5. Management operations and other uses

5.1 Management operations and facilities

Management and water supply operations are undertaken in the park by NPWS, WaterNSW and Sydney Water Corporation in accordance with the objectives of each agency's respective legislation.

Management access is provided by a network of management trails in the park, called fire roads, established to facilitate water monitoring, fire management and other operations. WaterNSW maintains perimeter management trails (parts of fire roads 1, 6M and 11) and roads and management trails to stored water assets (Avon Dam Road, fire roads 6 and 11A). Other management trails are maintained by NPWS.

The management trails generally utilise ridgetops and have been located to minimise adverse impacts on water quality. All are unsealed but, as stated in Section 3.2, most have concrete creek crossings. While well-located and maintained, management trails contribute to habitat fragmentation and sediment in waterways. Ongoing maintenance of management trails must consider the erosion potential of soils on the Woronora Plateau, and aim to avoid soil loss and subsequent sedimentation of waterways.

Nepean Dam Road and Avon Dam Road provide access for water authority and NPWS management as well as public access to the dam picnic areas (see Figure 2 and Section 3.6). These are sealed roads maintained by WaterNSW. They are located in an easement favouring WaterNSW and Sydney Water Corporation.

Water supply infrastructure

While the major infrastructure associated with water supply operations is located outside the park in operational envelopes surrounding Nepean and Avon dams, a number of facilities are distributed through the park. WaterNSW maintains perimeter fencing, gates and entry signage (see Section 3.2), the Avon Fire Tower (see Section 4.2) and water supply infrastructure (see Section 3.2). There are also stations for monitoring weather, water supply, water quality and dam safety scattered throughout the park. Water authority infrastructure known to occur in the park is listed in Appendix F. All built assets required by WaterNSW or Sydney Water Corporation to carry out their statutory functions for water supply and catchment protection will continue to be owned and operated by them. Where these assets pre-date the reservation of Upper Nepean State Conservation Area, they are recognised as 'existing interests' under section 47H of the National Parks and Wildlife Act.

WaterNSW may need to establish additional monitoring sites and other water supply facilities in the park. There are several such measures outlined in the *2017 Metropolitan Water Plan* and the *Illawarra Water Security Project* that will involve additional infrastructure development in the park, including borefield, transfer tunnel and deep water access projects.

WaterNSW has undertaken preliminary sampling and modelling of the borefield and is conducting environmental assessments and seeking planning approval for its construction and operation. The project would involve the development of a system of pipelines and associated pumping stations, water treatment facilities and powerlines.

The development of the transfer tunnel project would allow the underground transfer of water between Fitzroy Falls Reservoir and the Avon Dam and support the maintenance of more natural flow regimes in creeks and rivers (see Section 3.2). The construction of a drop shaft will require the extension and upgrade to (dormant) Fire Road 15B in the southern part of the state conservation area and along the boundary of the proposed additions to the park. The proposed road would connect Fire Road 1 (a WaterNSW/NPWS road) to Fire Road 15A in the small portion of Upper Nepean State Conservation Area adjoining Macquarie Pass National Park.

The *Illawarra Water Security Project* includes a proposal to access and use deep water from Avon Dam. The components are construction of a deep-water pumping station at Avon Dam, a new pipeline transferring the water to the existing Illawarra Water Filtration Plant, and the upgrade and realignment of powerline infrastructure from the dam to the energy provider's main line. These powerline works involve upgrading of overhead or trenched lines along upgraded Fire Road 4 and Avon Dam Road in the north of the park.

In order for the Minister to grant any new leases, licences, easements or rights of way for water infrastructure within a special area under section 153B of the National Parks and Wildlife Act, the park plan of management must identify the purpose and term of any such lease, licence, easement or right of way and its location. If new works for water transfers, groundwater access, water monitoring or other appropriate facilities are required:

- the lease, licence, easement or right of way will be vested in the Chief Executive Officer of WaterNSW
- any lease, licence, easement or right of way associated with the works shall be for an indefinite term, unless a lesser period is appropriate
- the location and extent of such works shall be identified in this plan of management and subject to an appropriate level of environmental impact assessment.

Desired outcomes

- NPWS and WaterNSW facilities adequately serve management and water supply needs and have acceptable environmental impact.

Management response

5.1.1 In liaison with WaterNSW, ensure that management operations avoid adverse impacts on the park's values and complement the protection and management of the Metropolitan Special Area to the east of the park.

5.1.2 Work collaboratively with WaterNSW on programs such as pest control, fire management and law enforcement.

5.1.3 Maintain the network of management trails shown in Figure 2 to an appropriate standard to avoid impacts on conservation or water quality values.

5.1.4 In conjunction with WaterNSW, regularly review the management trail network. Close any trails no longer required for management purposes and allow them to regenerate. Seek to minimise trails, especially through upland swamps or other dense vegetation, to protect habitat continuity and hinder movement of introduced predators.

5.1.5 Continue to allow the maintenance of existing water authority infrastructure in the park. Develop easement, lease or licence agreements, where needed, to permit upgrading or operation of existing assets and for any new assets that may be proposed as part of WaterNSW infrastructure projects identified in this plan. Allow the upgrade and extension of fire roads if required for the development of WaterNSW infrastructure projects.

5.2 Other uses

Other utilities

A number of other utilities operated by third parties also exist within the park, including transmission lines, fibre-optic cables, coaxial cables and the Moomba gas pipeline. Current interests are listed in Appendix G.

The majority of third-party interests in the park form corridors of cleared vegetation and require access to infrastructure for maintenance purposes. They contribute to cumulative adverse environmental impacts through habitat fragmentation, weed introduction, feral animal predation

and sediment runoff. Any increase in alien uses that require clearing of vegetation and ground surface disturbance, whether during construction or maintenance, would be incompatible with protection of conservation values and water quality.

