NSW NATIONAL PARKS & WILDLIFE SERVICE

Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area

Planning Considerations

environment.nsw.gov.au

Cover photo: Dharawal State Conservation Area. Lucas Boyd/DPE

Published by:

Environment and Heritage Group
Department of Planning and Environment
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment and Heritage 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
Website: www.environment.nsw.gov.au

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au
See also www.environment.nsw.gov.au

ISBN 978-1-922899-75-0
EHG 2022/0492
September 2022

Find out more about your environment at:

www.environment.nsw.gov.au

Contents

List of tables

List of figures

How to use this report

This planning considerations report outlines the matters considered in preparing the Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area Plan of Management, including the parks' key values, management principles and management considerations. Further information, including scientific names for common names of species, is provided in the appendices.

It is recommended that readers of this report also read the plan of management. The plan of management describes the desired outcomes for the parks' values and actions that the National Parks and Wildlife Service (NPWS) proposes to undertake to achieve these outcomes. It also sets out the recreational and commercial activities that are permitted in the parks and any requirements to undertake these activities, including whether consent must be sought from NPWS to undertake them.

This planning considerations report will be updated when appropriate, for example, if we have new information on:

- the values of the parks (e.g. new threatened species)
- management approaches (e.g. new feral animal and pest management techniques)
- new programs.

Changes will only be made to this report if they are consistent with the plan of management.

Acknowledgements

Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area are in the traditional Country of the Dharawal People.

This report was prepared by staff of NPWS.

Contact us

For more information about this plan of management or the Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area, contact the NPWS Illawarra Area Office at 84 Crown St (PO Box 5436), Wollongong NSW 2500 or by telephone on (02) 4223 3000.

Acknowledgement of Country

The parks covered in this report are part of an ancient landscape which is central to the living culture of Aboriginal people. The areas now known as Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area (and their surrounding lands and watercourses) have traditionally been under the care of the Dharawal language group peoples, and other families, groups and people. Aboriginal people have a deep spiritual and cultural connection to this Country. Their ancestors have lived here for thousands of years and, in doing so, form part of this living landscape.

Connections to Country and the significance of these parks to Aboriginal peoples — past, present and future — are acknowledged and respected. The role of Aboriginal people in identifying traditional connections and custodians for this place is acknowledged and supported.

Photo 1 **Artwork by attendees of a Dharawal cultural understanding workshop, and Lorraine Brown, Narelle Thomas and Allison Day of Coomaditchie United Aboriginal Corporation**

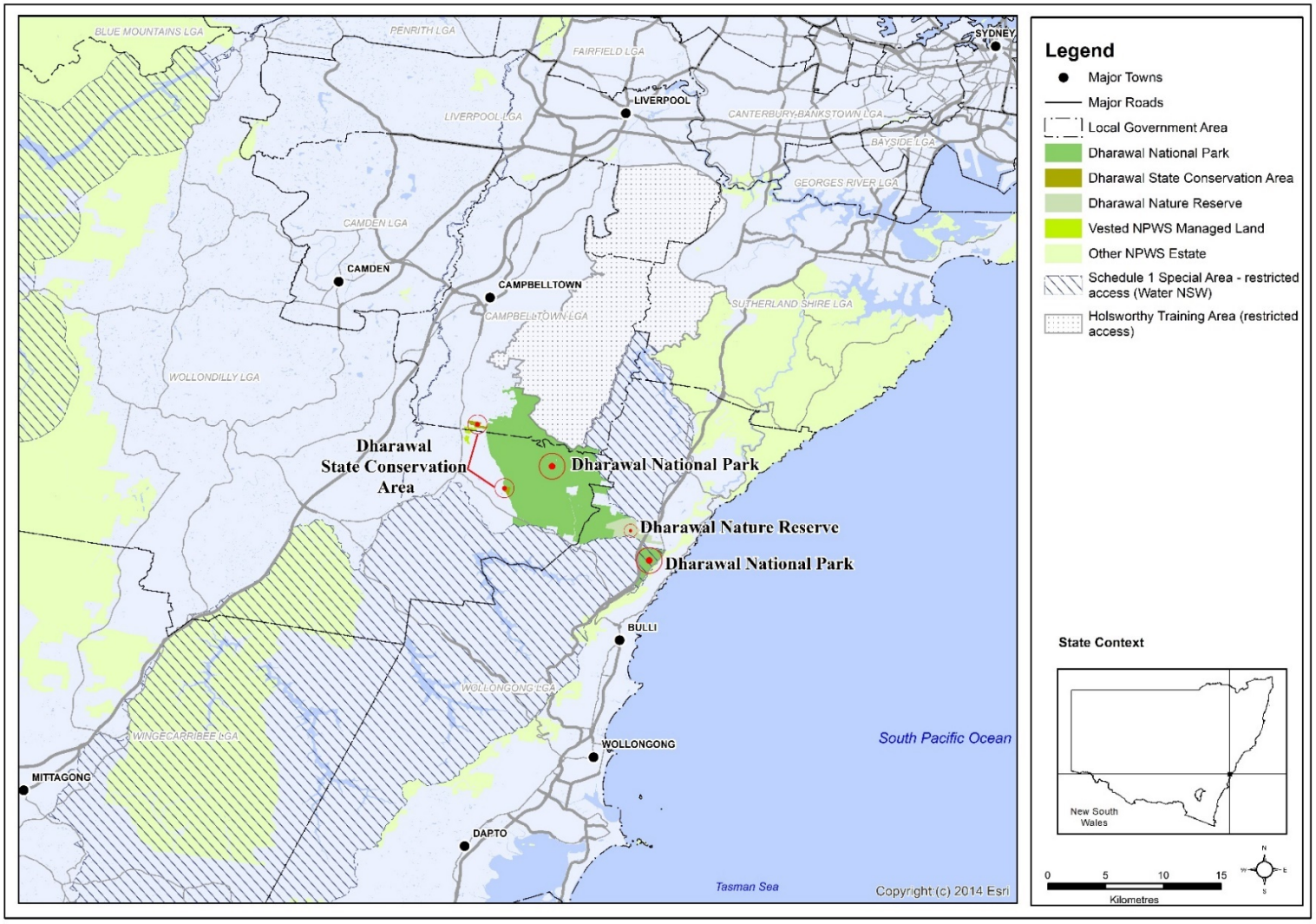

Figure 1 Location of the parks

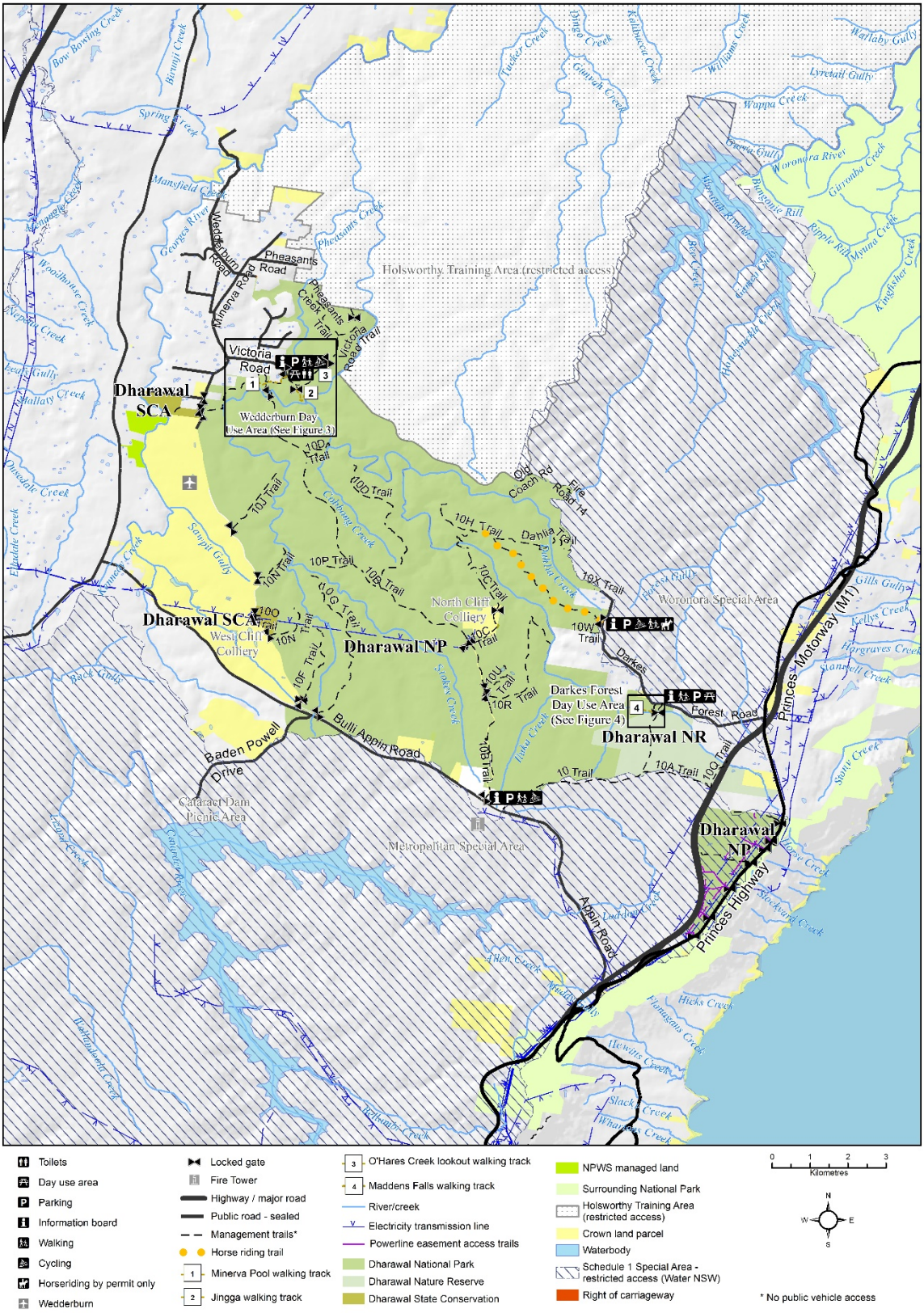

Figure 2 Dharawal National Park, Dharawal Nature Reserve, Dharawal State Conservation Area

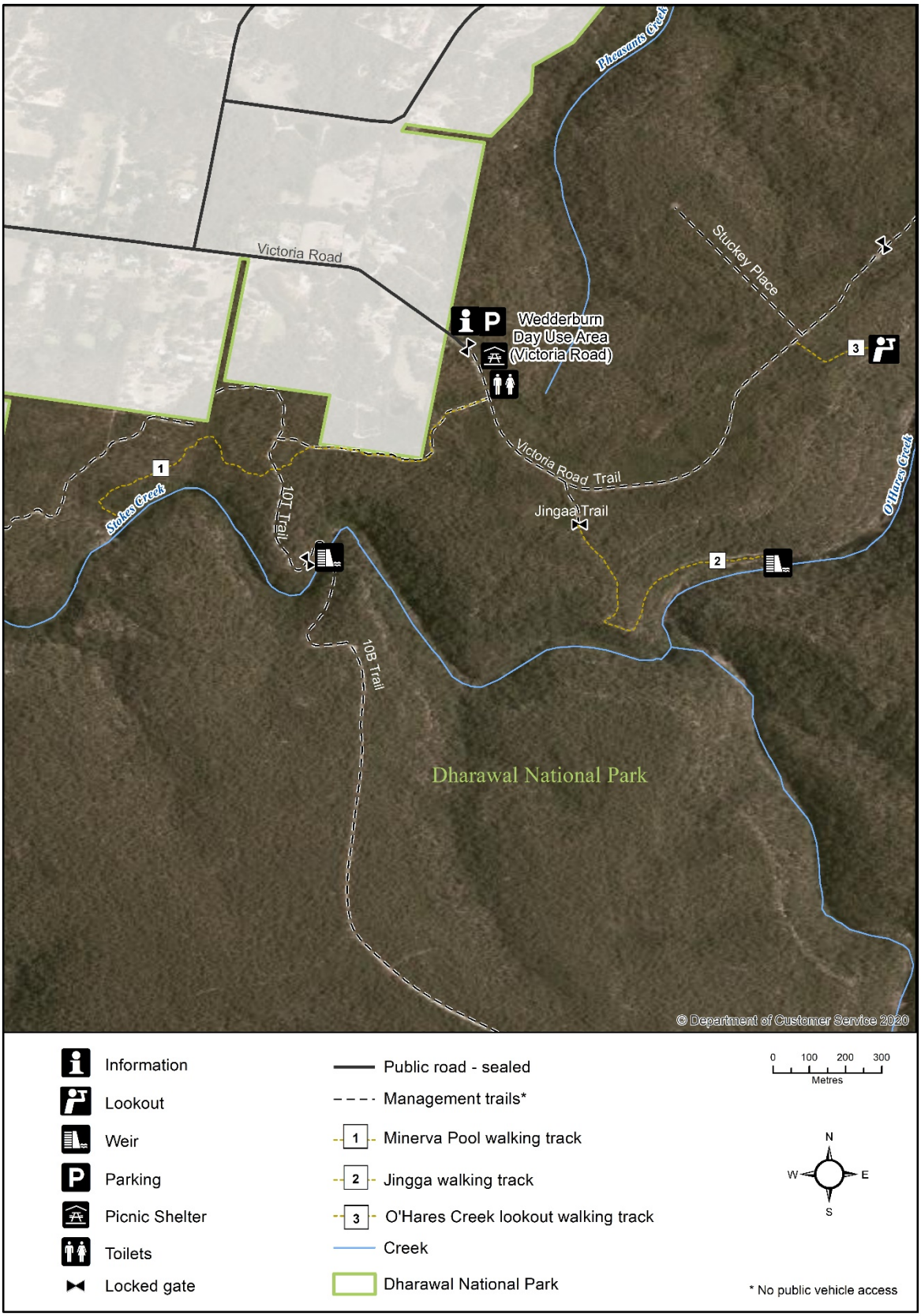

Figure 3 Wedderburn Day Use Area

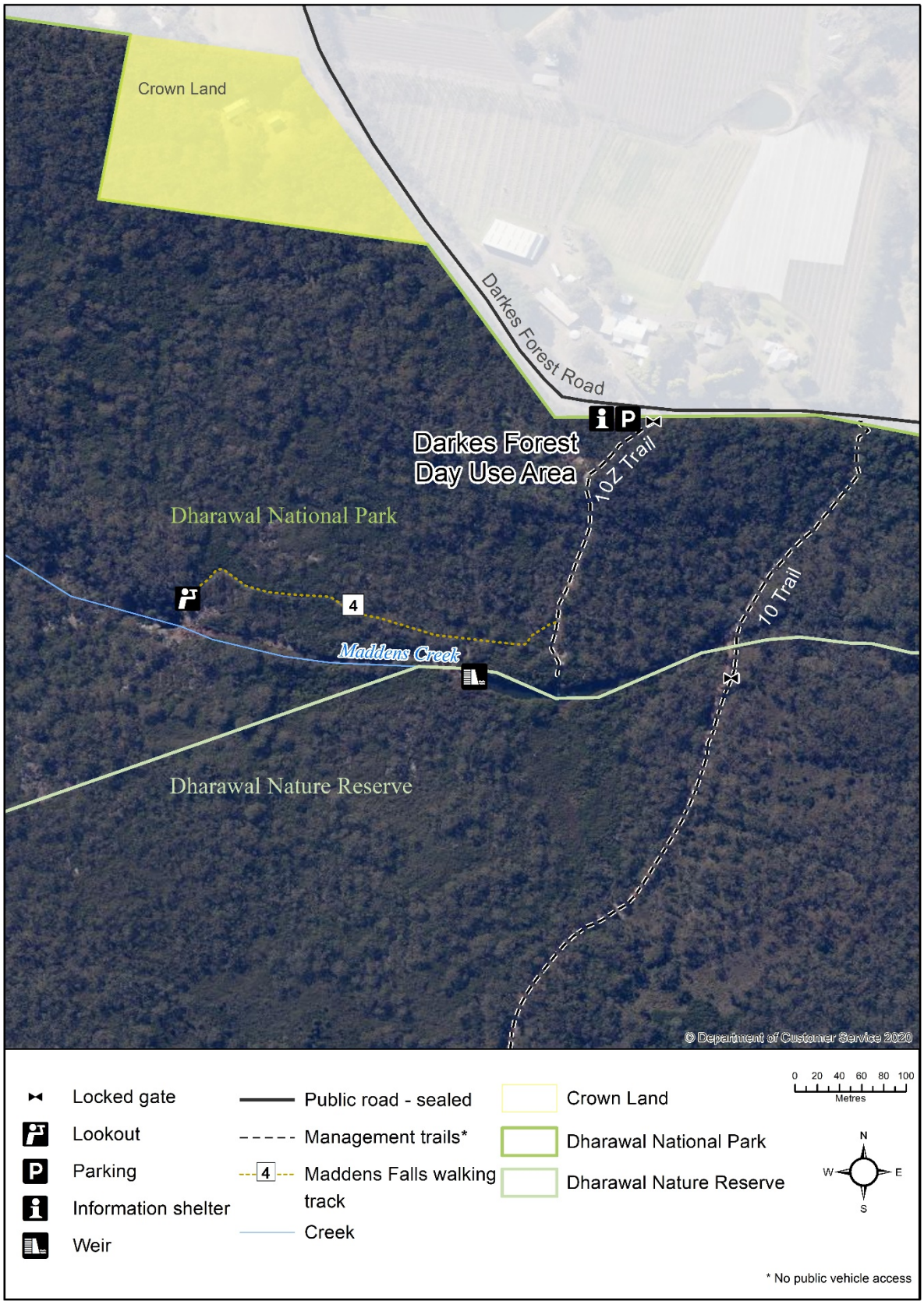

Figure 4 Darkes Forest Day Use Area

Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area

Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area (referred to as 'the parks' in this report), occupy a total area of 7,248 hectares and are located approximately 45 kilometres south-west of Sydney, between the Georges River and the Illawarra Escarpment (see Figure 1). The parks are in the traditional Country of the Dharawal[1] People, and Aboriginal people have cared for this Country for thousands of years. The naming of the parks reflects the Aboriginal history of the area and the connection that Aboriginal people have with this place.

The parks are on the Woronora Plateau and encompass almost the entire catchment of O'Hares and Stokes creeks. The landscapes range from extensive upland swamps in the south-east to forested sandstone plateaus with dramatic rocky gorges and waterfalls in the north-west.

The parks are part of the Sydney Basin Biogeographic Region and the Cataract biogeographic subregion (NPWS 2003b). Characteristic of the subregion, the Woronora Plateau is dominated by Triassic Hawkesbury Sandstone, which is associated with shallow, sandy and infertile soils.

What is the Sydney Basin Bioregion?

Australia is divided into bioregions. Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. Bioregions are characterised by climate, landform and biodiversity, and do not conform to administrative boundaries.

The Sydney Basin Bioregion covers about 4.53% of New South Wales and consists of a geological basin filled with near horizontal sandstones and shales of Permian to Triassic age that overlie older basement rocks of the Lachlan Fold Belt. The dominant sandstone is often referred to as Hawkesbury sandstone and includes uplifted landscapes in the west (such as in Blue Mountains National Park) and coastal landscapes of cliffs, beaches and estuaries in the east (such as in Royal National Park). The bioregion protects numerous species of plants and animals and is instrumental in the provision of ecosystem services such as clean water.

The parks are an integral part of a much larger protected area system extending from Royal National Park in the north, to Budderoo and Morton national parks in the south, and Nattai and Blue Mountains parks in the west. Together with the Woronora and Metropolitan special areas (WaterNSW) and Holsworthy Training Area (Department of Defence), these lands combine to form one of the largest contiguous protected areas in the State, providing unparalleled opportunities for the maintenance of ecological processes.

[1] Also known as Tharawal / Dariwal (AIATSIS 2020). Other spellings: Turuwal (Ridley 1875, 1878); Thurrawal (Mathews & Everitt 1900; Mathews 1901a, 1901b, 1903; Capell 1970); Thur'rawal (Mathews 1902); Dharawal (Capell 1970; Eades 1976).

Dharawal Nature Reserve and Dharawal State Conservation Area were reserved on 4 April 1996. Before reservation, the area was managed by Sydney Water and its predecessors. The majority of the parks were part of the former O'Hares Creek Special Area from 1927 until 2008, when the O'Hares Creek catchment was no longer required for public water supply. The eastern section of the national park, between the Princes Motorway and Princes Highway, remains part of the Metropolitan Special Area under the Water NSW Regulation 2020 (see Box 1).

In 2012 most of the former state conservation area was reserved as a national park in response to community concerns about the potential impacts of mining on the area's catchment, natural and cultural heritage values. Two small areas adjacent to the western boundary of the national park remain as state conservation area. See Figure 2.

The northern boundary of the national park adjoins the Holsworthy Training Area and areas of rural–residential development at Wedderburn. The southern boundary of the national park generally coincides with Bulli-Appin Road. Naturally vegetated land owned by the Tharawal Aboriginal Land Council (LALC), an aerodrome and mining operations are adjacent to the west.

To the east of the parks are the Woronora Special Area, Illawarra Escarpment State Conservation Area, Crown land, a golf course and rural–residential development at Darkes Forest. South of the parks are the Metropolitan Special Area, small areas of vegetated Crown land and clay/shale and sand quarries.

Two Crown land 'inholdings' are surrounded by the national park: North Cliff Colliery (approximately 80 hectares), and a 4-kilometre long corridor encompassing 10B Trail and 10C Trail (management trails) between North Cliff Colliery and Bulli-Appin Road.

The parks lie just to the east of Campbelltown City and the Greater Macarthur Growth Area. With new development opportunities identified in the local government area, the population of Campbelltown City is expected to increase from 171,000 in 2019 to over 275,000 in 2036 (Campbelltown City Council 2019). The parks are expected to experience increased recreational pressure as a result of this local population growth.

Photo 2 Dharawal National Park. Lucas Boyd/DPE

Box 1: Drinking water catchment 'special areas'

The section of Dharawal National Park east of the Princes Motorway is in the Upper Nepean River catchment. It is part of the Metropolitan Special Area (Schedule 1 of the Water NSW Regulation 2020) and the declared Sydney Drinking Water Catchment. Water NSW and the National Parks and Wildlife Service (NPWS) jointly manage the special area guided by the *Special Areas Strategic Plan of Management,* which outlines the responsibilities of both agencies in the management of special areas (WaterNSW & OEH 2015). The strategic plan sets out principles and objectives for management of special areas that consider the complementary purposes of protecting water quality and conserving natural and cultural heritage values.

The special area is subject to additional legislation and policy, including the Water NSW Act, Water NSW Regulation 2020 and *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*.

WaterNSW has primary regulatory responsibility for managing access to special areas. Public entry is generally not permitted to Schedule 1 lands, and certain activities are prohibited to protect the quality and quantity of the water supply. WaterNSW can give its consent to carry out these activities in specific circumstances. The Water NSW Act empowers WaterNSW to enter the area and carry out works for water supply. NPWS assists WaterNSW to implement its regulatory responsibilities.

WaterNSW has a concurrence role in relation to activities carried out or proposed to be carried out in the eastern section of Dharawal National Park, which is within the Metropolitan Special Area, including the granting of any lease, licence, easement or right-of-way. Specific controls to exclude incompatible activities from special areas are contained in the Water NSW Regulation, including the exclusion of general public access and recreational use (see Section 3.1).

The *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 Sydney Drinking Water Catchment (including the special areas), consider whether the activity would have a neutral or beneficial effect on water quality.

The parks are located in the administrative areas of the Tharawal and Illawarra LALCs, 2 Local Land Services regions (Greater Sydney and South East), and the Wollondilly Shire Council, Wollongong City Council and Campbelltown City Council local government areas.

1. Caring for Country

The parks are in the traditional Country of Dharawal People. The Country of the Dharawal language group extends from Botany Bay south to the Shoalhaven River and inland to Camden, and Dharawal people also have links with neighbouring language groups, including Gundungurra (also known as Gundungura or Gandangara; AIATSIS 2020) and Dharug (also known as Darug). Aboriginal people have cared for this Country for thousands of years. The naming of the parks reflects the Aboriginal history of the area and the connection that Aboriginal people have with this place.

What is 'Country'?

To Aboriginal people, the landscape is made up of many features that are interrelated. These include land, water, plants and animals, places and stories, historical and current uses, and people and their interactions with each other and place. These features are central to Aboriginal spirituality and contribute to Aboriginal identity. They are inseparable and make up what is known as 'Country'. As Rose (1996) explains:

'Country in Aboriginal English is not only a common noun but also a proper noun. People talk about Country in the same way that they would talk about a person: they speak to Country, sing to Country, visit Country, worry about Country, feel sorry for Country, and long for Country. People say that Country knows, hears, smells, takes notice, takes care, is sorry or happy. Country is a living entity with a yesterday, today and tomorrow, with a consciousness, and a will toward life. Because of this richness, Country is home, and peace; nourishment for body, mind, and spirit; heart's ease.'

Shared Country refers to lands or places that are 'common ground' shared by Aboriginal people from adjoining Country, or areas within the traditional Country of a particular people that are used by other Aboriginal people. These lands and places may be used, for example, to access water during drought, for ceremony, marriage or trade.

Dharawal People have a deep spiritual and cultural connection to this Country. The connection to this special place is ongoing and very important to Aboriginal people. Their ancestors have lived here for thousands of years, and in doing so, form part of this living landscape.

Photo 3 Cascading waterfalls, Dharawal National Park. Lucas Boyd/DPE

1.1 Aboriginal culture and heritage

The Woronora Plateau has been well covered by systematic archaeological survey and more than 1,000 Aboriginal sites have been identified to date, including over 395 sites in the parks (NPWS 2020a).

Aboriginal cultural heritage

Woodward et al. (2020) describe what Aboriginal cultural heritage is and what it means to Aboriginal people:

'…many different objects, sites and our knowledge, which has been passed from generation to generation, and connects us to our people and our Country. Our heritage also includes books, art, dance, songs which are created now based on our heritage. Our songs, stories and dances are often called intangible cultural heritage. Our material cultural heritage includes artefacts, rock art, artefact scatters, occupation sites, shell middens, stone arrangements, scarred trees, rock wells, carved rocks, and burial sites. Looking after and keeping our connections strong with these objects, sites and places is very important to us.'

The sites most frequently recorded in the parks are rock shelters containing art and stone axe grinding grooves. Other site types include rock shelters with occupation deposits, open camp sites, rock engravings and a rare water hole/well. Sites are particularly concentrated at the heads of creeks near areas of swamp, and downstream along gullies and gorges.

Hawkesbury sandstone forms numerous rock shelters (overhangs) and large, flat expanses suitable for art, rock engravings and axe grinding grooves. There is a transition in sites from predominantly rock engraving art in the east to charcoal and clay drawings in the west. Some overhangs contain exceptionally well-preserved drawings, stencils and paintings in black charcoal, white clay or red, yellow or orange ochre. The art sites on the Woronora Plateau differ in certain aspects from the rest of the Sydney Basin. They include unique and atypical motifs that are restricted to the Woronora Plateau and are technically complex compared to sites north of the Georges River. In many cases, the rock overhangs also contain a considerable depth of occupation deposit that may contain dateable material, providing valuable information on lifestyles and cultural change over time. Important environmental changes may also be recorded in the deposits, making them of geomorphological interest. The Aboriginal sites in the parks are also special for their location in a generally undisturbed setting.

The state conservation area and most of the national park are in the area of the Tharawal LALC, and the nature reserve and the south-eastern part of the national park are in the Illawarra LALC area. Tharawal LALC holds freehold title to a large area of land adjacent to the western boundary of the national park and two smaller areas near Appin Road.

NPWS maintains close liaison with the Tharawal and Illawarra LALCs, traditional custodial families, and other community members regarding the ongoing management of Aboriginal cultural values of the park.

1.1.1 Management considerations and opportunities

Aboriginal people have cultural associations and connections to Country in the parks, including the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable and need to be managed in an integrated manner across the landscape.

Although the NSW Government has legal responsibility for the protection of Aboriginal sites and places, NPWS acknowledges the right of Aboriginal people to make decisions about their own heritage. As such, Aboriginal communities will be consulted and involved in the management of Aboriginal sites, places and related issues; and in the promotion and presentation of Aboriginal culture and history.

Protection of sites is very important and local Aboriginal people have requested that the location of sites not be made public, except with agreement of the LALC and other relevant Aboriginal community organisations. Where this agreement is obtained, a conservation assessment should be undertaken before promotion of the sites and site protection works may be required.

Aboriginal art sites in shelters are particularly threatened by high intensity fires. Regular low intensity prescribed burns in the area of these sites will provide some protection from this threat. The reserve fire management strategy should reflect this threat and an appropriate response.

Minerva Pool has special significance as an Aboriginal women's place (see Box 2) and is an important part of Aboriginal culture. The Tharawal LALC asks that visitors respect the cultural importance of this site. Only women and children may enter the waters of Minerva Pool.

Access to Country is extremely important to Aboriginal people, and NPWS will facilitate access to Country and work with the Aboriginal community to realise opportunities for greater involvement in caring for Country. There is potential to enhance the identity of the parks as an Aboriginal cultural landscape, including activating cultural tourism and incorporating Aboriginal language in the naming of places, signage and interpretation.

Aboriginal cultural knowledge is kept alive and is passed on through language, song, dance, art, story, through being on Country, hunting and harvesting and through many other cultural practices. Opportunities to continue these practices are essential to the survival of Aboriginal culture (Woodward et al. 2020). The parks provide opportunities for the local Aboriginal community to access Country to maintain, renew or develop cultural connections and practices. This may include group activities or culture camps on Country and the non-commercial cultural use of resources such as medicinal plants, bush tucker and fish.

A database of Dharawal Traditional Knowledge was initiated in 2015 and includes audiovisual interviews with several people in community as well as footage of activities at a cultural day in the park. The report on this project (Urquhart 2015) concludes there is strong desire in the community to continue to engage in cultural learning and provide opportunities for children to learn and connect to Country. The database may be valuable for improving understanding of the cultural value of the parks and for the development of educational material. Tharawal LALC is the custodian of this database and their permission would be required for any potential use of the database.

Box 2: Minerva Pool

Minerva Pool in the Dharawal National Park has special significance for the Dharawal People. On 24 May 2017 a smoking ceremony was held at the site, as described by Tharawal LALC (2017):

'The Indigenous women of the Tharawal Local Aboriginal Land Council of the Dharawal Nation held a smoking ceremony at Minerva Pool, a sacred site. Smoking ceremonies are one of the most significant ancient ceremonies performed by Aboriginal people. The ceremonies are believed to have cleansing properties and the ability to ward off bad spirits, acknowledge ancestors and pay respect to both land and sea of Country. So, if you are visiting Minerva Pools, please remember to tread carefully and with respect during your visit. The Tharawal Local Aboriginal Land Council asks that only women and children enter the waters of Minerva Pool.'

Photo 4 ***The Women's Pool*. Artwork by Loraine Brown and Narelle Thomas of Coomaditchie United Aboriginal Corporation**

The rugged nature of the parks together with a history of restricted public access since 1927, has protected most Aboriginal sites from graffiti or other damage. Where graffiti has occurred, it is generally in sites close to vehicle trails. To ensure the ongoing protection of Aboriginal sites, the local Aboriginal community has requested that NPWS generally not publicise their location. The condition of significant and vulnerable sites should continue to be monitored (together with Aboriginal community representatives) and protective work should be undertaken where appropriate.

While there have been several archaeological surveys, there are opportunities to better understand the Aboriginal history and significance of these parks. NPWS will encourage research where it contributes to understanding and protection of cultural values, provides opportunities for Aboriginal community members to develop skills and is conducted in partnership with communities.

The role of Aboriginal people in identifying traditional connections and custodians for this place is acknowledged and supported.

2. Protecting the natural environment

2.1 Geology, landform and hydrology

The parks are located on the Woronora Plateau, which forms part of the southern rim of the Sydney Basin. The plateau dips gently north-west, from the abrupt edge formed by the Illawarra Escarpment down towards the Cumberland Plain. At its eastern extremity in Dharawal Nature Reserve, the plateau stands at nearly 400 metres above sea level, before gradually dropping to about 250 metres above sea level in the north-west around Wedderburn. The O'Hares Creek gully system deeply incises this plateau to a minimum elevation of 130 metres where it flows out of the northern boundary of the national park (DECC 2007a).

There are over 200 kilometres of watercourses in the parks, including O'Hares and Stokes creeks and their main tributaries. The plateau is deeply dissected by gorges along these creeks, and there are numerous pools and cascades.

The watercourses drain into the Georges and Nepean river systems. Almost the entire catchment of O'Hares and Stokes creeks is within the parks, and water quality is very high as the area has had a limited disturbance history. The catchment is the only major catchment on the Woronora Plateau that has not been impounded for water supply. The O'Hares catchment discharges a significant volume of water to the Georges River, and it is an important factor in the health of the Georges River, a major recreational waterway in Southern Sydney.

The Woronora Plateau is dominated by the Triassic Hawkesbury Sandstone geological formation, composed primarily of quartzose sandstone, with outcrops of shale and ironstone in some areas. The sandstone has formed cliffs and large rock outcrops along the gorges.

Photo 5 Upland swamps at Maddens Plains, Dharawal National Park. Peter Sherratt/DPE

Thin shale lenses occur, particularly in the eastern part of the nature reserve. These support different vegetation communities to the sandstone areas (see Section 2.2). Larger areas of shale adjoin the parks at Darkes Forest and Wedderburn, where rural settlements were established in the late 19th century.

Soils developed on sandstone are generally shallow, sandy and have low fertility, while the shale soils are deeper and more fertile. Areas of laterite (ironstone) soil occur in several locations in the nature reserve and along the southern part of 10B Trail in the national park.

Deposits of Quaternary alluvium lie across the plateau, particularly at the southern end of the national park and in the nature reserve. These have accumulated in low-relief areas at the headwaters of creeks. The underlying Hawkesbury sandstone has a surface of low permeability, resulting in the formation of numerous upland swamps (see Box 3). Rainfall and groundwater seepage through the joints in the sandstone contributes to the development and maintenance of the swamps. The swamps range from very small to extensive, including one of the largest on the Woronora Plateau. Deep permanent pools in the larger swamps are important sources of water for native animals during drought periods.

The parks overlie part of the extensive Southern Coalfield and there is a history of underground coalmining, which occurred at 400–500 metres below ground surface. Underground coalmining continues in surrounding areas.

Box 3: Upland swamps

The parks contain numerous and excellent examples of upland swamp communities. The upland swamps of the O'Hares Creek catchment are amongst the oldest of their type and are of considerable scientific importance. Dates of swamp sediment span at least 17,000 years and, combined with plant fossil evidence, suggest that there has been no significant change in the physical setting of the swamps since at least the late Pleistocene. As such, they provide an excellent record of climatic, geomorphic and biological events of the past 17,000 years after the retreat of the last Ice Age (Young 1982). The upland swamps are highly restricted in extent, with Maddens Plain supporting the most extensive swamp system in the Greater Southern Sydney Region (DECC 2007a).

Many of the upland swamps display linear patterned ground or long furrows, which run roughly parallel to the contour. These contours are thought to be initiated by slow, near-surface flow of saturated sediment and to characterise areas where the climate was formerly periglacial (Young 1982).

The upland swamps are important in capturing, storing and slowly releasing water and consequently contribute to maintaining a more regular flow in the parks' streams during dry periods.

2.1.1 Management considerations and opportunities

Monitoring by the Georges River Combined Councils' *Community River Health Program* in 2017–2018 found an overall grading of excellent for the O'Hares Creek catchment, with excellent water quality in Maddens Creek and good water quality in Stokes, Cobbong and Iluka creeks. Riparian vegetation and macroinvertebrate populations were found to be excellent in all of these creeks (Georges Riverkeeper 2018). It is important to retain high water quality levels by avoiding activities that could contribute pollutants and sediments to the streams.