Leases or other authorisations that existed at the time of reservation are recognised as existing interests under section 47H of the National Parks and Wildlife Act, and these former arrangements can continue. There are statewide agreements with some of the infrastructure managers including Integral Energy, TransGrid and Telstra, and easements are in place for some utilities. However, some existing uses, such as the Wingecarribee Shire Council use of the former quarry at Mount Butler for storage of road building materials and access to Burrawang Robertson Water Supply, are not presently covered by a lease, licence, easement or agreement. It is in the interests of both the holder of an existing interest and NPWS to formalise a clear understanding of respective responsibilities, especially regarding the need to avoid potential environmental or cultural impacts during ongoing management of facilities. Formal arrangements can address issues such as use and maintenance of access routes, clearing of vegetation under transmission lines and use of herbicides.

Mining and exploration

As described in Section 2.2, exploration for minerals and petroleum, as well as mining and petroleum production, are permissible uses within state conservation areas.

NPWS will work with the relevant regulatory authority to ensure that exploration and production proposals in state conservation areas comply with all statutory requirements, including any necessary environmental impact assessments and approvals.

As landowners, WaterNSW and NPWS actively contribute to the planning assessment process for mining and coal seam gas proposals, including exploration activities, in the drinking water catchments. WaterNSW and NPWS provide advice to assessment authorities, including seeking to amend proposals and seeking the inclusion of conditions of approval that will avoid or minimise impacts on water quality, quantity and ecological and heritage values (Water NSW & OEH 2015).

To date, coalmining has not occurred within the park, unlike the remainder of the Metropolitan Special Area to the east. Leases for coalmining and licences for coal and petroleum exploration have been granted over the park and two mining exploration boreholes have been installed. In November 2013 the NSW Government placed a hold on exploration and extraction of coal seam gas in the special areas of the Sydney drinking water catchment. Mining and mineral exploration activity may be proposed in future.

Transport corridors

Three railway lines run through the park but are excluded, or partly excluded, from the park:

- Moss Vale – Unanderra Railway (a 3.5-kilometre line in the south-east section of the park near Mount Murray) — corridor excluded from the park.
- Main Southern Railway (three disjunct sections, in the vicinity of Bargo, Yanderra and Alpine respectively, total distance about six kilometres, generally aligned along the western boundary of park) — corridor excluded from the park.
- Maldon–Dombarton Railway (a partially constructed line in the north-east part of the park, comprising a cleared formed corridor laid with ballast) — corridor excluded for the section north of Fire Road 11B but the remainder where it traverses the park is managed by NPWS under Part 11 of the National Parks and Wildlife Act.

The Maldon–Dombarton Railway project was reopened in 2014. The NSW Government invited private sector proponents to submit proposals to construct, operate and maintain the railway. No respondent was found capable to construct, operate and maintain the railway on a commercially sustainable basis without substantial ongoing NSW Government funding. The Maldon–Dombarton Railway is currently included as a ‘priority initiative’ in Infrastructure Australia’s Priority List with the business case under assessment (TfNSW 2016).

Orfords Road, Rowlands Road and parts of Tourist Road are located within lands proposed for addition to the park but are maintained by Wingecarribee Shire Council. These anomalies should be addressed through appropriate boundary adjustments.

Works on the railway corridors and the public roads running through the park, including repair of sealed surfaces, ballast replenishment and drainage works, have the potential to affect park values.

Part 11 lands west of Hume Motorway

As identified in Section 1.1, there are several parcels of unreserved lands west of the Hume Motorway that are vested in the Minister administering the National Parks and Wildlife Act for the purposes of Part 11 of that Act. These lands were acquired from Water NSW.

These lands have been assessed for their conservation values and their utility for park management or emergency services purposes. NPWS will retain Lot 1 DP 744545 as it is well situated to support potential development of office accommodation and workshop facilities for fire and park management purposes. NPWS may enter into a lease arrangement with emergency services for the shared use of these facilities. The remaining Part 11 lands will be considered for sale or transfer of ownership.

Trigonometrical stations

Several trigonometrical stations are located on high points within the park including at Mount Cotopaxi, Mount Lindsey, Cupitts Forest and at the Avon Fire Tower. An agreement between NPWS and the former Central Mapping Authority provides continued right of access to the stations for survey purposes, subject to environmental impact assessment.

Crown lands

Areas of Crown land exist within and adjacent to the park, including an area near Mount Lindsey and one east of Macquarie Hill. If added to the park, this latter portion of Crown land would provide an excellent connection between the park and Macquarie Pass National Park.

Access to private land

Access through the park to four areas of private property is currently authorised (see Table 4). These authorisations are recognised as existing interests under section 47H of the National Parks and Wildlife Act. Where appropriate, NPWS may seek to amend the conditions of the existing interest or replace it with a lease, licence or easement granted under section 153C the National Parks and Wildlife Act.

Table 4 Access by private landowners

Purpose	Held by
Easement created and registered for right of carriageway and services (DP 1067992), off Buckmans Lane, Single Tree Hill	Registered proprietor of Lot 1 DP 795446 and Lot 2 DP 751282
Property access from Diamond Fields Road and Fire Road 3, Mittagong	Registered proprietor of Lot 9 DP 751282
Property access off Mount Murray Road, adjacent to railway	Registered proprietor of Lot 16 DP 215550
Right of way off Tourist Road at Mount Butler	Registered proprietor of Lot 122 DP 751277

Desired outcomes

- Non-NPWS uses of the park have minimal environmental impact.
- The impacts of mining and mineral exploration activities on the park are mitigated.
- Appropriate access and maintenance arrangements are in place for private property access and for third-party infrastructure and use.

Management response

5.2.1 Arrange easements, licences or other formal agreements for existing third-party assets where needed, and for any new assets that are developed. Agreements will include, where relevant, measures for maintenance of the facility and the access trail by the licence holder, and measures to minimise impacts on ecological integrity, cultural heritage and water quality.

5.2.2 Ensure applications for mining, mineral exploration or gas exploration and extraction are subject to environmental assessment in accordance with the memorandum of understanding between NPWS and the relevant regulatory authority. In particular, seek to avoid disturbance to important features and values, including the hydrology of upland swamps and water quality in the park's rivers and streams.

5.2.3 Develop and implement a program for overseeing all aspects of the third-party interests including:

- an audit of all sites and their associated access trails, carried out in consultation with interest holders
- arrangements to address issues of access, maintenance, impacts on conservation and catchment values and other relevant issues
- ongoing monitoring of compliance with licence conditions.

5.2.4 Continue to permit existing access to private property through the park. Enter into trail maintenance agreements where needed.

5.2.5 Seek to exclude from the park Orfords Road, Rowlands Road and those parts of Tourist Road located within WaterNSW's lands identified as additions to the state conservation area.

5.2.6 Continue to authorise access for use and maintenance of the trigonometrical stations in accordance with existing or future formal agreements between NPWS and the relevant regulatory authority.

5.2.7 Seek to include within the park the Crown land inholdings and adjacent areas of Crown land.

5.2.8 Retain, reserve or seek to dispose or transfer ownership of Part 11 lands as appropriate.

6. Implementation

This plan of management establishes a scheme of operations for the park.

Identified activities for implementation are listed in the table below. Relative priorities are allocated against each activity as follows:

- **High priority** activities are essential to achieve 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 necessary to achieve the objectives and desired outcomes but not urgent.
- **Low priority** activities are desirable to achieve the objectives and desired outcomes but can be deferred in preference to other priorities.
- **Ongoing** activities are undertaken on an annual basis or in response to 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 National Parks and Wildlife Act.

Action no.	Management responses	Priority
	Geodiversity	
3.1.1	Minimise disturbance of significant landforms, particularly the volcanic features, upland swamps and gorges, in order to protect geodiversity and the park's natural landscapes.	Ongoing
3.1.2	As far as practicable, avoid earthworks in areas and soils identified as having very high erosion hazards. Apply appropriate erosion and sediment controls for all works, including maintenance activities. Revegetate disturbed areas where appropriate.	High
3.1.3	Confine any new infrastructure to previously disturbed sites wherever possible.	Ongoing
	Water supply and water quality	
3.2.1	Ensure management operations are planned and undertaken to avoid adverse impacts on water quality using best practice and up-to-date knowledge, including the results of WaterNSW water quality monitoring. Include in any environmental assessment for an activity in the park an assessment of whether it will have a neutral or beneficial effect on water quality and water-dependent ecosystems.	High
3.2.2	Maintain and, where necessary, upgrade drains, causeways and culverts on management trails.	High
3.2.3	Continue to adhere to the WaterNSW access policy and protocol that restricts vehicular access for authorised stakeholders during and immediately following threshold rainfall events.	Ongoing
3.2.4	In conjunction with WaterNSW, encourage neighbouring landowners to participate in programs like the Healthy Catchments Program to help protect water quality.	Low
3.2.5	Participate in the development of water sharing plans or other initiatives as appropriate, to ensure the needs of water-dependent ecosystems are adequately protected through environmental flow regimes.	Medium
	Native plants	
3.3.1	Implement relevant actions in the *Biodiversity Conservation Program* and recovery plans for threatened plants and communities occurring in the park.	High
3.3.2	As far as possible, protect threatened ecological communities and other priority habitats, such as riparian vegetation, from disturbance.	High

Action no.	Management responses	Priority
3.3.3	Prioritise the restoration of those cleared and disturbed areas where threatened ecological communities occur.	Medium
	Native animals	
3.4.1	Implement relevant actions from the *Biodiversity Conservation Program* and recovery plans for threatened native animal species occurring in the park.	High
3.4.2	Liaise with WaterNSW, local Councils and adjoining landholders to encourage catchment and land management practices that protect and conserve threatened native animal species and enhance habitat connectivity across the landscape.	Low
3.4.3	In liaison with WaterNSW, encourage research that improves understanding of the significance of the park for platypus and informs future management of the headwaters of the Nepean River within the park.	High
3.4.4	Investigate the feasibility and suitability of reintroducing species to the park that have become locally extinct.	Low
3.4.5	Replace creek crossings on management trails with crossings that will improve fish-passage when the crossings need to be upgraded or replaced.	Low
	Aboriginal connections to Country and shared heritage	
3.5.1	Consult and involve relevant groups, including Illawarra and Tharawal local Aboriginal land councils, in all aspects of management of Aboriginal cultural values.	High
3.5.2	Conduct a site assessment for Aboriginal or historic heritage before all new works involving ground disturbance.	Ongoing
3.5.3	Assess the condition of 5–10 Aboriginal sites each year. If needed, develop management strategies for Aboriginal sites to ensure their protection.	Medium
3.5.4	Seek to rename the park with an Aboriginal name in consultation with Aboriginal communities, in recognition of Aboriginal people's connections to the area.	Medium
3.5.5	Protect and conserve historic heritage values based on their heritage significance.	Ongoing
3.5.6	Prepare conservation management plans for heritage items in the park which are listed on the State Heritage Register.	Medium
3.5.7	Maintain safety fencing and signage in the 'Diamond Fields' area and at Mount Cotopaxi.	Medium
3.5.8	Undertake priority actions from the heritage assessment report for the Nepean Dam model spillway.	Low
	Public use and research	
3.6.1	WaterNSW will continue to manage access to the park in accordance with its access policy.	Ongoing
3.6.2	Liaise with WaterNSW regarding the provision of information at the Nepean Dam picnic area about the park and its natural, cultural and water quality values. Consider providing information at other locations if appropriate.	Medium
3.6.3	In conjunction with WaterNSW, permit research that is aimed at enhancing understanding of the park's values and informing future management. Research that is unrelated to the park or to water supply or water quality issues will not be permitted.	Ongoing
3.6.4	In conjunction with WaterNSW, implement measures to limit unauthorised access and associated impacts on park values.	Medium