The soils in the parks have a very high erosion hazard when disturbed or subjected to concentrated water flows. The parks have an extensive network of vehicle trails, many of

which are not required for park management operations. Many are poorly located and constructed and have degraded to the extent that they are no longer trafficable. Erosion and scouring is common, particularly on steeply sloping sections, and this erosion impacts surrounding areas and can be a source of sediment pollution in nearby watercourses. Most of the unwanted trails have been closed to vehicles, but illegal trail bike use is preventing revegetation. Trails retained for management purposes will be maintained to minimise erosion.

There is extensive illegal trail bike use in the parks, particularly along the western boundary of the national park and adjacent to private land at Wedderburn and Darkes Forest. This has resulted in track formation, erosion, vegetation destruction and water quality impacts. Illegal trail bike use is difficult and expensive to control, but management of this activity remains a priority.

Upland swamps are very susceptible to disturbance and can rapidly erode, causing downstream sedimentation and greater irregularity of stream flow. Illegal off-road trail bike riding through some swamps is an issue, particularly along the western edge of the national park and near 10 Trail.

Swamp vegetation can also be severely affected by bushfire, resulting in loss of ground surface protection and increased potential for erosion.

Photo 6 'V-notch' weir on O'Hares Creek, Dharawal National Park. John Yurasek/DPE

Current coalmining leases and exploration licences apply to areas to the west, south and north-east of the parks. Coalmining can result in ground subsidence (Holla & Barclay 2000) when underground voids or cavities collapse, or when soil or geological formations (including coal seams, sandstone and other sedimentary strata) compress due to changes in moisture content and pressure within the ground. Subsidence can also destabilise steep slopes and rock overhangs and this, in turn, can threaten public safety and Aboriginal sites such as rock shelters (Healthy Rivers Commission 2001).

Longwall mining directly under swamps in the Southern Coalfield can result in significant changes to swamp hydrology and redirection of surface runoff, and nearby swamps may also be impacted (IEPMC 2019).

Despite improvements in the understanding of impacts of longwall mining on swamps, further investigations are required to quantify the nature of these impacts and their consequences for swamp hydrology and ecology.

There are at least 5 constructed weirs in the parks: 2 on Stokes Creek, 2 on O'Hares Creek and one on Maddens Creek. There is also an overshot dam and associated pump on Maddens Creek which is licensed for water extraction (see Section 5.5).

The weirs act as a barrier to the movement of aquatic species, including fish that migrate as part of their lifecycle.

The concrete weir on O'Hares Creek, at the end of the Jingga Walking Track, is owned by WaterNSW and is part of continuing water monitoring operations. The 3 small concrete 'v-notch' weirs on O'Hares and Stokes creeks relate to previous water supply monitoring and are no longer utilised. Investigation into their impact on aquatic ecology, fluviology, sediment flow, recreation values and management utility would inform decisions about their future management, including potential removal or modification.

The weir on Maddens Creek has been identified as a priority for remediation to restore fish passage (Nichols & McGirr, 2005), however, the weir is utilised for licensed water extraction purposes (see Section 5.5).

2.2 Native plants and animals

The parks are an important part of a large protected area system that extends from Royal National Park in the north, Budderoo and Morton national parks in the south, and Nattai and Blue Mountains parks in the west. The parks lie on a transition from coastal to tableland communities and are a significant component of the wildlife corridor between the Illawarra Escarpment and Blue Mountains.

The area is relatively undisturbed, largely due to its history as a protected water catchment area since 1927, which restricted public access. As a result, the biodiversity, ecosystems, Aboriginal heritage and aesthetic values have been exceptionally well conserved.

The diverse topography and soil fertility, and moisture status across the parks have resulted in a range of forest, woodland, heath and wetland communities. The vegetation pattern also reflects the annual rainfall gradient, which varies from 862 mm at Wedderburn in the west to 1,426 mm at Darkes Forest in the east (Australian Bureau of Meteorology 2017).

Fifteen plant communities (see Appendix C) have been mapped in the parks, with the most widespread communities being sandstone woodland and sandstone gully forests (OEH 2016a). Over 900 hectares of upland swamps occur in poorly drained soils in the east of the parks contrasting sharply with the surrounding dry sclerophyll forest and woodland (see Box 3). Smaller areas of O'Hares Creek Shale Forest, an endangered ecological community, occur on remnant shale soils that lie as isolated caps above the sandstone plateau (NPWS 2003a). Larger areas of shale forest are found in the adjacent Woronora Special Area and freehold land at Darkes Forest. There are small areas of Heath-Mallee and Rock Plate Heath that are at the southern distributional limit for these community types. Areas of Coastal Sandstone Riparian Scrub are important because they are generally unaffected by weed invasion, unlike many comparable stands in conservation reserves where runoff is polluted by urban and industrial development in upper catchments. The plant communities generally display a high level of species richness (Keith & Myerscough 1993).

More than 500 native plant species have been recorded in the parks (DPIE 2020a). Three endangered ecological communities (listed under the *Biodiversity Conservation Act 2016*) have been mapped (Table 1) and at least 10 threatened native plant species have been recorded (Table 2).

Table 1 Threatened ecological communities in the parks

Threatened ecological community	Occurrence	BC Act Status *	EPBC Act Status *
Coastal Upland Swamp in the Sydney Basin Bioregion	Over 900 hectares in the south-eastern part of the parks.	EEC	EEC
O'Hares Creek Shale Forest	On small outcrops of Hawkesbury shale along southern part of 10B Trail and the head of O'Hares Creek to Maddens Plains. A small area also occurs east of 10H Trail.	EEC	
Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion	Large patch east of 10H Trail and small areas in Eastern Gully Forest downstream from shale and ironstone caps.	EEC	

Source: DPIE 2020a.

* BC Act = Biodiversity Conservation Act; EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*; EEC = endangered ecological community.

The parks support populations of the vulnerable prickly bush-pea, Woronora beard heath and small-flower grevillea, which are all essentially restricted to the Woronora Plateau. Maintenance of these populations in the parks is important for their overall conservation (Keith 1994). Dharawal National Park is part of the priority management site that has been identified for Woronora beard heath.

Photo 7 Shale forest near 10B Trail, Dharawal National Park. Nick Cubbin/DPE

Sublime Point pomaderris is known only from one site at Sublime Point, north of Wollongong. The species requires site-based management in order to secure it from extinction in New South Wales. Due to its significance to the survival of this species, the site

has been declared as an asset of intergenerational significance under the National Parks and Wildlife Act.

An endangered population of black cypress pine is restricted to a single outcrop of sandstone in the Darkes Forest area of the national park. This is the eastern limit of this species' range, and it is separate from other known populations. This location is also the wettest area (in terms of mean annual rainfall) where this species has been recorded (NSW Scientific Committee 2004).

There are only a few records of the hairy geebung in the parks, and this species tends to be present as isolated individuals or small populations. It is particularly threatened by inappropriate fire regimes.

A further 13 species are on the list of Rare or Threatened Australian Plants (Briggs & Leigh 1996), and another 24 species are regionally significant, being uncommon either generally or in the Sydney Region. The parks are also an important biogeographic location for 11 species that reach the southern limit of their known distribution in the area. Rare and biogeographically significant plant species are detailed in Appendix D.

Table 2 Threatened plants in the parks

Common name	Scientific name	BC Act Status *	EPBC Act Status *
	Acacia baueri subsp. *aspera*	V	
	Hibbertia puberula	E	
Black cypress pine, Woronora Plateau population	*Callitris endlicheri* – endangered population	EP	
Bynoe's wattle	*Acacia bynoeana*	E	V
Deane's paperbark	*Melaleuca deanei*	V	V
Hairy geebung	*Persoonia hirsuta*	E	E
Prickly bush-pea	*Pultenaea aristata*	V	V
Small-flower grevillea	*Grevillea parviflora* subsp. *parviflora*	V	V
Sublime Point pomaderris	*Pomaderris adnata*	E	
Woronora beard heath	*Leucopogon exolasius*	V	V

Source: DPIE 2020a.

* BC Act = Biodiversity Conservation Act; EPBC Act = Environment Protection and Biodiversity Conservation Act; V = vulnerable; E = endangered; EP = endangered population.

For animals, the parks provide a range of high quality habitats that have been protected for many years and are relatively undisturbed. Together with adjacent protected areas, they are an important part of a wildlife corridor which facilitates movement over an exceptionally large area. The parks are species-rich relative to their size, largely because of the sharp gradient of environments that occur from the Illawarra Escarpment across to the edge of the Cumberland Plain, including part of the largest expanse of upland swamp in the southern Sydney Basin.

The habitats in the parks are characterised by different groups of animal species. The upland swamps support the most distinct group of animal species (see Box 4). The sandstone woodlands dominating the parks support animals typical of coastal sandstone plateaus across the Sydney Basin. The woodlands and forests that occur in the far north-west of the parks are influenced by the richer soils of the Cumberland Plain and provide habitat for species such as koala and greater broad-nosed bat.

There have been several surveys of native animals of the parks, and at least 240 native animal species have been recorded (DPIE 2020a; DECC 2007a; Williams 2009; Gaia Research 2008; Bishop 1997; Harlow & Taylor 1995; Mills 1992; Australian Koala Foundation 1996; Robinson 1985). At least 35 threatened animal species (listed under the Biodiversity Conservation Act) have been recorded (see Table 3).

Box 4: Animals of the upland swamps

On the poorly drained soils in the east of the parks the upland swamp communities contrast sharply with the surrounding dry sclerophyll forest and woodland, which occupy the better-drained ridgetops and hillslopes. The swamps are generally treeless plains, with a dense shrub layer of banksia, dagger hakea or tea-trees, and a dense ground layer of sedges, rushes and ferns. Trees, including Blue Mountains mallee ash and scribbly gums, occasionally emerge from the shrub thickets, particularly in smaller patches of swamp and in the transition between swamps and the adjacent woodlands.

The swamps provide habitat for at least 10 threatened animal species and another 6 regionally significant species.

They support a high diversity of frogs, including ground frogs such as the common eastern froglet, eastern banjo frog and Haswell's froglet; and tree frogs such as Peron's tree frog, Blue Mountains tree frog, Freycinet's frog and Littlejohn's tree frog. The most frequently encountered reptiles are eastern water-skink, dark-flecked garden sunskink and pale-flecked garden sunskink. The eastern three-lined skink occurs but is extremely hard to detect because of the high vegetation density in its preferred habitat. The marsh snake and she-oak skink are also characteristic species.

The birds occurring in the swamps are quite distinct compared with other habitats in the parks. Honeyeaters are common, particularly tawny-crowned honeyeater, New Holland honeyeater, little wattlebird, eastern spinebill and white-cheeked honeyeater. The southern emu-wren is characteristic of the swamps, and is rarely found in the other habitats, as is the pheasant coucal. Also frequently observed are rufous whistler, grey fantail, fan-tailed cuckoo, grey shrike-thrush, tree martin, variegated fairy-wren and beautiful firetail. Birds of prey are commonly seen soaring above the plains, including swamp harrier, black-shouldered kite and nankeen kestrel.

Two commonly occurring arboreal mammals are the eastern pygmy-possum and common ringtail possum. The swamp wallaby and swamp rat are also common. Numerous bat species have been recorded flying over the swamps, including white-striped freetail-bat, Gould's wattled bat and chocolate wattled bat.

The parks are particularly significant for the diversity and richness of frog and reptile populations, including 3 nationally threatened species: giant burrowing frog, Littlejohn's tree frog and broad-headed snake. The giant burrowing frog occurs widely across the parks, though in low numbers, and is usually associated with heath on sandstone ridges. Littlejohn's tree frog breeds in the upper reaches of permanent streams and in perched swamps and is found in heath forests and woodlands outside breeding times. The giant burrowing frog and red-crowned toadlet have been recorded in drains along management trails and are vulnerable during road maintenance work.

Table 3 Threatened animals in the parks

Common name	Scientific name	BC Act Status *	EPBC Act Status *
Frogs			
Giant burrowing frog	*Heleioporus australiacus*	V	V
Littlejohn's tree frog	*Litoria littlejohnii*	V	V
Red-crowned toadlet	*Pseudophyrne australis*	V	
Reptiles			
Broad-headed snake	*Hoplocephalus bungaroides*	E	V
Rosenberg's goanna	*Varanus rosenbergi*	V	
Birds			
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	
Dusky woodswallow	*Artamus cyanopterus*	V	
Eastern bristlebird †	*Dasyornis brachypterus*	E	E
Eastern ground parrot †	*Pezoporus wallicus wallicus*	V	
Gang gang cockatoo	*Callocephalon fimbriatum*	V	
Glossy black-cockatoo	*Calyptorhynchus lathami*	V	
Little eagle	*Hieraaetus morphnoides*	V	
Little lorikeet	*Glossopsitta pusilla*	V	
Powerful owl	*Ninox strenua*	V	
Regent honeyeater †	*Anthochaera phrygia*	CE	CE
Scarlet robin	*Petroica boodang*	V	
Spotted harrier	*Circus assimilis*	V	
Square-tailed kite	*Lophoictinia isura*	V	
Swift parrot	*Lathamus discolor*	E	CE
Turquoise parrot	*Neophema pulchella*	V	
Varied sittella	*Daphoenositta chrysoptera*	V	
White-bellied sea eagle	*Haliaeetus leucogaster*	V	
White-throated needletail	*Hirundapus caudacutus*		V
Mammals			
Eastern coastal free-tailed bat	*Mormopterus norfolkensis*	V	
Eastern false pipistrelle †	*Falsistrellus tasmaniensis*	V	
Eastern pygmy-possum	*Cercartetus nanus*	V	
Greater broad-nosed bat	*Scoteanax rueppellii*	V	
Greater glider	*Petauroides volans*		V
Grey-headed flying-fox	*Pteropus poliocephalus*	V	V
Koala	*Phascolarctos cinereus*	V	V

Common name	Scientific name	BC Act Status *	EPBC Act Status *
Large bent-winged bat	*Miniopterus orianae oceanensis*	V	
Little bent-winged bat	*Miniopterus australis*	V	
Southern brown bandicoot	*Isoodon obesulus obesulus*	E	E
Southern myotis	*Myotis macropus*	V	
Spotted-tailed quoll	*Dasyurus maculates*	V	E
Yellow-bellied glider	*Petaurus australis australis*	V	V
Insects			
Giant dragonfly	*Petalura gigantea*	E	

Source: DPIE 2020a.

* BC Act = Biodiversity Conservation Act; EPBC Act = Environment Protection and Biodiversity Conservation Act; V = vulnerable; E = endangered; CE = critically endangered.

† Presumed locally extinct (DECC 2007a).

Photo 8 Rosenberg's goanna. Sarah Brookes/DPE

Several animals in the parks are of high regional conservation concern as they are rare and declining in the Sydney Basin. The parks are considered critical to the regional conservation of Littlejohn's tree frog, Rosenberg's goanna, giant burrowing frog, red-crowned toadlet, eastern pygmy-possum, beautiful firetail, southern emu-wren and tawny-crowned honeyeater (DECC 2007a).

The largest and most significant population of koalas, estimated between 300 and 400 individuals, on the outskirts of Sydney (known as the Campbelltown population) occurs in and near the park at Wedderburn (NSW Parliament 2020). Core habitat for koalas in the area is Western Gully Forest and Upper Georges River Sandstone Woodland vegetation communities along creek lines in the O'Hares Creek and Georges River area. Transition

vegetation communities in the north west of the parks have been identified as part of an important corridor for koalas (DPIE 2019). Dispersing male koalas occasionally move through the Darkes Forest area (DECC 2007a).

It is estimated that thousands of koalas perished across New South Wales during the extensive bushfires in the summer of 2019–20 (NSW Parliament 2020). While much of south-west Sydney was not directly impacted by these fires, remaining koala habitat in these areas is increasingly important to the survival of this species.

The creeks and upland swamps provide habitat for freshwater fish. Four native fish species (long-finned eel, Cox's gudgeon, climbing galaxia and Australian smelt) and 2 species of native spiny crayfish have been recorded (Knight & Bruce 2008). The parks contain suitable habitat for the threatened Macquarie perch, however, this species has not been recorded.

2.2.1 Management considerations and opportunities

Strategies for the conservation of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program*. Actions listed in each of these strategies are prioritised and implemented through the *Saving our Species* program, which aims to maximise the number of threatened species that are secured in the wild in New South Wales for 100 years (OEH 2016b).

- The following Saving our Species program priority management sites have been identified in the parks:
- Sublime Point pomaderris – Management actions for the site include weed control, maintaining appropriate fire regime, minimising damage from trail and track maintenance, minimising impact of rubbish dumping and monitoring threats. A conservation action plan, prepared in line with the National Parks and Wildlife Regulation, outlines management and monitoring requirements for this declared asset of intergenerational significance.
- Woronora beard heath – Management actions for the site include maintaining appropriate fire regime and monitoring species abundance and condition.

The identified actions will be implemented at these management sites, together with other relevant actions from the *Saving our Species* program for the other threatened species, populations and ecological communities that are known to occur in the parks.

The Commonwealth may prepare recovery plans for nationally listed threatened species under the *Environment Protection and Biodiversity Conservation Act 1999*. If prepared, these plans would apply to any of the nationally listed threatened species occurring in the parks.

O'Hares Creek Shale Forest is very restricted in extent occurring only in the O'Hares and Woronora catchments. In the parks it is found in small patches on remnant shale soils that lie as isolated caps above the sandstone plateau. Important actions for protecting this community include control of weeds, closing of illegal tracks and encouraging natural regeneration, and ensuring appropriate fire regimes.

The small areas of Southern Sydney Sheltered Forest are also threatened by inappropriate fire regimes, environmental weeds and grazing by deer.

The black cypress pine endangered population in the park is threatened by grazing deer and native animals, and by off-road trail bike use. The population has been fenced to reduce these impacts. High frequency fire is also a threat to this population. A wildfire in 2002 killed most of the mature trees, but the post-fire seedlings are beginning to produce seed cones. It will be vital to continue to protect the population from fire until more trees have matured and produced seed.

Photo 9 Black cypress pine, Dharawal National Park. Rowena Morris/DPE

The hairy geebung is usually present as isolated individuals or very small populations. It is subject to a number of threats, particularly inappropriate fire regimes, physical disturbance and competition from dense native vegetation and weed species.

Other plant species and ecological communities in the parks are threatened by weed invasion, grazing by feral animals, trampling by humans and feral animals, rubbish dumping, altered hydrological regimes, inappropriate fire regimes (see Box 6) and recreational pressures such as the illegal creation of tracks and trails (DECC 2007a). A number of threatened plant species in the parks are known to occur close to management trails and are vulnerable to damage from trail maintenance works or inappropriate recreational use.

Habitats in the parks have been assessed for their conservation significance (DECC 2007a, 2007b) and the highest priority habitats for conservation are:

- Upland swamps, which have exceptional importance for the conservation of threatened and regionally significant species and are the highest priority for the management of threatening processes and for land acquisition in the area (DECC 2007a).
- Western Gully Forest and Upper Georges River Sandstone Woodland habitat, which occur in the north-west area of the national park and are both poorly reserved in the Southern Sydney region. These habitats are important as part of a corridor of intact vegetation along the eastern edge of the Cumberland Plain, providing a linkage for wildlife, including threatened species such as the koala and greater broad-nosed bat, around the urban fringes of Southern Sydney (DECC 2007a)

Box 5: Threats to the upland swamps

Upland swamps in the parks have exceptional importance for the conservation of threatened species, regionally and locally significant species (see Box 4) and are the highest priority for the management of threatening processes and for land acquisition in the area (DECC 2007a). The swamps are threatened by high frequency wildfires, and environmental degradation caused by feral deer and fox predation is a significant threat to swamp animals.

Fire and rainfall/evaporation rates can influence the species composition of the swamps, particularly the proportions of woody shrubs versus sedges and herbs, the relative occurrence of the different swamp communities, and the balance between swamps and woodland. Management of fire could allow manipulation of the composition, diversity and structure of the swamp communities (Keith et al. 2006).

Other threats to the upland swamps include infection of native plants by *Phytophthora cinnamomi* (see Box 9) and disturbance associated with unauthorised recreational activities such as access by vehicles, trail bikes and horses. Longwall mining under upland swamps is a potential threat to the hydrology and ecology of the swamps (IEPMC 2019).

Restoration of habitats and degraded areas in the parks is prioritised through *Saving our Species* programs, feral animal and weed management strategies and other relevant park management programs. Several old quarries and other cleared sites exist in the parks. While rehabilitation work has been undertaken, recovery in some areas is being affected by illegal vehicle use. These sites may require further access control or other intervention where natural regeneration is insufficient.

Maximising the continuity of vegetation on a regional basis allows the movement of animals across the landscape and is critical to protecting native animals and minimising local extinctions in the parks. The parks are one of the better-connected protected area complexes as they are adjacent to extensive areas of protected native vegetation. However, there are barriers to movement, including the Princes Motorway, Princes Highway and Appin Road.

Parts of 10B Trail and 10C Trail were surfaced with coal wash some time ago (see also 6.1.1). Coal wash is readily transported in runoff during rainfall and can accumulate in drainage lines, ephemeral pools and creeks, and may produce an alkaline leachate. If alkaline conditions are created by coal wash they may adversely affect plants and animals or their habitats, including breeding grounds for many frog species.

The most significant threats to native animals in the parks are predation by fox in the upland swamps, environmental degradation caused by deer (see Section 2.3) and infection of frogs with chytrid fungus.

Chytrid fungus is widespread in the parks and may have caused the severe decline or local extinction of the green and golden bell frog, stuttering frog and potentially the green tree frog. It may also be a significant threat to Littlejohn’s tree frog (DECC 2007a).

Box 6: Fire in the parks

The impact of high frequency fires has been listed as a key threatening process under the Biodiversity Conservation Act (NSW Scientific Committee 2000a). The endangered ecological communities in the park are vulnerable to the effects of too-frequent fire.

The O'Hares Creek Shale Forest and the black cypress pine population are particularly vulnerable to frequent fire, and koala habitat in the in the north-west of the national park, is also threatened by high frequency fire. Several species, including the broad-headed snake, may be threatened by hot crown fires, and fires that result in substantial impact to tree hollows. Fire management in the parks should seek to minimise the risk to summer refugia/tree hollows from hot/extreme summer wildfires or prescribed burns.

The upland swamps are a particularly flammable vegetation community. The vegetation of the swamps is impacted by the fire regime and the maintenance of high species richness may be dependent on fire disturbance (Keith & Myerscough 1993; Keith 1991; Stricker & Wall 2000). Although the fire response of upland swamps is complex, substrate fires, recurring short intervals or long intervals should be avoided (NSW Scientific Committee 2012).

Aboriginal sites in the parks are also at risk from bushfire. Sites most at risk are rock art sites on westerly aspects which are vulnerable to cracking and exfoliation of rock, and sites on soil or rock platforms that could be affected by vehicles or earthmoving machinery.

The fire history of the parks has been documented since the 1950s with major wildfires occurring in 1965–66, 1968–69, 1990–91 and 2001–02 and together burning most of the parks. In 2012 a wildfire burnt much of the nature reserve. Most other unplanned fires have been restricted to less than 50 hectares. Most ignitions are caused by arson and deliberate misuse of fire.

NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service and is a member of the Southern Highlands, Macarthur and Illawarra bush fire management committees.

A fire management strategy which defines the fire management approach for the parks has been prepared (OEH 2009). It guides protection of the natural and cultural assets in and adjacent to the parks. It also outlines the recent fire history of the parks, key assets within and adjoining the parks, including sites of natural and cultural heritage value, fire management zones and fire control advantages such as management trails, asset protection zones and water supply points. The strategy includes fire thresholds to prevent the negative impacts on plant communities of too-frequent fires. Asset protection zones and strategic fire advantage zones have been established to help protect houses at Wedderburn and Darkes Forest.

Other specific issues for the conservation of threatened animals in the park include:

- The broad-headed snake is restricted to rocky habitat and adjacent forests in open sandstone ridge country. Protection of areas of exfoliating rock surfaces is crucial for the survival of this species. Closure of informal tracks near known habitat will improve protection of habitat for this species. These works will be informed by continuing habitat and species monitoring. Elsewhere in the Sydney region, habitat for broad-headed snakes has been significantly reduced by bushrock collection for garden use.
- It is considered that the Campbelltown koala population (estimated at 300-400) is not large enough to give it long-term resilience and it remains vulnerable. The biggest threat to the population is habitat loss and fragmentation (NSW Parliament 2020).

Maintenance of vegetation continuity between the park and adjoining habitat to the north and west is essential for the long-term wellbeing of the koala population. The Holsworthy Training Area provides connectivity for koala movement between populations in the Campbelltown and Heathcote areas. These connections are vital as the Campbelltown koala population has low genetic diversity (Lee et al. 2010). High frequency wildfires also pose a significant threat to the koala colony.

- Several threatened animal species have previously been recorded in the parks or nearby areas but are now thought to be locally extinct. These include the eastern ground parrot, eastern bristlebird, regent honeyeater, long-nosed potoroo, stuttering frog and green and golden bell frog. Inappropriate fire may have contributed to the local extinction of some of these species, including the eastern ground parrot, eastern bristlebird and long-nosed potoroo. Should any of these species be rediscovered they should have the highest priority for conservation and management.

Systematic and targeted vegetation and animal survey work has provided an adequate baseline understanding of the vegetation communities, and plant and animal species in the parks and allowed the setting of local conservation priorities. The survey work has also highlighted issues requiring further study to support effective management into the future (DECC 2007a). Recommendations for further study include:

- distribution of threatened plant species is only partially known and surveys would enhance the ability to protect populations from disturbance
- determination of the extent of chytrid fungus in the parks
- confirmation of the occurrence and determination of the distribution of plague minnow
- surveys for regent honeyeater and swift parrot
- ongoing surveys for long-nosed potoroo, particularly at Maddens Creek crossing – rediscovery of this species in the study area would have the highest conservation priority and immediately trigger the formulation and implementation of an active management program
- bi-annual surveys for upland swamp birds
- targeted surveys for eastern false pipistrelle, large-eared pied bat and little bentwing-bat
- further surveys for squirrel glider
- surveys for feral cats
- determination of whether spotted-tailed quoll persists in the area.

Box 7: Climate Change

Human-induced climate change is listed as a key threatening process under the Biodiversity Conservation Act (NSW Scientific Committee 2000b) and habitat loss caused by human-induced greenhouse gas emissions is listed under the Environment Protection and Biodiversity Conservation Act. The following is a snapshot of the predicted changes to climate for Metropolitan Sydney (OEH 2014):

- maximum temperatures are projected to **increase** in the near future* by 0.3–1.0°C
- maximum temperatures are projected to **increase** in the far future by 1.6–2.5°C
- minimum temperatures are projected to **increase** in the near future by 0.4–0.8°C
- minimum temperatures are projected to **increase** in the far future by 1.4–2.5°C
- the number of hot days (i.e. >35°C) will **increase**
- the number of cold nights (i.e. <2°C) will **decrease**
- rainfall is projected to **decrease** in spring and winter
- rainfall is projected to **increase** in summer and autumn
- average fire weather is projected to **increase** in spring
- severe fire weather days are projected to **increase** in summer and spring.

The projected increases in temperature, number of hot days and severe fire weather days are likely to influence bushfire frequency and intensity across the Metropolitan Sydney region and result in an earlier start to the bushfire season. Higher rainfall in summer and autumn are likely to accelerate all forms of soil erosion across the region and increase runoff at these times of year.

Climate change may change the size of populations and the distribution of species and alter 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, narrow ranges or slow growth rates, such as black cypress pine.

The potential impact of climate change on the park is difficult to assess since it depends on the compounding effects of other pressures, particularly the cumulative impact of vegetation clearing and urbanisation in surrounding areas and impacts on the integrity of wildlife corridors.

Climate change could have a significant impact on the parks' upland swamps through reduced rainfall, higher evaporation and increased fire frequency which will result in changes to species composition and structure of plant communities (NSW Scientific Committee 2000b).

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

2.3 Feral animals, pests and weeds

Pest species are plants, animals and pathogens that have negative impacts on the environment, economy and society. The impacts are most commonly caused by introduced species. Feral animals and pests can have impacts across the range of park values, including impacts on biodiversity, cultural heritage, catchment and scenic values, with several listed as key threatening processes.

A history of limited disturbance and restricted public access has minimised the introduction and establishment of major weed populations in the parks. However, a variety of weed species have been recorded, including species that are native to Australia but unlikely to be indigenous to the parks (Keith 1994). Priority species are listed in Appendix E. Introduced species are largely confined to disturbed areas in the parks including roadsides, utility corridors and access trails, management trails, abandoned quarries, old mining sites and areas adjacent or downstream from agricultural and urban development.

Pampas grass was previously scattered throughout the parks, particularly in old quarry and spoil placement sites, along easements and access trails, and other disturbed areas, but is now significantly reduced. Pampas grass is an aggressive competitor with native plants and seeds prolifically, with seeds often being wind dispersed or floating down drainage lines over large distances.

Blackberry and gorse occur in the parks but are subject to an ongoing control program and their occurrence is localised.

African lovegrass occurs along the southern boundary of the park adjacent to Appin Road, largely as a result of disturbance during road realignment. Although this weed has not invaded adjacent bushland, any disturbance along this edge is likely to lead to the grass spreading into the park.

A number of environmental weeds, including other exotic grasses, occur on or near the park boundaries and have potential to spread into the parks. Invasion of native plant communities by exotic perennial grasses including pampas grass, Rhodes grass, Coolatai grass, whisky grass and African lovegrass, is recognised as a threat to the parks' threatened ecological communities, threatened and rare plants, terrestrial orchids, ground-dwelling birds and reptiles (NSW Scientific Committee 2003).

Box 8: Phytophthora

Phytophthora cinnamomi (sometimes called cinnamon fungus) is a soil-borne pathogen which infects a large range of plant species and in some circumstances may contribute to plant death where there are other stresses present such as waterlogging, drought and perhaps wildfire (NSW Scientific Committee 2002). The fungus may be dispersed in flowing water, such as storm runoff, from infected roots to roots of healthy plants, as well as by vehicles, animals and walkers.

Dieback caused by Phytophthora is listed as a key threatening process under the Biodiversity Conservation Act (NSW Scientific Committee 2002) and Environment Protection and Biodiversity Act (DoE 2009).

Phytophthora has been known in the parks since 2008 (Suddaby & Liew 2008) and recent studies have found it to be widespread with presence and infection of plant species in all catchments including Illuka Creek, Dahlia Creek, Cobbong Creek, O'Hares Creek, Four Mile Creek and Stokes Creek (Craven & McDougall 2015).

Other environmental weeds occurring in the vicinity of the parks include introduced pine trees, Queensland silver wattle, prickly pear, fireweed, cotoneaster, broad and narrow-leaf privet, spear thistle and senna.

Phytophthora has been detected throughout the parks at a number of locations and is a significant threat to plant species and communities in the parks (see Box 8). The fungus is a potential risk to significant plant species and communities in the parks, including the endangered Coastal Upland Swamp and Southern Sydney Sheltered Forest communities, which are in landscapes where the fungus tends to be present and contain species that are susceptible to the disease.

The most significant feral and pest animals known in the parks are foxes, deer and the common yabby (see Box 9). Other feral and pest animals recorded include the plague minnow (or mosquito fish), feral cats, wild dogs, rabbits, goats, pigs and introduced birds. Priority species are listed in Appendix E. The extensive network of trails facilitates the easy movement of introduced animals in the parks.

Box 9: Feral animals in the parks

Foxes are widespread and common in the parks and may be having an impact on native animals. Foxes suppress native animal populations, particularly medium-sized ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Predation by the red fox is a key threatening process listed under the Biodiversity Conservation Act (NSW Scientific Committee 1998) and Environment Protection and Biodiversity Act (DEWHA 2008).

Deer have been recorded in the parks, mostly in the south-east and near the park boundaries. Deer have a significant impact on the environment and herbivory and environmental degradation caused by deer is listed as a key threatening process under the Biodiversity Conservation Act. Deer alter vegetation structure and species abundance, reduce the regeneration ability of native species, create soil instability, disperse weeds and displace native animals such as swamp wallabies. Deer have the potential to significantly impact upland swamps, alter the composition and structure of other threatened ecological communities and damage the endangered black cypress pine population.

Common yabbies are found in watercourses throughout the parks. Although native to Australia, this species is not indigenous to the area and is a potential major threat to the indigenous spiny crayfish, the threatened giant burrowing frog and Littlejohn's tree frog, and other frog species.

The **mosquito fish**, or plague minnow, is found in the lower reaches of Stokes and O'Hares creeks. This species impacts on native fish, invertebrates and frogs.

2.3.1 Management considerations and opportunities

The *Biosecurity Act 2015* and its regulations provide specific legal requirements for the response, management and control of biosecurity risks, including weeds, feral animals and other pest animals. These requirements apply equally to public land 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 Greater Sydney and South East regions where the parks are located (GSLLS 2017, 2018; SELLS 2017, 2018). These plans identify priority weeds, feral animals 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).

The relevant NPWS pest management strategy (OEH 2012a) identifies feral animals, pest species and priority programs for the parks. The overriding objective of the pest management strategy is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. The strategy also identifies where other site-specific or pest-specific plans or strategies need to be developed to provide a more detailed approach. Reactive programs may also be undertaken in cooperation with neighbouring land managers in response to emerging issues.

As the parks are at the top end of a water catchment, control of weed species is particularly important so that the further dispersal of weeds into the catchment via drainage lines is reduced.

An integrated approach to weed management is employed in the parks using a range of techniques at critical times of the year, and often targeting more than one species. Methods may include physical removal, herbicide use, fire, biological control and revegetation. Key weed control programs include bush regeneration undertaken by NPWS staff, volunteers and contractors. Long-term control programs have been undertaken in the parks for target species, including gorse, blackberry and pampas grass, and the continuation of these programs is a priority.

Exotic grasses favour disturbed areas such as roadsides. They have potential to spread in the park via management trails, utility access tracks and other disturbed areas or when other vegetation is reduced after bushfire events. There are a number of utility corridors and associated access trails in the parks, particularly in the southern part of the national park and the nature reserve. The role of utility providers in the management and control of weed species is particularly important in these areas. Priority areas for monitoring and control of these weed species include upland swamps and O'Hares Creek Shale Forest in the nature reserve and the southern end of the national park.

Management of Phytophthora in the parks is in accordance with current best practice management guidelines and will aim to minimise the spread of the fungus and prevent impacts on new species and ecological communities (O'Gara et al. 2005; DPIE 2020b). Actions include avoiding areas where it is present and implementing hygiene protocols, such as cleaning vehicles, boots and equipment, which can help minimise the spread of the fungus. Fire management, trail maintenance, access for research and infrastructure maintenance must consider Phytophthora presence and implement risk management recommendations for its control (Craven & McDougall 2015). Any proposals for new walking tracks or other facilities should sample for the fungus and consider results in the planning process. Track closures should be implemented or maintained where necessary to minimise chance of spread to areas that are currently free of Phytophthora.

NPWS works with Local Land Services and park neighbours on cooperative programs to control feral and pest animal species. Management of foxes in the parks is guided by the key threatening process strategy and focuses on the protection of the broad-headed snake and threatened frog and mammal populations.

Wild dogs are known to occur in the parks. Wild dogs include any wild-living dog in New South Wales, including dingos, feral dogs and their hybrids. Wild dogs can have a major impact on domestic stock and may also have significant impacts on the distribution and abundance of native wildlife. NPWS manages wild dogs in parks in accordance the relevant Local Land Services regional strategic pest animal management plan (GSLLS 2018; SELLS 2018). Control of wild dogs is undertaken in the parks.

Mosquito fish are present in the lower reaches of Stokes and O'Hares creeks. Waterfalls and weirs inhibit their movement into the upper reaches of the creeks, so they are not currently considered a significant threat to the frog species in the parks. Any removal of weirs will need to consider the species' potential to move upstream.

3. Shared cultural heritage

Both Aboriginal and non-Aboriginal people place values on cultural and natural landscapes. These values may be attached to the landscape as a whole, or to parts of the landscape (e.g. a particular plant, animal or place). All landscapes contain the imprint of human use. On any given area of land some historical activity will have taken place. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land-use practices, and people continue to influence the land through recreational use, cultural practices, the presence of introduced plants and animals and, in some cases, air and water pollution.