Action no.	Management responses	Priority
	Pests	
4.1.1	Manage pest species in line with pest management strategies relevant to the park.	Ongoing
4.1.2	Continue to monitor pests and to undertake targeted pest control programs in collaboration with WaterNSW, owners of third-party infrastructure and adjoining landowners where relevant.	High
4.1.3	Liaise with road and rail authorities in relation to controlling weeds and rubbish dumping along the western boundary of the park.	Medium
	Fire management	
4.2.1	Undertake fire management in accordance with the park fire management strategy and integrate it with fire management for the remainder of the Metropolitan Special Area.	Ongoing
4.2.2	Prepare and implement annual fire management works schedules in accordance with the fire management strategy and in consultation with WaterNSW, Wollondilly and Wingecarribee shire councils and other relevant regulatory authorities where needed.	High
4.2.3	During wildfire planning and suppression, seek to maintain a proportion of core habitat for koalas as unburnt.	High
4.2.4	Wherever possible, avoid the use of heavy machinery for fire suppression in wetlands, threatened ecological communities and areas with threatened plant species or archaeological sites.	Ongoing
4.2.5	Rehabilitate areas disturbed by fire suppression operations as soon as practical after fire to facilitate recovery and minimise impacts on water quality.	Medium
4.2.6	Support research to guide fire management in the park, including post-fire monitoring where needed.	Low
4.2.7	Participate on the Southern Highlands Bush Fire Management Committee to ensure a coordinated approach to bushfire planning and management and practices that recognise the park's natural, cultural and water catchment values.	High
4.2.8	Continue to work collaboratively with WaterNSW to provide and support specialised rapid response remote area fire teams.	Ongoing
	Climate change	
4.3.1	Continue fire, pest and weed management, public access restrictions and other programs, and adapt where required, to minimise climate change–induced threats and protect water quality.	Ongoing
	Management operations and facilities	
5.1.1	In liaison with WaterNSW, ensure that management operations avoid adverse impacts on the park's values and complement the protection and management of the Metropolitan Special Area to the east of the park.	Ongoing
5.1.2	Work collaboratively with WaterNSW on programs such as pest control, fire management and law enforcement.	Ongoing
5.1.3	Maintain the network of management trails shown in Figure 2 to an appropriate standard to avoid impacts on conservation or water quality values.	High
5.1.4	In conjunction with WaterNSW, regularly review the management trail network. Close any trails no longer required for management purposes and allow them to regenerate. Seek to minimise trails, especially through upland swamps or other dense vegetation, to protect habitat continuity and hinder movement of introduced predators.	Medium
5.1.5	Continue to allow the maintenance of existing water authority infrastructure in the park. Develop easement, lease or licence agreements, where needed, to	Low

Action no.	Management responses	Priority
	permit upgrading or operation of existing assets and for any new assets that may be proposed as part of WaterNSW infrastructure projects identified in this plan. Allow the upgrade and extension of fire roads if required for the development of WaterNSW infrastructure projects.	
	Other uses	
5.2.1	Arrange easements, licences or other formal agreements for existing third-party assets where needed, and for any new assets that are developed. Agreements will include, where relevant, measures for maintenance of the facility and the access trail by the licence holder, and measures to minimise impacts on ecological integrity, cultural heritage and water quality.	Low
5.2.2	Ensure applications for mining, mineral exploration or gas exploration and extraction are subject to environmental assessment in accordance with the memorandum of understanding between NPWS and the relevant regulatory authority. In particular, seek to avoid disturbance to important features and values, including the hydrology of upland swamps and water quality in the park's rivers and streams.	Ongoing
5.2.3	Develop and implement a program for overseeing all aspects of the third-party interests including: • an audit of all sites and their associated access trails, carried out in consultation with interest holders • arrangements to address issues of access, maintenance, impacts on conservation and catchment values and other relevant issues • ongoing monitoring of compliance with licence conditions.	Medium
5.2.4	Continue to permit existing access to private property through the park. Enter into trail maintenance agreements where needed.	Low
5.2.5	Seek to exclude from the park Orfords Road, Rowlands Road and those parts of Tourist Road located within WaterNSW's lands identified as additions to the state conservation area.	High
5.2.6	Continue to authorise access for use and maintenance of the trigonometrical stations in accordance with existing or future formal agreements between NPWS and the relevant regulatory authority.	Ongoing
5.2.7	Seek to include within the park the Crown land inholdings and adjacent areas of Crown land.	Low
5.2.8	Retain, reserve or seek to dispose or transfer ownership of Part 11 lands as appropriate.	Medium

Appendices

Appendix A Vegetation communities identified in the park

Broad structural group (% total vegetation)	Vegetation community (Mapping Unit – NPWS 2003)	Extent (ha)	Threatened ecological community
Shale sandstone transition forests and woodlands (approx. 4%)	Cumberland Shale Plains Woodland (MU21)	7	Cumberland Plain Woodland
	Transitional Shale Dry Ironbark Forest (MU22)	830	Shale Sandstone Transition Forest
	Transitional Shale Stringybark Forest (MU23)	234	Shale Sandstone Transition Forest
Elevated Mittagong sandstone woodland-heath (approx. 3%)	Highland Sandstone Scribbly Gum Woodland (MU31)	878	
	Highland Sandstone Allocasuarina Heath (MU41)	59	
Sandy scrubs (approx. 1%)	Sandstone Riparian Scrub (MU4)	230	
	Rock Pavement Heath (MU38)	37	
	Upland Swamps: Tea-tree Thicket (MU43)	7	Coastal Upland Swamp
Tall open grassy forests on enriched soils (approx. 11%)	Nepean Gorge Moist Forest (MU9)	353	
	Robertson Basalt Brown Barrel Forest (MU10)	148	Robertson Basalt Tall Open-forest
	Moist Shale Messmate Forest (MU11)	421	Robertson Basalt Tall Open-forest
	Highlands Ribbon Gum Gully Forest (MU12)	439	Southern Highlands Shale Woodlands (part)
	Highlands Alluvial Red Gum Woodland (MU24)	10	Southern Highlands Shale Woodlands
	O'Hares Creek Shale Forest (MU17)	9	O'Hares Creek Shale Forest
	Highlands Shale Tall Open Forest (MU18)	2,021	Southern Highlands Shale Woodlands
Rainforests and moist eucalypt forests (less than 1%)	Coachwood Warm Temperate Rainforest (MU2)	17	
	Robertson Cool–Warm Temperate Rainforest (MU3)	2	Robertson Rainforest
	Moist Gully Gum Forest (MU8)	5	
Exposed sandstone woodlands and heath (approx. 53%)	Exposed Sandstone Scribbly Gum Woodland (MU29)	9,360	
	Nepean Enriched Sandstone Woodland (MU30)	5,411	