Most of the area of the parks was protected as water supply catchment for over 80 years, or remains protected as water supply catchment, and is relatively undisturbed. This has resulted in rich and well-preserved examples of cultural heritage. Culturally important places, sites and objects of both Aboriginal and non-Aboriginal origin occur throughout the parks and provide a record of human activities related to the natural features of the region.

Shared heritage

Australia has one of the oldest records of human existence on the planet, with records dating back 40,000 years. Many places today have particular significance to Aboriginal people.

Other places hold significant history to both Aboriginal and non-Aboriginal people, and very often this history is a shared one. **Shared cultural heritage** refers to history and heritage after 1788 when Europeans first arrived in Australia. This heritage is shared by all Australians and includes places and items that may have historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance. Shared heritage in the parks is made up of living stories as well as connections to the past including natural resources, objects and traditions that need to be conserved for current and future generations.

Documented European exploration in the area of the parks commenced with George Caley in 1802 and Dr Charles Throsby in 1815. Darkes Forest was named after Surveyor Darke who marked out routes in the district in the 1840s.

The rugged sandstone landscapes of the Woronora Plateau, with its generally poor soils, were avoided by early Europeans seeking farmland. Areas more suited to agricultural development, such as the nearby centres of Appin and Wollongong, were under cultivation by the early 1820s. Aboriginal people were progressively driven from their land as European settlement expanded and disease and warfare took their toll, but they may have continued to occupy the sandstone country of the parks for longer than nearby areas.

Several important sites of contact between Aboriginal people and Europeans occur in the region. One of these is Bull Cave, north of the parks, where Dharawal People sketched the cattle they saw after a small herd escaped soon after the arrival of the First Fleet in 1788. South of the parks, in the gorge of the Cataract River, is a massacre site at which at least 14 Aboriginal people died in 1816 during a punitive expedition ordered by Governor Macquarie. A memorial ceremony continues to be held each year to remember and honour the Dharawal People who died.

3.1 Coalmining

Coalmining began in the district in 1849 at Mt Keira on the Illawarra Escarpment and by the 1870s it was a major industry, progressively extending further westwards. Mining has

occurred beneath parts of the parks, and the former North Cliff Colliery remains an inholding in the centre of the national park (see Figure 2).

Physical evidence of coalmining, and sand and shale extraction, remains in the parks in the form of vehicle trails, cleared or excavated areas, seismic survey lines and utility infrastructure, including a powerline, telephone cable and water pipeline related to North Cliff Colliery (see Section 5).

Photo 10 Shale forest with gymea lilies in Dharawal National Park. Lucas Boyd/DPE

During the late 19th and early 20th centuries the Upper Nepean Water Supply Scheme and Cataract, Cordeaux, Avon, Nepean and Woronora dams were constructed. The O'Hares Creek catchment was declared a special area in 1927 with the intention of damming the creek to supplement water supplies. This proposal was largely abandoned in 1978 but the area continued to be managed by the Sydney Water Board and subsequently the Sydney Water Corporation until 1996, when it was reserved under the *National Parks and Wildlife Act 1974*. Three small concrete 'v-notch' gauging weirs, related to past water supply investigations and used for recording stream flow from 1943 to the early 1990s, still exist on O'Hares and Stokes creeks. There are also a seismic monitoring station and meteorological station which remain operational (see Section 5). An additional weir and gauging station was constructed on O'Hares Creek in 1978 and is maintained by WaterNSW (see Section 5).

The Australian Army used part of the O'Hares Creek catchment from the 1930s until the early 1990s for training, as a supplement to the adjacent Holsworthy Field Firing Range. Army use included camping, orienteering and field exercises. Spent plastic cartridges, 'fox-holes' and cleared bivouac sites are tell-tale signs of past army activity in the parks. As a precaution, areas between the current Holsworthy Training Area and Darkes Forest are considered to potentially contain unexploded ordnance.

A former military truck (known as a Matilda Tank) is located south-east of 10D Trail. One anecdotal report says that the truck was converted into a bulldozer for road work during the

1950s while another says it transported felled timber, mostly stringybark, from the parks to a timber yard in Sydney.

A cleared area in the park adjacent to the western end of 10T Trail was formerly grazed under a special lease (Lot 47) that expired in 1991 and a licence (Lot 15) which terminated in 1995. A field archers' club also operated on this land for several years. From 2015 to 2018 a regeneration project involved ripping the ground and planting native tube stock with the help of volunteers. Regeneration and revegetation is continuing on this site.

The area west of Victoria Road Trail is reported to have been cleared and grazed during the 1960s but has since regenerated. This area was later proposed for residential development and Victoria Road Trail and a side road were sealed to provide access for the subdivision. Protests by local conservation groups during the 1980s, to protect O'Hares Creek gorge from development, eventually resulted in the area being acquired for reservation. Strong community support for protection of the area continued and led to creation of the national park in 2012, establishing what is seen as a benchmark for what community conservation efforts can achieve.

3.1.1 Management considerations and opportunities

The significance of any remains of past mining, catchment and military uses in the parks has not been assessed. It is considered unlikely that any will be significant, however, they are of interest at the local level as a record of past activities in the parks. The heritage values of the parks should be assessed, and if any heritage items of significance are identified they should be included in the NPWS Heritage and Conservation Register (s.170 of the *Heritage Act 1977*) and protected accordingly.

The history of the parks and the role of community conservation efforts should be interpreted for parks visitors.

Photo 11 Maddens Falls, Dharawal National Park. John Yurasek/DPE

4. Providing for visitor use and enjoyment

A range of visitor opportunities are provided in the parks. NPWS aims to ensure that visitors enjoy, experience and appreciate the parks, and that park values are conserved and protected.

The parks currently experience low to medium levels of visitation. Park visitors are generally involved in low-impact, self-reliant activities such as bushwalking, swimming, cycling and birdwatching. Most visitors are attracted by the semi-remote character and spectacular scenery, gorges, waterholes and waterfalls.

The parks are close to large and expanding residential population centres in the Southern Sydney, Macarthur and Illawarra regions. With increasing population, demand for bushland recreation opportunities is increasing. Improvements have been made to visitor facilities on the edge of the national park at Wedderburn and Darkes Forest to increase the opportunities available and the range of visitors who can enjoy the parks.

Visitor opportunities that are considered appropriate in the national park are those that are ecologically sustainable and which directly contribute to visitors' enjoyment and understanding of the area.

The primary purpose of nature reserves is to conserve ecosystems, species, communities or natural phenomena. They differ from national parks in that there is no requirement to provide for visitor use in nature reserves. Research, educational use, nature study and enjoyment are appropriate uses where they do not conflict with conservation.

The state conservation area is very small and subject to underground mining operations. Therefore, it does not provide visitor facilities or opportunities.

The parks are part of a larger system of protected lands in the region that provide a wide range of outdoor recreation opportunities. These include picnic areas at Cataract, Cordeaux and Woronora dams; the Cataract Scout Camp; a range of day use, camping, walking and other facilities in Heathcote and Royal national parks and Garawarra and Illawarra Escarpment state conservation areas; and local reserves along the Georges River and Illawarra Escarpment. The Cataract Dam picnic area, just south of the parks, has comfortable car-based picnic facilities, while cafes, picnic facilities and lookouts are available immediately to the east of the parks on the edge of the Illawarra Escarpment.

4.1 Access

Sealed roads provide convenient recreational access to the parks at Wedderburn, Darkes Forest and along Appin Road. From these sealed roads there are 7 entrances into the parks along management trails. There is no public vehicle access into the parks. Within the parks a network of unsealed management trails provides a range of opportunities for cycling and walking and limited opportunities for horse riding.

The eastern section of the national park (between the Princes Motorway and the Princes Highway) is part of the Metropolitan Special Area and classified as Schedule 1 lands under the Water NSW Regulation 2020. Public entry to Schedule 1 lands is generally not permitted (see Box 1).

4.1.1 Management considerations and opportunities

Appin Road is a primary route for people travelling between the Macarthur region and South Coast beaches, and therefore the park's southern boundary has high public exposure to passing traffic. Appin Road is a high-speed road and, while it is likely to continue to provide

an entry point (via 10B Trail) into the park for walking and cycling activities, further development of facilities for park visitors at this location is constrained by land tenure and road safety issues. Primary visitor access points are Victoria Road at Wedderburn and Darkes Forest Road at Darkes Forest. Visitor facilities, including limited carparking, will continue to be provided at these locations.

Access to the special area is controlled by both NPWS and WaterNSW and may only be authorised through the issue of a consent under the Water NSW Regulation and the National Parks and Wildlife Regulation. To overcome the need to separately obtain consent from the 2 agencies, all requests for access to the special area are assessed by WaterNSW under an access policy and accompanying access protocol that have been agreed between the 2 agencies.

Photo 12 O'Hares Creek Lookout, Jingga Walking Track, Dharawal National Park. Rowena Morris/DPE

4.2 Picnicking and day use

Day use areas, typically picnic facilities or sites for interpretation and education, are often the main destination for most visitors to parks.

Day use areas in the parks are provided in the Wedderburn and Darkes Forest precincts (see Table 4) of the national park. The primary purpose of these facilities is to cater for visitors who will be walking or cycling in the parks or want an easily accessible opportunity to appreciate the park's values. These day use facilities are located on the plateau areas near the edges of the national park, where they are easily accessed and have minimal impact on park values.

Informal roadside parking and interpretive information is also provided at the entrances to 10H Trail (off Darkes Forest Road) and 10B Trail (off Appin Road).

There are no visitor facilities in the nature reserve or state conservation area.

Table 4 Day use areas in the parks

Day use area	Features	Visitor facilities
Wedderburn (Victoria Road)	Track head for access to O'Hares Creek Lookout, Minerva Pool, Jingga Walking Track	Carpark, tables, toilets (disabled access), information
Darkes Forest (Maddens Falls)	Track head for access to Maddens Falls Lookout	Informal parking

4.2.1 Management considerations and opportunities

Lack of public vehicle access and a history of active protection as a water supply catchment has meant that the parks are relatively undisturbed. The parks are relatively small and have very significant natural and cultural values and sensitive landscapes that are vulnerable to erosion and other impacts. It is vital that visitor opportunities be designed and managed to protect these values.

Population growth, particularly in the Macarthur area, will place increasing pressure on the parks. However, to protect the area's semi-remote character and the parks' significant natural and cultural values, visitor facilities will remain low-key and on the edges of the parks. The central areas of the national park will continue to be available for self-reliant recreation such as bushwalking and cycling.

Visitor facilities have been subject to high levels of vandalism, and this will continue to be a consideration in the management of access to the parks and the provision of visitor facilities and amenities.

4.3 Bushwalking

Bushwalking allows visitors to be in close contact with the environment and can increase understanding and enjoyment of parks.

The parks provide a range of bushwalking opportunities within a number of settings, with varying degrees of physical challenge and self-reliance (see Table 5 and Figures 2, 3, 4). The walking track grades identify a track's suitability for different user groups and abilities as follows:

- Grade 1 – No bushwalking experience required. Flat, even surface with no steps or steep sections. Suitable for wheelchair users who have someone to assist them.
- Grade 2 – No bushwalking experience required. The track is a hardened or compacted surface and may have a gentle hill section or sections and occasional steps.
- Grade 3 – Suitable for most ages and fitness levels. Some bushwalking experience recommended. Tracks may have short steep sections, a rough surface and many steps.
- Grade 4 – Bushwalking experience recommended. Tracks may be long, rough and very steep. Directional signage may be limited.

The O'Hares Lookout, Jingga and Minerva Pool walking tracks all branch off the Victoria Road Management Trail and can be combined to provide a 7.5-kilometre walk, noting parts of the Jingga Walking Track are very steep and gravelly (see Figure 3).

Other management trails in the parks (including 10, 10B, 10C 10D and 10H) provide walking opportunities but walks on these trails are very long (up to 20 kilometres). A small proportion of visitors who are experienced and equipped for self-reliant bushwalking utilise other areas in the parks.

Photo 13 Jingga Walking Track, Dharawal National Park. Nick Cubbin/DPE

Table 5 Walking tracks in the parks

Track name	Location	Distance	Current grade*	Comment
Maddens Falls Lookout	Darkes Forest	1 km return	Grade 3	Combines 10Z Trail with a boardwalk
O'Hares Creek Lookout	Wedderburn	2.8 km return	Grade 1	
Jingga	Wedderburn	2.4 km return	Grade 3	Very steep in parts, with a rough surface
Minerva Pool	Wedderburn	2.4 km return	Grade 3	

* Tracks are graded using the Australian Walking Track Grading System, which is based on the Australian Standard for walking track construction (AS 2156) (NPWS 2020).

4.3.1 Management considerations and opportunities

The creation of new walking track routes is not feasible due to environmental impacts and resource implications. However, there are opportunities to formalise additional walking routes in the parks by utilising the network of existing management trails, closed trails and informal walking tracks together with the installation of new short linking tracks where required. Opportunities include:

- A medium distance walk in the Darkes Forest area of the park that would include access to waterholes. A 4-kilometre loop track could be formalised from the informal tracks that exist across O'Hares Creek, linking 10H, 10C and 10R trails. This would provide an opportunity for an 11–12-kilometre loop incorporating 10C and 10R trails starting from either 10B Trail off Appin Road or 10H Trail off Darkes Forest Road.

- There is potential to modify the Minerva Pool Walking Track to create a 2.5-kilometre loop walk utilising 10T Trail. This would require an easement to allow public foot access and management access or construction of a short new section of trail to avoid private land.
- The formalisation of a walking track known as Seven Creeks Way along an existing informal track in the south-western part of the park has previously been proposed as part of a long-distance walking track in the region, linking bushland in the Georges River catchment to the Illawarra Escarpment. Much of the track is poorly drained and deeply eroded by trail bike use, and it would require significant work to make it suitable for walking or cycling. Public use of this track may threaten broad-headed snake populations in this area. Consideration could be given to formalising this track subject to environmental impact assessment, sufficient resourcing and links with a regional network of tracks,
- The informal Iluka Track is poorly drained and deeply trenched. This track branches off the 10 Trail which traverses Schedule 1 lands and is subject to access restrictions.

4.4 Cycling

The national park provides opportunities for cycling along a number of management trails, including 10B, 10C, 10H, 10D, 10R, 10U, 10T trails and Victoria Road Trail (see Figure 2). The management trails provide a good length of cycling route, most of which is reasonably level. The flatter areas of the plateau provide opportunities for less experienced riders and families, while the long and somewhat steeper management trails in the central part of the parks (10H/10C route and the northern end of 10B Trail) offer more challenging opportunities for more experienced riders. The trails also present the opportunity to combine cycling with bushwalking to allow access to features in the centre of the park on a day visit.

Cycling is not permitted on walking tracks, 10 Trail (which runs through the nature reserve and the WaterNSW special area) or on 10Z Trail in the Darkes Forest area of the national park, as this short trail is part of the popular walk to Maddens Falls.

4.4.1 Management considerations and opportunities

The soil-borne pathogen *Phytophthora cinnamomi* is known to be present in the parks and must be considered in the management of cycling opportunities. 10 Trail passes through areas of threatened ecological communities, areas where Phytophthora is known to be present and through the edge of the Metropolitan Special Area. Cycling is not permitted on 10 Trail.

Box 10: Cycling the 10B Trail

10B Trail offers the perfect day out for a long mountain bike ride. At about 15 kilometres long, it starts near the Appin Road entrance of Dharawal National Park and follows an unsealed road through open forest and woodlands along a sandstone ridge. It is a great bike ride for small groups and families with older children.

The last 3 kilometres present more of a challenge, when the trail descends into Stokes Creek gorge, leading to a steep climb up to the park's northern entrance at Wedderburn.

At the creek crossing (Stokes Creek) there is a broad rock platform where you can stop for a break. Birds, including the raucous yellow-tailed black-cockatoo, inhabit the area. For a more challenging experience, riders may leave 10B Trail to follow 10D Trail before crossing Cobbong Creek and rejoining 10B Trail.

Photo 14 10B Trail in Dharawal National Park. John Yurasek/DPE

4.5 Horse riding

Horse riding is a popular recreational activity that has cultural associations for many Australians. The NPWS *Strategic Directions for Horse Riding in NSW National Parks* (OEH 2012b) provides a framework to improve riding opportunities in eight priority regions in New South Wales. The South Coast, where the parks are located, is not one of the priority regions.

It is recognised that many riders enjoy riding in bushland. However, horse riding can have unacceptable impacts causing erosion, vegetation trampling, weed introduction, increase nutrient inputs into watercourses and conflict with other park users if undertaken in unsuitable locations.

Horse riding is permitted, subject to written consent, on 10H Trail to its junction with 10C Trail (see Figure 2). 10H Trail is accessed from Darkes Forest Road. Horse riding is not permitted off-trail or in other parts of the parks. Horse riding that is part of a competition or large-scale organised activity (including non-commercial) is not permitted. All commercial activities require a licence.

Other opportunities for horse riding in a bushland setting exist in parts of the nearby Garawarra and Illawarra Escarpment state conservation areas.

4.5.1 Management considerations and opportunities

A network of unauthorised horse riding trails has developed in the park adjacent to private land at Darkes Forest on both sides of O'Hares Creek gorge. These trails are highly eroded and in places contain introduced grasses and other weeds. The tracks have been closed but will take considerable time to rehabilitate. Off-track riding is a particular concern on the soft soils near watercourses, which are highly vulnerable to erosion and weed establishment. Horse riding can also damage some types of Aboriginal sites, particularly rock engravings.

Horse riding opportunities in the parks have been considered, including review of horse riding on 10H Trail. NPWS has examined environmental and safety issues as well as other uses of the area and historical horse riding use and determined that horse riding will be allowed on 10H Trail, but it is not appropriate to extend the horse riding trail network beyond this trail. Widespread and more intensive horse riding would pose a significant threat to the parks' natural and cultural values and would not be appropriate.

4.6 Water-based activities

Waterholes and watercourses are common in the parks. These watercourses provide welcome rest stops on many of the bushwalking routes and some provide opportunities for swimming.