Broad structural group (% total vegetation)	Vegetation community (Mapping Unit – NPWS 2003)	Extent (ha)	Threatened ecological community
	Upper Georges River Sandstone Woodland (MU35)	963	
	Budawang Ash Mallee Scrub (MU36)	9	
	Rock Plate Heath–Mallee (MU39)	203	
Sandstone gully forests (approx. 24%)	Sandstone Gully Peppermint Forest (MU26)	1,451	
	Nepean Sandstone Gully Forest (MU27)	5,578	
	Western Sandstone Gully Forest (MU28)	11	
	Escarpment Edge Silvertop Ash Forest (MU32)	170	
Upland swamp complex and freshwater wetlands (approx. 3%)	Upland Swamps: Banksia Thicket (MU42)	27	Coastal Upland Swamp
	Upland Swamps: Sedgeland–Heath Complex (MU44)	225	Coastal Upland Swamp
	Upland Swamps: Fringing Eucalypt Woodland (MU45)	125	
	Upland Swamps: Mallee–Heath (MU46)	31	
	Highlands Sandstone Swamp Woodland (MU47)	400	
	Highlands Swamp Gum – Melaleuca Woodland (MU48)	89	
Regenerating vegetation (less than 1%)	Recolonisation of cleared or heavily disturbed vegetation (includes 0.8 ha Acacia Scrub MU56A, NPWS 2002)	2	
Weeds and exotics (less than 1%)		4	
Cleared (approx. 1%)		382	
Total area		**30,148**	

Source: NPWS 2002, 2003.

Appendix B Threatened ecological communities in the park

Threatened ecological community (*BC Act status*)	Corresponding vegetation communities (mapping unit / MU number)	Area (ha)
Shale Sandstone Transition Forest (*critically endangered*)	Transitional Shale Dry Ironbark Forest ('Bargo Brush') (MU22) Transitional Shale Stringybark Forest (MU23)	1064
Shale Sandstone Transition Forest in the Sydney Basin Bioregion (NSW SC 2014) occurs along the western edge of the park near Bargo, where shale soils of the Cumberland Plain interface with the sandstone geologies of the Mittagong and Hawkesbury formations, or occasionally where remnant caps of shale soil occur on top of sandstone geologies at disjunct locations. Species composition reflects the ecotone between the two environments. The richer shale soil results in a grassy woodland and open forest, but where the sandstone influence is greater a more pronounced shrub layer occurs. Small areas occur in only three conservation reserves. Currently, no Transitional Shale Dry Ironbark Forest is protected and only 2.5% of Transitional Shale Stringybark Forest is protected elsewhere within the NSW reserve system (NPWS 2003). Therefore the 1064 hectares of this threatened ecological community (TEC) in the park is highly significant to the conservation of this community. This TEC is listed as endangered under the Environment Protection and Biodiversity Conservation Act.		
Southern Highlands Shale Woodlands (*endangered*)	Highlands Shale Tall Open Forest – part (MU18) Highlands Ribbon Gum Gully Forest (MU12) Highlands Alluvial Red Gum Woodland (MU24)	2470
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion (NSW SC 2001) occur only on Wianamatta Group shale in the Southern Highlands at elevations between 600 and 800 metres. A 5-kilometre band stretches across the southern edge of the park to the Illawarra Escarpment, with elevation ranging between about 600 and 800 metres (NSW SC 2001). By far the largest component community occurring in the park is Highlands Shale Tall Open Forest, totalling over 2200 hectares. It is characterised by tall eucalypts up to 35 metres in height, above a sparse shrub and small tree layer. Highlands Alluvial Red Gum Woodland occurs on the poorly drained alluvial flats that surround Chain of Ponds Creek near Aylmerton and along the slopes of the Burke River. This community has an open grassy understorey. The third component community, Highlands Ribbon Gum Gully Forest, occurs in deeper gully lines in the far south-west corner of the park. Further sampling of Highlands Ribbon Gum Gully Forest is required to establish diagnostic species. As none of the component communities are represented in other parks, the protection of 2470 hectares represents a significant contribution to its conservation. This TEC is not listed under the Environment Protection and Biodiversity Conservation Act.		
Robertson Basalt Tall Open-forest (*critically endangered*)	Robertson Basalt Brown Barrel Forest (MU10) Moist Shale Messmate Forest (MU11)	569
Robertson Basalt Tall Open-forest in the Sydney Basin and South Eastern Highlands Bioregions (NSW SC 2016) is restricted to moist, elevated areas on fertile soils associated with Tertiary volcanics on the Robertson Plateau and at Sassafras. It is known to occur at elevations between 650 and 850 metres where mean annual rainfall is in the range 1000–1450 mm (NSW SC 2016). Within the park, it occurs at Mount Butler and west of Mount Murray. The majority of the TEC occurs on private land in very small patches. Degradation of these tall open-forests by past practices is likely to have reduced the diversity of species that may once have occurred. Similarly, the vegetation in many remnants may have changed from a tall open forest structure to an open forest or woodland structure due to clearing and disturbance. None of Robertson Basalt Brown Barrel Forest and only about 11% of extant Moist Shale Messmate Forest is currently reserved. Therefore the 569 hectares being protected in the park near Mount Murray – East Kangaloon is significant to this community's ongoing conservation. This TEC is listed as endangered under the Environment Protection and Biodiversity Conservation Act and is referred to as Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion.		

Threatened ecological community (*BC Act status*)	Corresponding vegetation communities (mapping unit / MU number)	Area (ha)
Robertson Rainforest (*endangered*)	Robertson Cool–Warm Temperate Rainforest (MU3)	2
Robertson Rainforest in the Sydney Basin Bioregion (NSW SC 2011) occurs in the south-east edge of the park at Macquarie Hill on the high-elevation basalt soils. The underlying basalt geology distinguishes it from the other types of rainforest occurring in the Metropolitan Special Area. This rainforest type is thought to have once been extensive across the plateau but is now severely depleted. Only 571 hectares remain in total and only 1% of its extant area is currently reserved. The majority occurs on private land in a highly fragmented state. This TEC is not listed under the Environment Protection and Biodiversity Conservation Act.		
O'Hares Creek Shale Forest (*endangered*)	O'Hares Creek Shale Forest (MU17)	9
O'Hares Creek Shale Forest (NSW SC 1998b) is extremely restricted in its distribution, occurring on remnant shale soils that lie as isolated caps above the extensive sandstone plateau between the watersheds of O'Hares and Woronora catchments. Trees of the upper canopy are distinctively taller than the surrounding sandstone woodland vegetation. The park contains one of a number of isolated patches about four kilometres south of the junction of the Avon and Cordeaux rivers, adjoining Fire Road 6B. Only 285 hectares of this TEC remain in total. Of this, 23 hectares or 8.2% is protected in reserves. This TEC is not listed under the Environment Protection and Biodiversity Conservation Act.		
Cumberland Plain Woodland (*critically endangered*)	Cumberland Shale Plains Woodland (MU21)	7
Cumberland Plain Woodland in the Sydney Basin Bioregion (NSW SC 2009b) occurs predominantly on soils derived from Wianamatta Group shale while isolated patches may be found on soils derived from the Mittagong Formation, but only in the vicinity of outcrops of almost pure shale. In the park, a fragment of Cumberland Shale Plains Woodland occurs on the eastern extremity, on part of Portion 62 Parish of Wilton. The community is severely depleted and of very high conservation significance and it was estimated in 1988 that only 6% of the original extent of the community remained (Benson & Howell 1990). The remaining TEC is most widely distributed on the Cumberland Plain and within the Metropolitan Special Area is restricted to an area of 112 hectares on the extreme north-west edge in the vicinity of Broughtons Pass. Only 8% of the current extent of this TEC is protected in reserves. This TEC is nationally listed as critically endangered and is referred to as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.		
Coastal Upland Swamp (*endangered*)	Upland Swamps Banksia Thicket (MU42) Upland Swamps Tea-tree Thicket (MU43) Upland Swamps Sedgeland–Heath Complex (MU44)	259
Coastal Upland Swamp in the Sydney Basin Bioregion (NSW SC 2012) occurs primarily on impermeable sandstone plateaus with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams and on sandstone benches with abundant seepage moisture. These are the swamps on more fertile substrates and the peaty or sphagnum-containing swamps (Douglas 2011). Some small areas of the TEC Montane Peatland and Swamp (NSW SC 2010) may occur on the southern edges of the park, south-east of Robertson Burrawang Water Supply. More detailed assessment is needed to determine which swamps should be classified as TEC.		

Appendix C Threatened native plant species recorded in the park

Bargo geebung (*Persoonia bargoensis*) — endangered (Biodiversity Conservation Act); vulnerable (Environment Protection and Biodiversity Conservation Act)

- erect bushy shrub to 2.5 metres high
- woodland or forest on sandstone and loamy gravelly soils
- highly restricted distribution bounded by Picton, Douglas Park, Yanderra and Cataract River
- populations are very small and scattered, with total population likely to be less than 250
- fire-sensitive and appears to require a minimum fire frequency of 10–15 years between fires
- threatened by slashing of vegetation along fire trails and inappropriate fire regimes.

Brown pomaderris (*Pomaderris brunnea*) — vulnerable (Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act)

- shrub to three metres high
- grows in moist woodland or forest on floodplains and creek lines
- found in a very limited area around the Colo, Nepean and Hawkesbury rivers, and near Walcha on the New England Tablelands
- threatened by too-frequent burning and weed invasion.

Bynoe's wattle (*Acacia bynoeana*) — endangered (Biodiversity Conservation Act); vulnerable (Environment Protection and Biodiversity Conservation Act)

- semi-prostrate shrub to one metre high
- occurs in heath or dry sclerophyll forest on sandy soils
- about 30 very small populations between the Hunter Valley and Southern Highlands – Shoalhaven
- small populations susceptible to localised extinction
- commonly on trail margins and therefore at risk from road maintenance and weed invasion.

Deane's paperbark (*Melaleuca deanei*) — vulnerable (Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act)

- a shrub to three metres high
- occurs in heath on sandstone
- extremely fragmented in 75 known populations
- threats are small size of populations, frequent fire, limited capacity to regenerate
- locations on edge of trails increase susceptibility to disturbance including changes in runoff and weed encroachment.

Epacris purpurascens var. *purpurascens* — vulnerable (Biodiversity Conservation Act); not listed (Environment Protection and Biodiversity Conservation Act)

- an erect shrub 50–150 centimetres high
- occurs in sclerophyll forest, scrubs and swamps
- currently known from about 30 locations, the largest occurring within Water NSW catchments
- main threats are clearing and frequent fire
- susceptible to localised extinctions due to fragmented and small size of populations.

Hairy geebung (*Persoonia hirsuta*) — endangered (Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act)

- spreading shrub with small leaves of variable shape

- has a scattered distribution around Sydney in sandy soils in dry sclerophyll open forest woodland and heath on sandstone
- usually present as isolated individuals or very small populations
- it is probably killed by fire but will regenerate from seed.

Mittagong geebung (*Persoonia glaucescens*) — endangered (Biodiversity Conservation Act); vulnerable (Environment Protection and Biodiversity Conservation Act)

- erect shrub to three metres high
- grows on ridge tops and upper slopes in dry forests, on clayey and gravely laterite soil
- highly restricted distribution in Mittagong area that appears to have contracted
- populations are linear and fragmented
- commonly on disturbance margins and therefore susceptible to road maintenance work
- killed by fire and has low seed viability.