4.6.1 Management considerations and opportunities

Swimming in wild rivers has inherent dangers with hazards including fast flowing water, submerged objects, deep water and steep cliffs or banks. Visitors to the parks should be aware of the dangers.

Minerva Pool has special significance as an Aboriginal women's place (see Box 2) and is an important part of Aboriginal culture. To respect the cultural importance of this site the Tharawal LALC request that only women and children enter the waters of the pool. Minerva Pool is deep, surrounded by irregular cliff edges and may contain submerged objects. It is not safe for jumping or diving and not suitable for inexperienced swimmers.

Located on O'Hares Creek away from Minerva Pool is Jingga Pool (at the end of the Jingga Walking Track). In the language of the Dharawal people, *jingga* means 'nice and sweet' in relation to water. Jingga Pool also provides swimming opportunities and is an alternative location for men to swim. Jingga Pool has deep water and is surrounded by cliff edges. Fast flowing water, submerged objects and deep water are continuing hazards. It is not suitable for inexperienced swimmers.

4.7 Camping

Camping is not permitted in the parks in order to protect the significant catchment, natural and cultural values of the parks.

Opportunities for vehicle-based and walk-in camping in bushland are available nearby in Royal National Park, Heathcote National Park, Illawarra Escarpment State Conservation Area and Cataract Scout Camp (by prior arrangement with Scouts NSW).

4.7.1 Management considerations and opportunities

With a large number of waterways, steep topography, and significant natural and cultural values, the parks are not suitable for the establishment of camping facilities. The provision of camping opportunities and facilities would impact bank stability, water quality, significant plant communities and cultural values and is likely to increase the risk of fire ignition.

4.8 Non-commercial group activities

Group activities and events provide opportunities to promote park values and encourage support for conservation of those values in the parks and elsewhere. Large groups can, however, have an environmental impact and can restrict opportunities for independent visitors. Some organised group activities have been undertaken in the parks including rescue, navigation and similar types of training exercises.

Photo 15 Jingga Pool, Dharawal National Park. Nick Cubbin/DPE

4.8.1 Management considerations and opportunities

Group activities are managed in accordance with the National Parks and Wildlife Regulation and associated NPWS policies and procedures that aim to encourage sustainable use by preventing impacts on the natural and cultural values of the parks and minimising impact on other visitors. Non-commercial, large-scale group activities may require consent, and group activities of a commercial nature require licensing (see Table 4 in the plan of management). All activities must be consistent with the management principles of the parks and be compatible with the natural and cultural heritage values of the parks.

4.9 Commercial activities and events

Commercial tourism increases the opportunity for public participation in nature-based activities and provides opportunities for professional instruction in the safety and minimal impact aspects of various recreational pursuits.

A small number of commercial tour operators are licensed to use the parks and it is expected that the area may become more attractive to commercial tourism operators.

4.9.1 Management considerations and opportunities

Commercial tour operators require an Eco Pass licence and use of the parks is limited to formal trails and tracks.

There are opportunities for the Aboriginal community to develop and operate commercial cultural tourism in the parks.

Other group activities and events of a commercial nature require a licence under the National Parks and Wildlife Regulation. Activities must be consistent with the parks' management principles and protection of natural and cultural heritage values. Licence applications are assessed in accordance with relevant NPWS policies and procedures and conditions can be applied to minimise any adverse impacts.

4.10 Information, interpretation and education

Providing information for park visitors assists in the protection of natural and cultural heritage, promotes support for conservation, and increases the enjoyment and satisfaction of visitors.

Information, interpretation and education programs in the parks are delivered through:

- interpretive signs including information about park values and recreation opportunities at the national park entrances at Victoria Road, 10H Trail, 10B Trail and Darkes Forest
- guided activities as part of the Discovery ranger program and opportunistically as part of research projects or management programs conducted in the parks
- directional, regulatory and safety signs that support safe and sustainable use of facilities
- app and web-based information for trip planning, safety and understanding park values.

Photo 16 NPWS Discovery activity in Dharawal National Park. Rowena Morris/DPE

Research projects have been undertaken in the parks by NPWS, other authorities and tertiary education institutions, particularly students and staff of the University of Wollongong, University of NSW and University of Technology Sydney. Research has concentrated on native plant and animal species and Aboriginal heritage, and there have also been studies of water quality. Limited public access to the parks has minimised disturbance and interference to research sites, so the parks remain a valuable ongoing research location, and research continues to provide valuable information for management of the parks.

4.10.1 Management considerations and opportunities

The significance and little disturbed nature of the parks and their proximity to the population centres of Wollongong and Southern Sydney present a range of opportunities for research and education. The visitor facilities at the Victoria Road entrance provide support for educational visits by local schools.

There are opportunities to better interpret the natural and cultural values of the parks through a range of media, including app and web-based technology, guided activities, displays and signs. The level, wheelchair-accessible track to O'Hares Lookout provides a very good location to implement interpretation for guided and self-guided visits to the park, particularly highlighting Aboriginal cultural values. Interpretation at this site will be developed in conjunction with local Aboriginal community organisations.

Walking tracks in the Darkes Forest area provide possibilities for viewing upland swamps and opportunities for interpretation to increase understanding and appreciation of the conservation history and significant environmental values of the swamps.

The parks will continue to provide opportunities for research that contribute to the understanding and management of park values.

Visitor safety is an important part of the parks' information programs and signage. Safety signage in the parks is provided in English but includes international symbols for people from non-English speaking backgrounds. Safety information is regularly reviewed as part of the parks' risk management program to ensure that essential safety messages are communicated effectively.

5. Park infrastructure and services

5.1 Park infrastructure and services

Management operations in the parks are coordinated from the NPWS Office in Wollongong and field depot at Byrong Park, Mount Keira.

There are 7 kilometres of sealed management trails and 62 kilometres of unsealed management trails in the parks. These are maintained to provide access for fire management, feral animal control, monitoring and other management activities.

The management trails in the park are an important fire management asset and most of the management trails are identified as strategic or tactical fire trails. The fire trails are detailed in fire access and fire trail (FAFT) plans prepared by the relevant Rural Fire Service bush fire management committee under the Rural Fires Act (Illawarra, Macarthur and Wollondilly bush fire management committees cover the area of the parks). These fire trails must be established and maintained consistent with prescribed fire trail standards to enable access for fire suppression and management (RFS 2016). Appropriate trail construction and maintenance standards are implemented to minimise impacts on the environmental and cultural heritage values of the parks.

All management trails are gated on the park boundaries and have associated wing fencing. There are also internal gates with wing fencing on 10B Trail and 10C Trail. These gates are associated with managing access to the former North Cliff Colliery site.

Fencing has been constructed along the western boundary of the national park between 10T Trail and 10F Trail, at the southern end of a closed trail along the old alignment of Appin Road and at the eastern end of the redundant North Cliff Colliery powerline, adjacent to 10B Trail.

Several management trails run along boundaries with the adjoining Metropolitan and Woronora special areas or the Holsworthy Training Area. 10V Trail, just outside the north-east park boundary, is maintained by the Department of Defence. A short length of 14 Trail (known as Fire Road 14), along the north-east park boundary, is maintained by WaterNSW.

In the nature reserve, 10A Trail and 10Q Trail are maintained by WaterNSW. The section of 10 Trail in the nature reserve is maintained by NPWS, while the remainder of the trail is maintained by WaterNSW.

5.1.1 Management considerations and opportunities

Management trails provide potential access for illegal activities such as waste dumping, arson and timber and bushrock collection. Vehicle and waste dumping and arson commonly occur along the boundary of the national park near the 10T Trail entrance. Although the road and gate are not in the park, these activities occurring here impact park values. Relocating the gate to a position further north would restrict access and reduce potential for illegal activities.

Some existing management trails and park access roads extend across adjacent lands owned and managed by other authorities or private individuals. To confirm and secure legal access for management purposes and visitor use via these routes, an access strategy will be prepared and implemented for the parks. The strategy will identify and prioritise actions to secure access agreements or negotiate other legal instruments where appropriate and required. A short section of 10T Trail crosses private land. NPWS requires vehicle access to the surrounding areas of park and will need to either construct a new short section of trail or implement other recommendations of the park access strategy.

Photo 17 10B Trail in Dharawal National Park. John Yurasek/DPE

The FAFT plan identifies realignment and/or reclassification of the 10H trail is required. Trail upgrades, including new turnarounds, are required on a number of other trails.

Management trails that are not required for vehicle access or fire management purposes may be reduced to walking track width and designated for walking, or closed and rehabilitated.

Many of the management trails in the parks are identified by a number rather than a name, as this was the system utilised by the catchment authority before the land became national park. Replacing the numeric names (or adding to the existing names) with a local Aboriginal name or geographic name (such as nearby creeks) for the primary management trails would facilitate understanding of their location by visitors and staff.

A concrete water tank, installed during former proposals to subdivide the area, is located near the northern end of Victoria Road Trail and is used as a water source for fire management operations. A sealed side road off Victoria Road Trail, known as Stuckeys Place, also remains from former subdivision. This road is not needed for management purposes and may be rehabilitated.

6. Non-park infrastructure and services

The parks contain a range of infrastructure and other assets owned and operated by other organisations, including electricity transmission lines, underground telecommunication cables, rain and river gauges, weirs and water pumps (see Appendix F).

6.1 Mining and exploration

Exploration for and production of minerals and petroleum are permissible uses in state conservation areas.

The parks overlie part of the extensive Southern Coalfield and there is a history of underground coalmining, which occurred at 400–500 metres below ground surface. Visible evidence of past exploration and mining activity includes vehicle trails, seismic lines, boreholes and a powerline and telephone cable, as well as infrastructure on the North Cliff Colliery inholding in the national park.

Most existing mining interests were terminated when the national park was gazetted in 2012, apart from a lease held by Endeavour Coal over the southern section of the state conservation area for coalmining and underground access associated with the West Cliff Colliery, and an exploration licence which applies to the northern section of the state conservation area. West Cliff Colliery is adjacent to the southern section of the state conservation area and comprises coal processing, stockpiling, transportation, waste emplacement and mine administration facilities.

6.1.1 Management considerations and opportunities

NPWS works closely with the state government authorities responsible for mining and petroleum activities, including mineral exploration and mine site rehabilitation, to ensure that exploration and production proposals in state conservation areas comply with all statutory requirements, including any necessary environmental impact assessments and approvals.

WaterNSW and NPWS, as joint managers of the Special Area, work within the Department of Planning framework to provide input into decision making for mining activities.

Coal licences exist for part of the state conservation area and surrounding areas.

The former North Cliff Colliery, owned by Endeavour Coal, is located on a Crown reserve inholding in the park (Crown Reserve R41372). The mine's facilities have been decommissioned and will no longer be used for mining purposes. However, the cleared site and coal wash on the southern parts of 10B Trail and 10C Trail are potential sources of sediment or water pollution in the park. Endeavour Coal is required to rehabilitate the site and the nature of the rehabilitation will depend on any future uses of the land. Removal of all facilities and revegetation of the area will maximise the habitat value of the site. The sections of 10B and 10C trails between the North Cliff Colliery inholding and Appin Road are corridors of Crown land excluded from the park (Crown Reserve 100247). Endeavour Coal has rights to use the trails and is responsible for their maintenance.

The effectiveness of rehabilitation of old mining trails in the parks is variable and a number of the trails continue to be used informally by walkers or illegally by trail bikes.

Lands categorised as state conservation areas are reviewed by the Minister for Environment and Heritage, in consultation with the Minister responsible for the *Mining Act 1992*, every 5 years. These reviews aim to assess whether there is still a need for mining or exploration activity. If there is no longer a need, a state conservation area can be upgraded and

recategorised as national park. A review of state conservation areas occurred in 2020 and no change was recommended to the categorisation of Dharawal State Conservation Area.

6.2 Powerlines

A number of major powerlines are located in the parks including:

- parallel 330 kV (Transgrid) and 11 kV (Endeavour Energy) transmission lines and an associated vehicle trail (10Q) which crosses the nature reserve immediately west of the Princes Motorway
- a 132 kV (Endeavour Energy) transmission line crossing the eastern tip of the nature reserve and the eastern section of the national park between the Princes Motorway and the Princes Highway
- a 33 kV (Endeavour Energy) transmission line crossing the eastern section of the national park near the Princes Highway
- a 33 kV (Endeavour Energy) transmission line crossing the southern edge of the eastern section of the national park
- a 33 kV electricity transmission line (depowered) owned by Endeavour Coal crosses the national park between the West Cliff Colliery and the North Cliff Colliery inholding. Several closed vehicle trails provide access to this power line.

6.2.1 Management considerations and opportunities

Towers, clearings and vehicle trails along the powerlines have significant environmental and visual impacts; as can associated management activities such as vegetation trimming, the use and maintenance of access trails and use of herbicides. The TransGrid line is covered by a formal easement granted under section 153(1) of the National Parks and Wildlife Act. Impacts are minimised through a statewide agreement between TransGrid and NPWS for inspection and maintenance of existing transmission lines and infrastructure.

Some powerlines traversing the parks are not covered by a formal easement. In accordance with the *Electricity Supply Act 1995* a network operator can operate and use the existing powerlines whether or not there is a formal easement in place. The Endeavour Energy lines are covered by a consent under the National Parks and Wildlife Regulation, enabling inspection, maintenance and emergency works in accordance with an agreed protocol that aims to minimise impacts associated with the lines.

The electricity transmission line between the West Cliff Colliery and the former North Cliff Colliery has been depowered but the infrastructure remains. Its future depends on any future use of the North Cliff Colliery inholding.

6.3 Telecommunications

The following telecommunications infrastructure is in the parks:

- two underground optic fibre cables (Optus and Telstra) parallel the 330 kV transmission line on the western side of the Princes Motorway, through the nature reserve
- several hundred metres of a Telstra underground telephone cable, including 2 access pits, are located in the national park just south of 10T Trail at Wedderburn
- approximately 2 kilometres of mainly underground telephone cable (decommissioned) connecting the former North Cliff Colliery and the Darkes Forest Mine (which is outside of the parks). Much of the cable is located along 10R Trail to its junction with O'Hares Creek, where it enters adjoining private land.

- a telecommunications tower, outside of the park, is accessed via 10J Trail from the Princes Highway.

6.3.1 Management considerations and opportunities

Maintenance of the telecommunications cables can be undertaken without NPWS approval but any works other than maintenance require NPWS approval and licensing under the National Parks and Wildlife Act.

The underground telephone cable which approximately follows 10R Trail has been decommissioned and its future depends on any future use of the North Cliff Colliery land.

6.4 Water management and monitoring

The eastern section of the national park (between the Princes Motorway and Princes Highway) is in the Metropolitan Special Area and is subject to a joint management agreement between NPWS and WaterNSW (see Box 1). This agreement provides a formal basis for the joint management of this section of the park consistent with each agency's enabling legislation. NPWS manages the natural and cultural values and maintains the management trails, while WaterNSW manages access into the special area.

WaterNSW owns an operational rain gauge adjacent to 10B Trail, opposite its northern junction with 10D Trail.

A small hut in the northern part of the park west of 10B Trail formerly housed a seismic monitoring station, collecting data for WaterNSW. It was accessed by foot but was decommissioned in 1998. While the structure is no longer needed, it is in a remote site and there is no requirement to remove it.

WaterNSW also owns and operates a surface water monitoring gauge on Stokes Creek at Four Mile, and a weir and river gauge, on O'Hares Creek at the end of the Jingga Walking Track. These are part of a system of gauges across New South Wales that provide important hydrological information for a number of purposes. Access to the O'Hares Creek gauge, for maintenance and verification, is generally by foot as the track is steep and has a loose surface. Vehicle access would be needed if major work is required in future, but the weir is in good condition and significant work is not anticipated. Three other 'v-notch' weirs on Stokes and O'Hares creeks relate to previous water supply investigations and are no longer utilised.

6.4.1 Management considerations and opportunities

NPWS works closely with WaterNSW via multi-agency operations and opportunistic patrols to protect the catchment integrity and associated water quality. NPWS will continue to support research involving water monitoring.

6.5 Water extraction

WaterNSW administers licences to extract water under the *Water Management Act 2000* from creeks in the national park and nature reserve. Associated structures may also need to be licensed under the National Parks and Wildlife Act.

A licence exists for an overshot dam on Maddens Creek and a 100 mm centrifugal pump in the national park upstream from Maddens Falls. An underground pipeline conveys water several hundred metres through the park to a neighbouring orchard. The pump is accessed by 10Z Trail off Darkes Forest Road, and is used regularly to operate and maintain the pump. A meter has been installed at the orchard to record volumetric limits imposed on

extraction by WaterNSW. The dam and water extraction are licensed by WaterNSW while NPWS licences the pipeline.

Photo 18 Dam on Maddens Creek just above Maddens Falls. John Yurasek/DPE

Further upstream on Maddens Creek there are 2 smaller weirs. A water extraction licence provides for a pump situated on adjacent private land.

6.5.1 Management considerations and opportunities

Water flow in Maddens Creek, immediately downstream of the licensed dam and pump, has been observed to cease periodically during prolonged dry periods. At these times the rate of water extraction can exceed natural inflows and a section of the creek, including Maddens Falls, completely dries out. Blocking of the outlet pipe can intensify these impacts. Other impacts of the pumping include noise for park visitors, potential oil spills and altered movement of aquatic species.

Appendices

Appendix A Legislation and policy

The following laws and policies apply to how we manage our parks (this is not a complete list):

NSW legislation

- *National Parks and Wildlife Act 1974* and National Parks and Wildlife Regulation
- *Environmental Planning and Assessment Act 1979*
- *Heritage Act 1977*
- *Biodiversity Conservation Act 2016*
- *Biosecurity Act 2015*

Other NSW laws may also apply to park management:

- *Work Health and Safety Act 2011*

Commonwealth legislation and policy

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Disability Discrimination Act 1992*
- Building Code of Australia

NPWS policies and strategies

A range of NPWS policies and strategies may also apply to park management:

- park management policies – www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/park-policies
- pest management strategies – www.environment.nsw.gov.au/topics/animals-and-plants/pest-animals-and-weeds/regional-pest-management-strategies
- fire management strategies – www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/fire-management-strategies

Other laws, policies and strategies may also apply. Please contact NPWS for advice.