Small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) — vulnerable (Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act)

- a low-spreading to erect shrub, usually less than one metre high
- grows in sandy or light clay soils usually over thin shales, in a range of vegetation types
- sporadic throughout the Sydney Basin but mainly found around Picton, Appin and Bargo
- often occurs in open, slightly disturbed sites such as along trails and hence is vulnerable to weed encroachment and damage during road maintenance work
- other threats include inappropriate fire regime.

Woronora beard-heath (*Leucopogon exolasius*) — vulnerable (Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act)

- an erect shrub to one metre
- occurs in woodland on sandstone on low-nutrient soils
- often found on sandy alluvium and rocky sandstone hillsides near creeks
- fire regime required to maintain the species is currently unknown.

Appendix D Threatened terrestrial native animals recorded in the park

Common name	Scientific name	BC Act status*	Comments
Mammals			
Brush-tailed rock-wallaby	*Petrogale penicillata*	E [1]	Not found in recent surveys, probably locally extinct
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	V	
Eastern false pipistrelle	*Falsistrellus tasmaniensis*	V	
Eastern freetail-bat	*Mormopterus norfolkensis*	V	
Eastern pygmy-possum	*Cercartetus nanus*	V	
Greater broad-nosed bat	*Scoteanax rueppellii*	V	
Greater glider	*Petauroides volans*	–[1]	
Grey-headed flying-fox	*Pteropus poliocephalus*	V [1]	
Koala	*Phascolarctos cinereus*	V [1]	
Large-eared pied bat	*Chalinolobus dwyeri*	V [1]	
Southern brown bandicoot (eastern)	*Isoodon obesulus obesulus*	E [2]	Not found in recent surveys, may no longer occur
Southern myotis	*Myotis macropus*	V	
Spotted-tailed quoll	*Dasyurus maculatus*	V [2]	
Squirrel glider	*Petaurus norfolcensis*	V	Extremely rare in the region, possibly close to local extinction
Birds			
Diamond firetail	*Stagonopleura guttata*	V	
Freckled duck	*Stictonetta naevosa*	V	
Gang-gang cockatoo	*Callocephalon fimbriatum*	V	
Glossy black-cockatoo	*Calyptorhynchus lathami*	V	
Little eagle	*Hieraaetus morphnoides*	V	
Little lorikeet	*Glossopsitta pusilla*	V	
Masked owl	*Tyto novaehollandiae*	V	
Olive whistler	*Pachycephala olivacea*	V	Near eastern limit of range, habitat likely to be restricted
Powerful owl	*Ninox strenua*	V	
Scarlet robin	*Petroica boodang*	V	
Sooty owl	*Tyto tenebricosa*	V	
Square-tailed kite	*Lophoictinia isura*	V	
Swift parrot	*Lathamus discolor*	E [2]	
Turquoise parrot	*Neophema pulchella*	V	
Varied sittella	*Daphoenositta chrysoptera*	V	
Reptiles and amphibians			

Common name	Scientific name	BC Act status*	Comments
Broad-headed snake	*Hoplocephalus bungaroides*	E [1]	
Littlejohn's tree frog	*Litoria littlejohni*	V [1]	
Red-crowned toadlet	*Pseudophryne australis*	V	

* Biodiversity Conservation Act status: V = vulnerable; E = endangered; – = not listed.
[1] Also listed as vulnerable under the Environment Protection and Biodiversity Conservation Act.
[2] Also listed as endangered under the Environment Protection and Biodiversity Conservation Act.

Appendix E Historic heritage in the park

Location	Feature and location
Avon Dam	Original Avon Weir, downstream from dam, on edge of park.
Izards Knob	Site of early homestead. Stone fences and some exotic plants remain.
Kangaloon	Possible building site associated with Robertson Burrawang Water Supply.
Kangaloon	Site of homestead, old fence, in clearing on upper Nepean River south-east of Robertson Burrawang Water Supply. Sandstone blocks and broken glass are reported to remain. Nearby clearings later used for forestry and turf farming.
Macquarie Hill	Postal shed site. Associated with early mail service along Bong Bong Track. Mail is reported to have hung there waiting for the next rider.
Macquarie Hill	Stone fence in clearing between Moss Vale – Unanderra Railway and Fire Road 15 associated with settlement during the 1860s–1880s.
Macquarie Hill	Sites of two early homesteads just north of Fire Road 15.
Menzies Selection	Former agricultural homestead site, sandstone bricks remain. Later pine plantation.
Moss Vale – Unanderra Railway	Four railway camp sites, including a horse camp and married men's camp, located along both sides of the railway line near Macquarie Hill. Associated with construction of the railway in late 1920s. An old stone chimney is reported to be located in or near the horse camp.
Moss Vale – Unanderra Railway	Railway construction sites near Macquarie Hill. Cleared area with rubble.
Moss Vale – Unanderra Railway	Summit Tank Railway Dam, from which water was pumped to Summit Tank, outside the park.
Mount Cotopaxi	Small former agricultural clearing. Gold exploration shaft, probably from World War II, west of Fire Road 1E. A chimney and metal framework remain.
Mount Lindsey	Early agricultural site, former homestead. Later used as a forestry arboretum.
Mount Murray	Site of early homestead called Molly Morgan homestead (named after a racehorse, which was named after a convict). Located north of Fire Road 1. Sandstone bricks are reported to remain. Nearby site called Molly Morgan's Crossing on Dudewaugh Creek, a tributary of Burke River.
Mount Murray	Site of Mount Murray School, southern end of Fire Road 1. Functioned from late 19th century to 1920s. Foundations are reported to remain.
Mount Murray	Original road (known as Bong Bong Track or Five Islands Road), north of Tourist Road between fire roads 1 and 2. No known remains of road.
Mount Murray	Gerrigaroo Selection, former agricultural use, later pine plantation.
Nepean	Farm site with split-rail fence, off Avon Dam Road near Nepean River.
Nepean	Charcoal pits – four pits about 15 metres x 2.5 metres lined with concrete, brick and stone, pipes in walls, scattered bits of iron. Adjacent to Fire Road 5.
Nepean	Nepean Dam spillway model on the Avon Dam Road crossing of Nepean River.
Nepean Dam	Cuttings and embankments from disused railway line adjacent to Nepean Dam that was used to bring in material for dam construction.
Pearsons Selection	Former agricultural homestead site. Well reported to remain. Later pine plantation.
Pheasants Nest	Sandstone blocks, possible marker or former air shaft for Nepean Tunnel. Top of hill on northern boundary.
Pheasants Nest	Two sandstone tunnel markers with air shaft for Nepean Tunnel. The markers are towers about three metres high.
Tourist Road	Well cut in stone, north of Tourist Road, east of Rowlands Road.