Appendix B Scientific plant and animal names

The following table shows the scientific name for common plant and animal names used in this plan.

Common name	Scientific name
Plants	
Black cypress pine	*Callitris enlicheri*
Blue Mountains mallee ash	*Eucalyptus stricta*
Bynoe's wattle	*Acacia bynoeana*
Dagger hakea	*Hakea teretifolia*
Deane's paperbark	*Melaleuca deanei*
Fern-leaved banksia	*Banksia oblonga*
Hairy geebung	*Persoonia hirsuta*
Prickly bush-pea	*Pultenaea aristata*
Scribbly gum	*Eucalyptus haemostoma*
Small-flower grevillea	*Grevillea parviflora* subsp. *parviflora*
Sublime Point pomaderris	*Pomaderris adnata*
Woronora beard heath	*Leucopogon exolasius*
Birds	
Beautiful firetail	*Stagonopleura bella*
Black-shouldered kite	*Elanus axillaris*
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*
Dusky woodswallow	*Artamus cyanopterus cyanopterus*
Eastern bristlebird	*Dasyornis brachypterus*
Eastern ground parrot	*Pezoporus wallicus wallicus*
Eastern spinebill	*Acanthorhynchus tenuirostris*
Fan-tailed cuckoo	*Cacomantis flabelliformis*
Gang gang cockatoo	*Callocephalon fimbriatum*
Glossy black-cockatoo	*Calyptorhynchus lathami*
Grey fantail	*Rhipidura albiscapa*
Grey shrike-thrush	*Colluricincla harmonica*
Little eagle	*Hieraaetus morphnoides*
Little lorikeet	*Glossopsitta pusilla*
Little wattlebird	*Anthochaera chrysoptera*
Nankeen kestrel	*Falco cenchroides*
New Holland honeyeater	*Phylidonyris novaehollandiae*
Pheasant coucal	*Centropus phasianinus*
Powerful owl	*Ninox strenua*
Regent honeyeater	*Anthochaera phrygia*

Common name	Scientific name
Rufous whistler	*Pachycephala rufiventris*
Scarlet robin	*Petroica boodang*
Southern emu-wren	*Stipiturus malachurus*
Spotted harrier	*Circus assimilis*
Square-tailed kite	*Lophoictinia isura*
Swamp harrier	*Circus approximans*
Swift parrot	*Lathamus discolor*
Tawny-crowned honeyeater	*Gliciphila melanops*
Tree martin	*Petrochelidon nigricans*
Turquoise parrot	*Neophema pulchella*
Varied sittella	*Daphoenositta chrysoptera*
Variegated fairy-wren	*Malurus lamberti*
White-bellied sea eagle	*Haliaeetus leucogaster*
White-cheeked honeyeater	*Phylidonyris niger*
White-throated needletail	*Hirundapus caudacutus*
Yellow-tailed black-cockatoo	*Calyptorhynchus funereus*
Frogs	
Blue Mountains tree frog	*Litoria citropa*
Common eastern froglet	*Crinia signifera*
Eastern banjo frog	*Limnodynastes dumerilii*
Freycinet's frog	*Litoria freycineti*
Giant burrowing frog	*Heleioporus australiacus*
Green and golden bell frog	*Litoria aurea*
Green tree frog	*Litoria caerulea*
Haswell's froglet	*Paracrinia haswelli*
Littlejohn's tree frog	*Litoria littlejohnii*
Peron's tree frog	*Litoria peronii*
Red-crowned toadlet	*Pseudophyrne australis*
Stuttering frog	*Mixophyes balbus*
Reptiles	
Broad-headed snake	*Hoplocephalus bungaroides*
Dark-flecked garden sunskink	*Lampropholis delicata*
Eastern three-lined skink	*Acritoscincus duperreyi*
Eastern water-skink	*Eulamprus quoyii*
Marsh snake	*Hemiaspis signata*
Pale-flecked garden sunskink	*Lampropholis guichenoti*
Rosenberg's goanna	*Varanus rosenbergi*

Common name	Scientific name
She-oak skink	*Cyclodomorphus michaeli*
Mammals	
Chocolate wattled bat	*Chalinolobus morio*
Common ringtail possum	*Pseudocheirus peregrinus*
Eastern coastal free-tailed bat	*Mormopterus norfolkensis*
Eastern false pipistrelle	*Falsistrellus tasmaniensis*
Eastern pygmy-possum	*Cercartetus nanus*
Gould's wattled bat	*Chalinolobus gouldii*
Greater broad-nosed bat	*Scoteanax rueppellii*
Greater glider	*Petauroides volans*
Grey-headed flying-fox	*Pteropus poliocephalus*
Koala	*Phascolarctos cinereus*
Large bent-winged bat	*Miniopterus orianae oceanensis*
Large-eared pied bat	*Chalinolobus dwyeri*
Little bent-winged bat	*Miniopterus australis*
Long-nosed potoroo	*Potorous tridactylus*
Southern brown bandicoot	*Isoodon obesulus obesulus*
Southern myotis	*Myotis macropus*
Spotted-tailed quoll	*Dasyurus maculates*
Squirrel glider	*Petaurus norfolcensis*
Swamp rat	*Rattus lutreolus*
Swamp wallaby	*Wallabia bicolor*
White-striped freetail-bat	*Austronomus australis*
Fish and crayfish	
Australian smelt	*Retropinna semoni*
Climbing galaxias	*Galaxias brevipinnis*
Cox's gudgeon	*Gobiomorphus coxii*
Spiny crayfish	*Eustacus* sp.
Long-finned eel	*Anguilla reinhardtii*
Macquarie perch	*Macquaria australasica*
Insects	
Giant dragonfly	*Petalura gigantea*

Common plant names from PlantNET (The NSW Plant Information Network System). Royal Botanic Gardens and Domain Trust, Sydney. http://plantnet.rbgsyd.nsw.gov.au [10/06/2021].

Appendix C Vegetation communities in the parks

NSW formation	NSW class	Community (PCT)	Distribution	BC Act status	Hectares
Dry sclerophyll forests	Sydney Coastal Dry Sclerophyll Forests	Sydney South Exposed Sandstone Woodland (1777)	Widespread throughout area on ridges and plateau tops		2959
		Coastal Sandstone Gully Forest (1250)	Widespread in gullies of the central area of the national park		1516
		Southern Sydney Sheltered Forest (1785)	Small area near Darkes Forest	EEC – Southern Sydney Sheltered Forest	16
		Sydney Hinterland Exposed Sandstone Woodland (1787)	Widespread through central area of the national park		1056
		Exposed Sandstone Scribbly Gum Woodland; Upland swamps: Fringing Eucalypt Woodland (1083)	Scattered patches throughout eastern section of the national park		45
		Silvertop Ash Ironstone Woodland (1085)	Small areas in the eastern section of the national park		17
	Sydney Hinterland Dry Sclerophyll Forests	Sydney Hinterland Apple-Blackbutt Gully Forest (1789)	Gullies in the north western part of the national park		361
		Sydney Hinterland Grey Gum Ridgetop Forest (1790)	Northern section of the state conservation area and north western boundary of the national park		350
Forested wetlands	Eastern Riverine Forests	Coastal Sandstone Riparian Scrub (1292)	Banks of O'Hares and Stokes Creeks and their major tributaries		187
Freshwater wetlands	Coastal Heath Swamps	Coastal Upland Damp Heath Swamp; Banksia Thicket (1803)	Upper slopes of large swamps. Restricted to patches in the south of the parks	EEC – Coastal Upland Swamp	23

NSW formation	NSW class	Community (PCT)	Distribution	BC Act status	Hectares
		Coastal Upland Wet Heath Swamp; Sedgeland-Heath Complex; Tea-Tree Thicket (1804)	Patches scattered throughout the south and east of the parks, especially Maddens Plains	EEC – Coastal Upland Swamp	901
Heathlands	Sydney Coastal Heaths	Coastal Sandstone Heath-Mallee (1824)	Patches scattered through the central and north western areas of the national park		253
		Coastal Sandstone Rock Plate Heath (881)	Restricted to a few very small patches in the eastern and southern parts of the parks on sandstone pavements on the plateau, skeletal soils		15
Rainforests	Northern Warm Temperate Rainforests	Coastal Warm Temperate Rainforest (905)	Tiny patch in the Darkes Forest area of the national park		0.5
Wet sclerophyll forests	Northern Hinterland Wet Sclerophyll Forests	O'Hares Creek Shale Forest (1846)	Broad ridges on outcrops of Hawkesbury Shale, eastern part of the parks	EEC – O'Hares Creek Shale Forest	26

Source: OEH 2016a, *The Native Vegetation of the Sydney Metropolitan Area* - Version 3 VIS_ID 4489; and Illawarra PCT 2016 VIS4678.
PCT = Plant community type.

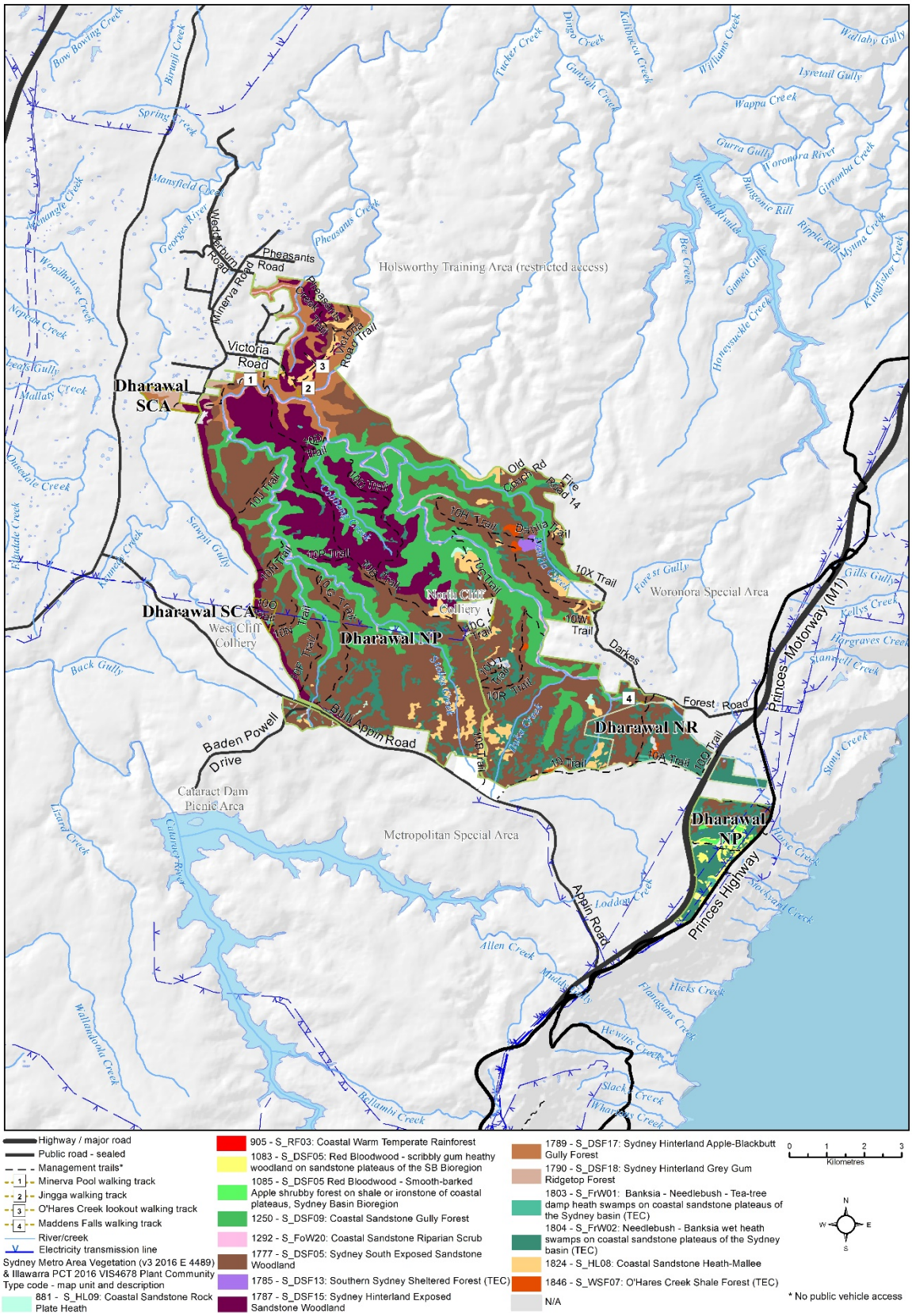

Figure 5 Vegetation communities in the parks

Appendix D Rare and biogeographically significant plant species

Species	Significance	Dharawal vegetation community (after Keith 1994)
Blandfordia cunninghamii	3RC-	Western Gully Forest
Darwinia diminuta	3RCi (southern limit)	Mallee Heath
Darwinia grandiflora	2RC-	Woodland Heath and Restioid Heath
Epacris coriacea	3RC-	Eastern Gully Forest
Eucalyptus apiculata	2R	Restioid Heath, Mallee Heath and Rock Pavement Heath
Eucalyptus luehmanniana	2RCa (southern limit)	Mallee Heath
Gonocarpus salsoloides	3RCa (southern limit)	Cyperoid Heath and Sedgeland
Grevillia longifolia	2RC-	Eastern Gully Forest
Hibbertia nitida	2RC-	Eastern Gully Forest
Lomandra fluviatilis	3RC-	Riparian Scrub
Monotoca ledifolia	3RC-	Rock Pavement Heath
Prasophyllum nublingii	2KC- (southern limit)	Sandstone Woodland
Tetratheca neglecta	3RC-	Sandstone Woodland, Ironstone Heath and Mallee Heath
Acacia stricta	Uncommon in Sydney region	Shale Forest
Allocasuarina nana	Coastal locality of typical inland species	Mallee Heath
Allocasuarina paludosa	Uncommon in Sydney region	Restioid Heath
Angophora hispida	Southern limit	Ironstone Heath and Mallee Heath
Banksia cunninghamii	Coastal locality of typical inland species	Eastern Gully Forest
Blechnum ambiguum	Uncommon	Eastern Gully Forest
Boronia serrulata	Uncommon & southern limit	Sandstone Woodland
Callitris endlicheri	Coastal locality of typical inland species, disjunct population	Rock Pavement Heath
Corybas fordamii	uncommon in Sydney region	Cyperoid Heath, Sedgeland and Restioid Heath
Doryanthes excelsa	Southern limit	Shale Forest and eastern Gully Forest
Eriachne glabrata	Southern limit	Restioid Heath
Eucalyptus ligustrina	Uncommon	Sandstone Woodland

Species	Significance	Dharawal vegetation community (after Keith 1994)
Eucalyptus multicaulis	Uncommon	Sandstone woodland and Western Gully Forest
Eucalyptus squamosa	Uncommon	Western Gully Forest
Grevillia diffusa var. *diffusa*	Uncommon	Sandstone Woodland and Eastern Gully forest
Leucopogon amplexicaulis	Uncommon	Eastern gully Forest
Melaleuca squamea	uncommon in Sydney region	Cyperoid Heath
Melichrus urceolatus	uncommon in Sydney region	Sandstone woodland
Persoonia mollis subsp. *nectans*	Uncommon	Eastern Gully Forest
Pseudanthus orientalis	Uncommon in Sydney region and southern limit	Banksia Thicket and Mallee Heath
Pultenaea divaricata	Uncommon in Sydney region	Ti-Tree Thicket and Cyperoid Heath
Pultenaea hispidula	Uncommon in Sydney region	Shale Forest
Tetratheca shiressii	Southern limit	Sandstone Woodland
Thelymitra circumsepta	Uncommon in Sydney region	Restioid Heath and Ironstone Woodland

Source: Briggs and Leigh 1996

2	Species with a very restricted distribution in Australia and with a maximum geographic range of <100 km
3	Species with a range over 100 km but occurring in only small populations which are mainly restricted to highly specific and localised habitats
V	Vulnerable species at risk of disappearing from the wild over a long period
R	Rare
K	Poorly known
C	Population reserved
a	Adequately reserved
i	Inadequately reserved
-	Adequacy of reservation unknown.

Appendix E Feral animals, pests and weeds

The following table summarises key information on feral animals and pests in the park at the time of publication of this plan. Current information on the status of feral animals and pests and whether they have a threat abatement plan can be found on the department's website. Further feral animal and pest information on the parks is also available in the relevant NPWS pest management strategy. The Local Land Services Act declares certain animals to be pests.

Feral and pest animals

Common name	Scientific name	KTP	NSW TAP	Priority GSLLS /SELLS	Declared pest
European red fox	*Vulpes vulpes*	Y	Y	Y	Y
Wild dog (incl. dingo and feral dog and hybrids)	*Canis lupus* subspp. *C. lupus dingo* (dingo) *C. lupus familiaris* (feral dog)	Y	N	Y	Y
Rabbit, hare	*Oryctolagus cuniculus*	Y	N	Y	Y
Cat	*Felis catus*	Y	N	Y	N
Rusa deer/wild deer	*Cervus timorensis*	Y	N	Y	N
Goat	*Capra hircus*	Y	N	Y	N
Common yabby	*Cherax destructor*	Y	N	N	N
Mosquito fish/ plague minnow	*Gambusia holbrooki*	Y*	N	N	N

Priority GSLLS/SELLS = priority pest in the Greater Sydney or South East Local Land Services area

* = Key threatening process under the *Fisheries Management Act 1994*.

Priority weeds

Common name*	Scientific name	KTP	NSW TAP	Priority GSLLS/ SELLS	WONS
African lovegrass	*Eragrostis curvula*	Y	N	Y[5]	N
Arum lily	*Zantedeschia aethiopica*	N	N	Y[5]	N
Blackberry complex	*Rubus fruticosus* sp. agg.	N	N	Y[3]	Y
Coolatai grass	*Hyparrhenia hirta*	Y	N	Y[5]	N
Crofton weed	*Ageratina adenophora*	N	N	Y[5]	N
Fireweed	*Senecio madagascariensis*	N	N	Y[3]	N
Gorse	*Ulex europaeus*	N	N	Y[3]	Y
Ground asparagus	*Asparagus aethiopicus*	Y	N	Y[3]	Y
Japanese honeysuckle	*Lonicera japonica*	Y	N	Y[5]	N

Common name*	Scientific name	KTP	NSW TAP	Priority GSLLS/ SELLS	WONS
Pampas grass	*Cortaderia selloana*	Y	N	Y[4]	N
Rhodes grass	*Chloris gayana*	Y	N	Y[5]	N
Whisky grass	*Andropogon virginicus*	Y	N	Y[5]	N

Source: DPIE 2020a; OEH 2012a.

* This is not a complete list of weed species recorded in the parks. It is a list of species that have been recorded in the parks and are a priority for control.

KTP = key threatening process listed under the Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act.

NSW TAP = threat abatement plan prepared under the Biodiversity Conservation Act.

Priority GSLLS/SELLS = priority pest in the Greater Sydney Local Land Services area.

[1] Declared key threatening process under the Biodiversity Conservation Act.

[2] Declared key threatening process under the Environment Protection and Biodiversity Conservation Act.

[3] Statewide priority weed under the Biosecurity Act 2015.

[4] Regional priority weed (GSLLS 2017; SELLS 2017).

[5] Other weed of regional concern.

WONS = Weed of National Significance.

Other environmental weeds

Common name	Scientific name
Queensland silver wattle	*Acacia podalyriifolia*
Prickly pear	*Opuntia stricta*
Cotoneaster	*Cotoneaster glaucophyllus*
Broad-leaf privet	*Ligustrum lucidum*
Narrow-leaf privet	*Ligustrum sinense*
Spear thistle	*Cirsium vulgare*
Senna	*Senna pendula var. glabrata*

Appendix F Non-park infrastructure

Asset	Owner	Status	Location
Seismological station	NPWS (formerly SCA). Decommissioned in 1998 but cover retained in case of future need	Redundant	NW part of park, west of 10B Trail & south of Stokes Ck (Site Code APN) located at -34.17079, 150.82351
Weirs on Stokes and O'Hares Creeks. Small empty shed at 10B weir	NPWS (formerly Sydney Water). Decommissioned	Redundant	10D/O'Hares Creek crossing, 10B/Stokes Creek crossing, 10P/Stokes Creek
Rain gauge in fenced compound	WaterNSW	Operational	10B Trail opposite junction with 10D Trail
Weir and river gauge	WaterNSW	Operational	O'Hares Creek at end of Jingga Trail
Weir, pump and pipeline	Neighbour	Operational	Maddens Creek, 10Z Trail
Transmission line	TransGrid	Operational	330kV line through nature reserve, west of Princes Freeway
Transmission line	Endeavour Energy	Operational	132 kV line across eastern tip of nature reserve and eastern section of park, between the freeway and highway
Transmission line	Endeavour Energy	Operational	33 kV line across eastern section of the park near the Princess Highway
Transmission line	Endeavour Energy	Operational	33 kV line across southern edge of eastern section of park
Transmission line	Endeavour Energy	Operational	11kV line through nature reserve, west of Princes Freeway
Transmission line	Endeavour Coal	Redundant	33kV line between West Cliff Colliery and North Cliff Colliery
Fibre optic cable	Telstra	Operational	Underground cable through nature reserve on western side of Princes Freeway
Fibre optic cable	Optus	Operational	Underground cable through nature reserve on western side of Princes Freeway
Telephone cable	Endeavour Coal	Redundant	Connect North Cliff Colliery and Darkes Forest Mine, partly along 10R Trail
Telephone cable	Endeavour Coal	Operational	Underground cable and two access pits on western boundary of park, just south of 10T Trail
Access (10J Trail) to telecommunications tower	Telstra and Vodaphone	Operational	Access to telecommunications tower located just outside northern boundary of eastern section of park

References

AIATSIS 2020, Austlang, https://collection.aiatsis.gov.au/austlang/about.

Australian Bureau of Meteorology 2017, https://bom.gov.au.

Australian Koala Foundation 1996, Wedderburn Fauna Planning Study, prepared for Campbelltown City Council.

Bishop K 1997, Sampling Report, Dharawal State Conservation Area, unpublished report.

Briggs JD & Leigh JH 1996, *Rare or Threatened Australian Plants*, CSIRO Publishing, Collingwood, Vic., Australia.

Campbelltown City Council 2019, *Population Forecast*, https://forecast.id.com.au/campbelltown.

Craven P & McDougall K *2015, Occurrence of the Plant Pathogen Phytophthora cinnamomi at Dharawal National Park, O*ffice of Environment and Heritage, Nowra. www.ipcn.nsw.gov.au/resources/pac/media/files/pac/project-submissions/2020/10/dendrobium-extension-project-ssd-8194/20201215t170337/occurrence-of-phytophthora-cinnamomi-at-dharawal-np6271.pdf

DECC 2007a, *The Vertebrate Fauna of Dharawal State Conservation Area, Dharawal Nature Reserve and Adjacent Lands*, Department of Environment and Climate Change NSW, Hurstville, https://www.environment.nsw.gov.au/resources/nature/surveys/dharawalSCAvertebratefauna.pdf.

DECC 2007b, Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region: Volume 1 – Background Report; Volume 2 – Fauna of Conservation Concern including Priority Pest Species; Volume 4 – The Fauna of the Metropolitan, O'Hares Creek and Woronora Special Areas – Summary of Findings and Recommendations. A joint project between the Sydney Catchment Authority and the Department of Environment and Climate Change, Department of Environment and Climate Change, www.environment.nsw.gov.au/research-and-publications/publications-search/terrestrial-vertebrate-fauna-of-the-greater-southern-sydney-region-volume-1-background-report.

DEWHA 2008, *Threat Abatement Plan for the European Red Fox*, Department of the Environment, Water, Heritage and the Arts, Canberra, www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox.

DoE 2009, *Listed Key Threatening Processes*: *Dieback caused by the root-rot fungus* (Phytophthora cinnamomi), Department of the Environment, www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl.

DPIE 2019, *Conserving Koalas in the Wollondilly and Campbelltown Local Government Areas*, Department of Planning, Industry and Environment, Sydney www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/conserving-koalas-wollondilly-campbelltown-local-government-areas-190573.pdf

DPIE 2020a, *NSW BioNet*, Department of Planning, Industry and Environment, Sydney, www.bionet.nsw.gov.au/.

DPIE 2020b, *Hygiene Guidelines:* Protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants, Department of Planning, Industry and Environment, Sydney.

www.environment.nsw.gov.au/research-and-publications/publications-search/hygiene-guidelines

Gaia Research Pty Ltd 2008, Survey of Amphibians in Dharawal State Conservation Area and Nature Reserve, report to NPWS.

Georges Riverkeeper 2018, *Georges River Report Card 2017–2018*, https://georgesriver.org.au/sites/default/files/resources/2019-05/Georges%20River%20Report%20Card%202017-18.pdf.

GSLLS 2017, *Greater Sydney Regional Strategic Weed Management Plan 2017–2022*, prepared in partnership with the Greater Sydney Regional Weed Committee and published by Greater Sydney Local Land Services, revised September 2019, https://greatersydney.lls.nsw.gov.au/__data/assets/pdf_file/0010/722368/Greater-Sydney-Regional-Weed-Mgmt-Plan-FINAL-Sept-2019.pdf.

GSLLS 2018, *Greater Sydney Regional Strategic Pest Animal Plan 2018–2023,* Greater Sydney Local Land Services, http://www.lls.nsw.gov.au/__data/assets/pdf_file/0003/820794/greater-sydney-strategic-pest-plan-web.pdf.

Harlow P & Taylor J 1995, *Reptile and Frog Survey of O'Hares Creek, Wedderburn, NSW*, report to the National Parks Association. https://catalogue.nla.gov.au/Record/2415378

Holla L & Barclay E 2000, *Mine Subsidence on the Southern Coalfield New South Wales*, New South Wales Department of Mineral Resources, Sydney.

Healthy Rivers Commission 2001, *Independent Inquiry into the Georges River-Botany Bay System – Final Report*, Healthy Rivers Commission of New South Wales, Sydney, https://georgesriver.org.au/resources/independent-inquiry-georges-river-botany-bay-system-2001-final-report.

Heritage NSW 2020, *Aboriginal Heritage Information Management System*, NSW National Parks and Wildlife Service, Sydney, www.heritage.nsw.gov.au/search-for-heritage/aboriginal-heritage-information-management-system/.

IEPMC 2019, Independent Expert Panel for Mining in the Catchment Report: Part 2. Coal Mining Impacts in the Special Areas of the Greater Sydney Water Catchment, prepared for the NSW Department of Planning, Industry and Environment. https://www.chiefscientist.nsw.gov.au/independent-reports/mining-in-the-sydney-drinking-water-catchment

Keith DA 1991, Coexistence and species diversity in upland swamp vegetation: the roles of an environmental gradient and recurring fires, PhD thesis, University of Sydney.

Keith DA 1994, Floristics, structure and diversity of natural vegetation in the O'Hares Creek catchment south of Sydney, *Cunninghamia*, vol. 3, 3, pp:543–594, www.rbgsyd.nsw.gov.au/getmedia/97e49775-b9cb-41f3-890f-23ec9e3f3107/Volume-3(3)-1994-Keith543-594.pdf.aspx.

Keith DA, Rodoreda S, Holman L & Lemmon J 2006, *Monitoring Change in Upland Swamps in Sydney's Water Catchments: The roles of fire and rain*, Department of Environment and Climate Change, Sydney. https://catalogue.nla.gov.au/Record/3885438

Keith DA & Myerscough PJ 1993, Floristics and soil relations of upland swamp vegetation near Sydney, *Australian Journal of Ecology*, 18, pp.325–344, https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1442-9993.1993.tb00460.x.

Knight J and Bruce A 2008, Fish Distribution and Abundance Within the Dharawal State Conservation Area, report for the NSW Department of Environment & Climate Change.

Lee T, Zenger K, Close R, Jones M & Phalen D 2010, Defining spatial genetic structure and management units for vulnerable koala (*Phascolarctos cinereus*) populations in the Sydney region, Australia, *Wildlife Research*, 37, pp.156–165, www.publish.csiro.au/wr/pdf/WR09134.

Mills K 1992, The Birds of the O'Hares Creek Catchment, Woronora Plateau, Illawarra Region, NSW, unpublished report.

Nichols S & McGirr S 2005, *Reviewing and Restoring Fish Passage in Urbanised Waterways, Sydney Catchments*, report to the Sydney Metropolitan Catchment Management Authority, Department of Primary Industries (Aquatic Habitat Rehabilitation section), Cronulla, https://georgesriver.org.au/resources/reviewing-and-restoring-fish-passage-urbanised-waterways-sydney-catchments-2005-report.

NPWS 2003a, *The Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments.* NSW National Parks and Wildlife Service, Sydney. https://www.environment.nsw.gov.au/surveys/WoronoraAssessment.htm.

NPWS 2003b, *The Bioregions of New South Wales: Their biodiversity, conservation and history,* NSW National Parks and Wildlife Service, Sydney, www.environment.nsw.gov.au/resources/nature/BioregionsNswOverview.pdf.

NPWS 2020, *Australian Walking Track Grading System*, NSW National Parks and Wildlife Service, Sydney, www.nationalparks.nsw.gov.au/safety/bushwalking-safety/australian-walking-track-grading-system.

NSW Parliament 2020, *Koala Populations and Habitat in New South Wales*, NSW Parliament Legislative Council, www.parliament.nsw.gov.au/lcdocs/inquiries/2536/Koala%20populations%20and%20habitat%20in%20New%20South%20Wales%20-%20Report%203.pdf.

NSW Scientific Committee 1998, *Predation by the European Red Fox: Key threatening process listing,* New South Wales Scientific Committee, https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/1996-1999/predation-by-the-european-red-fox-vulpes-vulpes-key-threatening-process-listing.

NSW Scientific Committee 2000a, High Frequency Fire Resulting in the Disruption of Life Cycle Processes in Plants and Animals and Loss of Vegetation Structure and Composition - Key threatening process listing. New South Wales Scientific Committee, https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2000-2003/high-frequency-fire-disruption-of-life-cycle-processes-key-threatening-process-listing

NSW Scientific Committee 2000b, *Anthropogenic Climate Change – Key threatening process listing.* New South Wales Scientific Committee, https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2000-2003/anthropogenic-climate-change-key-threatening-process-listing

NSW Scientific Committee 2002, *Infection of Native Plants by Phytophthora cinnamomi - Key threatening process listing*. NSW Scientific Committee, https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2000-2003/infection-of-native-plants-by-phytophthora-cinnamomi-key-threatening-process-listing

NSW Scientific Committee 2003, Invasion *of Native Plant Communities by exotic Perennial Grasses - Key threatening process listing*. NSW Scientific Committee. https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2000-

2003/invasion-of-native-plant-communities-by-exotic-perennial-grasses-key-threatening-process-listing

NSW Scientific Committee 2004, *Woronora Plateau population of Callitris endlicheri (a tree) - endangered population listing*. NSW Scientific Committee. https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2004-2007/woronora-plateau-population-of-callitris-endlicheri-endangered-population-listing

NSW Scientific Committee 2012, *Coastal Upland Swamp in the Sydney Basin Bioregion – Endangered ecological community listing*. NSW Scientific Committee. https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2011-2012/coastal-upland-swamp-in-the-sydney-basin-bioregion-endangered-ecological-community-listing

O'Gara E, Howard K, Wilson B & Hardy GEStJ 2005, *Management of Phytophthora cinnamomi for Biodiversity Conservation in Australia: Part 2 – National best practice guidelines*. A report funded by the Commonwealth Government Department of the Environment and Heritage by the Centre for *Phytophthora* Science and Management, Murdoch University, Western Australia. http://www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation

OEH 2009, *Fire Management Strategy – Dharawal State Conservation Area and Dharawal Nature Reserve*. Office of Environment and Heritage, Sydney. www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Fire-management-strategies/dharawal-state-conservation-area-nature-reserve-fire-management-strategy-090462.pdf.

OEH 2012a, *Regional Pest Management Strategy 2012–17, South Coast Region*, Office of Environment and Heritage, Sydney, www.environment.nsw.gov.au/research-and-publications/publications-search/regional-pest-management-strategy-2012-2017-south-coast-region.

OEH 2012b, *Strategic Directions for Horse Riding in NSW National Parks*, Office of Environment and Heritage, Sydney, www.environment.nsw.gov.au/research-and-publications/publications-search/strategic-directions-for-horse-riding-in-nsw-national-parks.

OEH 2014, *Metropolitan Sydney: Climate change snapshot*, Office of Environment and Heritage, Sydney, www.climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/Metro-Sydney-Climate-Change-Downloads.

OEH 2016a, *The Native Vegetation of the Sydney Metropolitan Area – Volume 1: Technical Report* (Version 3.0 and VIS_ID 4489) and *Volume 2: Vegetation Community Profiles*. NSW Office of Environment and Heritage, Sydney, www.environment.nsw.gov.au/surveys/VegetationSydMetro.htm.

OEH 2016b, *Saving our Species 2016-2021: More plants and animals to be saved from extinction*, Office of Environment and Heritage, Sydney, https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/saving-our-species-2016-2021-more-plants-and-animals-to-be-saved-20160332.pdf.

RFS 2016, *NSW RFS Fire Trail Standards 2016*, version 1.1, www.rfs.nsw.gov.au/__data/assets/pdf_file/0009/69552/Fire-Trail-Standards-V1.1.pdf.

Robinson NTH 1985, Mammals of the Metropolitan Water, Sewerage and Drainage Board Catchments, University of Wollongong.

Rose DB 1996, Nourishing Terrains: Australian Aboriginal views of landscape and wilderness, Australian Heritage Commission.

SELLS 2017, *South East Regional Strategic Weed Management Plan 2017–2022*, South East Local Land Services, https://southeast.lls.nsw.gov.au/__data/assets/pdf_file/0006/722706/South-East-Regional-Weed-Mgmt-Plan.pdf.

SELLS 2018, *South East Regional Strategic Pest Animal Plan 2018–2023*, South East Local Land Services, www.lls.nsw.gov.au/__data/assets/pdf_file/0007/820789/20200517-SELLS_Strategic-Pest-Plan.pdf.

Stricker JAS & Wall CA 2000, *Wetlands of the Nepean – Hawkesbury catchment,* report prepared for Sydney Catchment Authority, www.chen.org.au/PDFs/Wetlands_of_the_Nepean-Hawkesbury_Catchment.pdf.

Suddaby & Liew 2008, *Best Practice Management Guidelines for* Phytophthora cinnamomi *within the Sydney Metropolitan Catchment Authority Area*, Botanic Gardens Trust, Sydney, www.spiffa.org/uploads/2/6/7/5/2675656/bestpracticeguidelinesforp.cinnamomiinsmcma.pdf.

Tharawal LALC 2017, Tharawal Local Aboriginal Land Council Facebook post, www.facebook.com/TharawalLALC.

Urquhart L 2015, Dharawal Cultural Understanding Recording Project, a report to Tharawal Local Aboriginal Land Council.

Water NSW and OEH 2015, *Special Areas Strategic Plan of Management 2015,* published by Water NSW and Office of Environment and Heritage, August 2015, www.environment.nsw.gov.au/research-and-publications/publications-search/special-areas-strategic-plan-of-management-2015.

Williams N 2009, Additional Targeted Vertebrate Fauna Surveys of Dharawal SCA and NR, report to NSW National Parks and Wildlife Service.

Woodward E, Hill R, Harkness P & Archer R (Eds) 2020, Our Knowledge Our Way in caring for Country: Indigenous-led approaches to strengthening and sharing our knowledge for land and sea management, Best Practice Guidelines from Australian experiences, North Australian Indigenous Land and Sea Management Alliance (NAILSMA) and CSIRO, www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Our-Knowledge-Our-Way.

Young ARM 1982, *Upland Swamps (dells) on the Woronora Plateau, NSW,* PhD thesis, University of Wollongong, http://ro.uow.edu.au/theses/261/.

More information

- Department of Planning and Environment
- Dharawal National Park, Dharawal Nature Reserve and Dharawal State Conservation Area Plan of Management
- Key threatening processes
- Local Land Services Act
- Pest Management Strategy