Tourist Road	Sandstone quarry site north of Tourist Road near Doudles Folly Creek, used to construct early homesteads.
Upper Nepean	Diggers Creek Diamond Field. Part of a large washing wheel, a chimney and diggings remain.
Upper Nepean	Small-scale gold diggings adjacent to Diggers Creek.
Wilton	Farm site with two shed floors (one with timber posts), brick well and two small dams. Adjacent to Fire Road 11.
Wilton	Farm site with two shed floors. Adjacent to Fire Road 11.
Yerrinbool	Bargo Brush Gaol site, western end of Fire Road 3B. No remains.
Yerrinbool	Site of Bargo Brush rubbish tip, Fire Road 3, south of Fire Road 3B.

Note: much of the above information is from Godden McKay Heritage Consultants (1993). The locations and current state of these items need to be verified by NPWS to confirm their status.

Appendix F Water authority assets in the park

Asset purpose and location (includes associated structures)	Term*	WaterNSW ID no.
WaterNSW assets		
Hydrometric and water quality monitoring station – Nepean River at inflow	Indefinite	2122051
Hydrometric station and water quality monitoring – Burke River at inflow	Indefinite	2122052
Hydrometric station and water quality monitoring – Nepean River at McGuires Crossing	Indefinite	212209
Hydrometric station – Diamond Fields Road, between Crooked and McGuires creeks	Indefinite	568054
Hydrometric station – East Kangaloon	Indefinite	568070
Hydrometric station – Fire Road 1, Hambridge	Indefinite	568058
Hydrometric station (disused) and weir – Mt Lindsey	Indefinite	
Hydrology station – Nepean River at Avon Dam Road	Indefinite	212204
Hydrology station – Fire Road 6B between Cordeaux and Avon rivers	Indefinite	568060
Hydrology station – Avon River at Avon Dam	Indefinite	212210
Seismic vault – Mt Cotopaxi	Indefinite	
Seismic vault – Avon	Indefinite	
Avon Dam Road, including bridge over Nepean River	Indefinite	
Nepean Dam Road	Indefinite	
Survey control point and sight lines – Nepean storage	Indefinite	N04
Control mark for dam monitoring – Nepean–Avon ridge	Indefinite	PM56605
Nepean Tunnel, section nearest Pheasants Nest Weir	Indefinite	
Fences and gates at park perimeter (approx. 65 gates in total)	Indefinite	
Timber routed signs at park perimeter (approx. 9 in total)	Indefinite	
Avon Fire Tower	Indefinite	
Bores constructed as part of the proposed Upper Nepean (Kangaloon) borefield	Indefinite	
Burrawang to Avon Tunnel	Proposed	
Powerline trench and cable under Avon Dam Road and Fire Road 4	Proposed	
Sydney Water Corporation assets		
Water pipeline along Avon and Nepean Dam roads	Indefinite	

* All these infrastructure assets are to be maintained by WaterNSW or Sydney Water Corporation on an ongoing basis for indefinite terms. Additional essential assets may be constructed in future.

Appendix G Interests held by third parties

Holder of asset	Purpose and location
Australian Rail Track Corporation	Access via Fire Road 15A to Moss Vale – Unanderra line.
Australian Rail Track Corporation	Access via Fire Road 3B to tower near Yerrinbool Station. Access to Main Southern Railway via unnamed track south of Yerrinbool near Fire Road 3A.
Australian Rail Track Corporation	Access via Fire Road 5A to Main Southern Railway Line.
Department of Primary Industries – Lands	Access to various trigonometric stations e.g. Mount Cotopaxi, Mount Lindsey, Cupitts Forest.
Endeavour Energy	Various sections of powerline and underground cables, including along the western boundary, Nepean Dam Road, Avon Dam Road and Fire Road 4.
Endeavour Energy	Access via fire roads 1, 3B, 3C, 4 and 5A to powerlines.
TransGrid	Easements and access licences for the TransGrid TL16 Canberra–Dapto 330 kilovolt transmission line, south-east area of the park. Access via Fire Road 1.
Telstra	Access via fire roads 5 & 5A to the Sydney–Melbourne line located in the park.
Telstra	Homebush–Dapto fibre-optic and coaxial cables, near western boundary. Access along fire roads 3B & 5A.
Telstra	Telecommunication service lines for the Nepean Water Filtration Plant, along Nepean Dam Road.
Jemena (formerly Agility)	Easement and access licence (AGL Moomba–Sydney, Wilton–Mount Keira, Mount Keira–Wollongong). Access to rail corridor near Yanderra, and fire roads 3 & 3A and substation north of rail corridor near Old South Road.
Nextgen	Sydney–Melbourne communications line near western boundary. Access via fire roads 3B & 5A.
NBN	Communications cable. Access via fire road 3B.
AAPT Ltd (formerly Powertel)	Sydney–Melbourne communications line near western boundary. Access along fire roads 3B & 5A.
Optus	Fibre-optic cable and access along fire roads 3B & 5A.
Optus	Telecommunications tower, cabling and access licence, Arina Road Bargo.
Wingecarribee Shire Council	Orfords Road, Rowlands Road and part of Tourist Road near Rowlands Road. Access to Robertson Burrawang Water storage and to the former quarry at Mountt Butler.

All these infrastructure assets are to be maintained on an ongoing basis for indefinite terms, except where a shorter term is appropriate. Additional essential assets may be constructed in future, subject to environmental impact assessment.

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