NSW National Parks and Wildlife Service

Kalyarr National Park

Draft planning considerations

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Acknowledgement of Nari Nari Country

Kalyarr National Park is the traditional Country of the Nari Nari People. The park is an integral part of this rich and complex cultural landscape which is of profound significance. The rights of the Nari Nari People and their aspirations for their Country are acknowledged and respected.

This resource may contain images or names of deceased persons in photographs or historical content.

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This planning considerations report outlines the matters considered in preparing the Kalyarr National Park draft plan of management (NSW DCCEEW 2024). This includes the park's key values, management principles and management considerations. Further information is provided in the appendices, including relevant legislation and policy (Appendix A), and scientific names for common names of species referred to in the report (Appendix B). The 'More information' section provides links to relevant websites.

It is recommended that readers of this report also read the draft plan of management.

Acknowledgements

Kalyarr National Park is in the traditional Country of the Nari Nari People.

This plan of management was prepared by staff of NPWS, in consultation with Mawambul Co Management Group.

Contact us

For more information about this plan of management or Kalyarr National Park, contact the NPWS Riverina Area office at 200 Yambil Street, Griffith NSW 2680, or PO Box 1049 Griffith 2680 or by telephone on 02 6966 8100.

1. Kalyarr National Park – Nari Nari Country

Kalyarr National Park is part of Nari Nari Country and is of high cultural significance to the Nari Nari People. The park is **40,899 ha** in area and includes approximately 60 km frontage to the Lachlan River (see Figure 1). 'Kalyarr' is the Aboriginal name used by Nari Nari for the Lachlan River. Kalyarr National Park is referred to as 'Kalyarr' or 'the park' in this report.

The Nari Nari are one of a group of Aboriginal people whose Country is between the lower Murrumbidgee and lower Lachlan area of the Riverine Plain, extending from Booligal almost as far as Balranald to the west, and Hay to the east. Nari Nari share a border to the south-west with Mutthi Mutthi and Wathi Wathi, to the south with Wemba Wemba, to the north with Ngiyampaa and to the east with Wiradjuri (noting there are many different spellings for these names). However, the boundaries in this area are complicated because of the small size of language groups along the Murray River and lower Murrumbidgee, and the lack of research into the area as a whole (Pardoe and Martin 2001).

From a linguistic perspective, the Nari Nari, Mutthi Mutthi, Wathi Wathi and Wemba Wemba are all part of the Kulin language group, as distinct from the Wiradjuri language group further to the east (Hercus 1989, cited in Pardoe and Martin 2001).

Kalyarr was formed from the purchase of several former sheep stations between 2003 and 2012, through a combination of Commonwealth and NSW state government funding. A former state forest was added to the park in 2010. Reservation of the park followed a complex history as areas were added and renaming occurred. Norwood, Mallawa and Geramy were originally reserved as Kalyarr State Conservation Area. The state conservation area was recategorised as national park in 2013.

The boundaries and names of the former pastoral holdings and state forest that make up Kalyarr National Park are shown in Figure 2. These names are used in this report to describe different areas in the park.

The land surrounding Kalyarr continues to be farmed for sheep grazing and dryland cropping. The nearest localities are Hay (40 km to the south-east), Maude to the south-west, and Oxley to the north-west (see Figure 3).

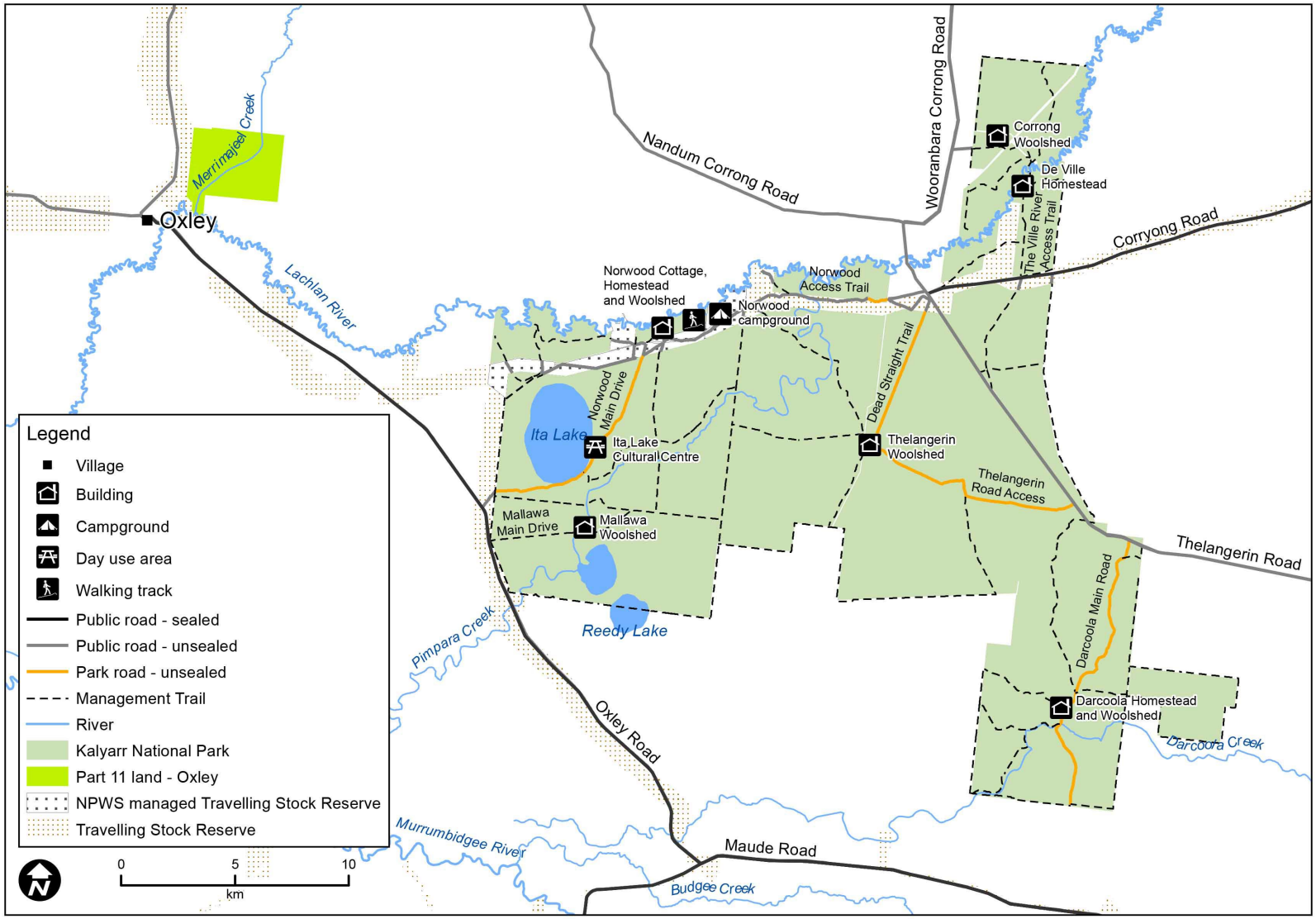

Figure 1 Map of Kalyarr National Park

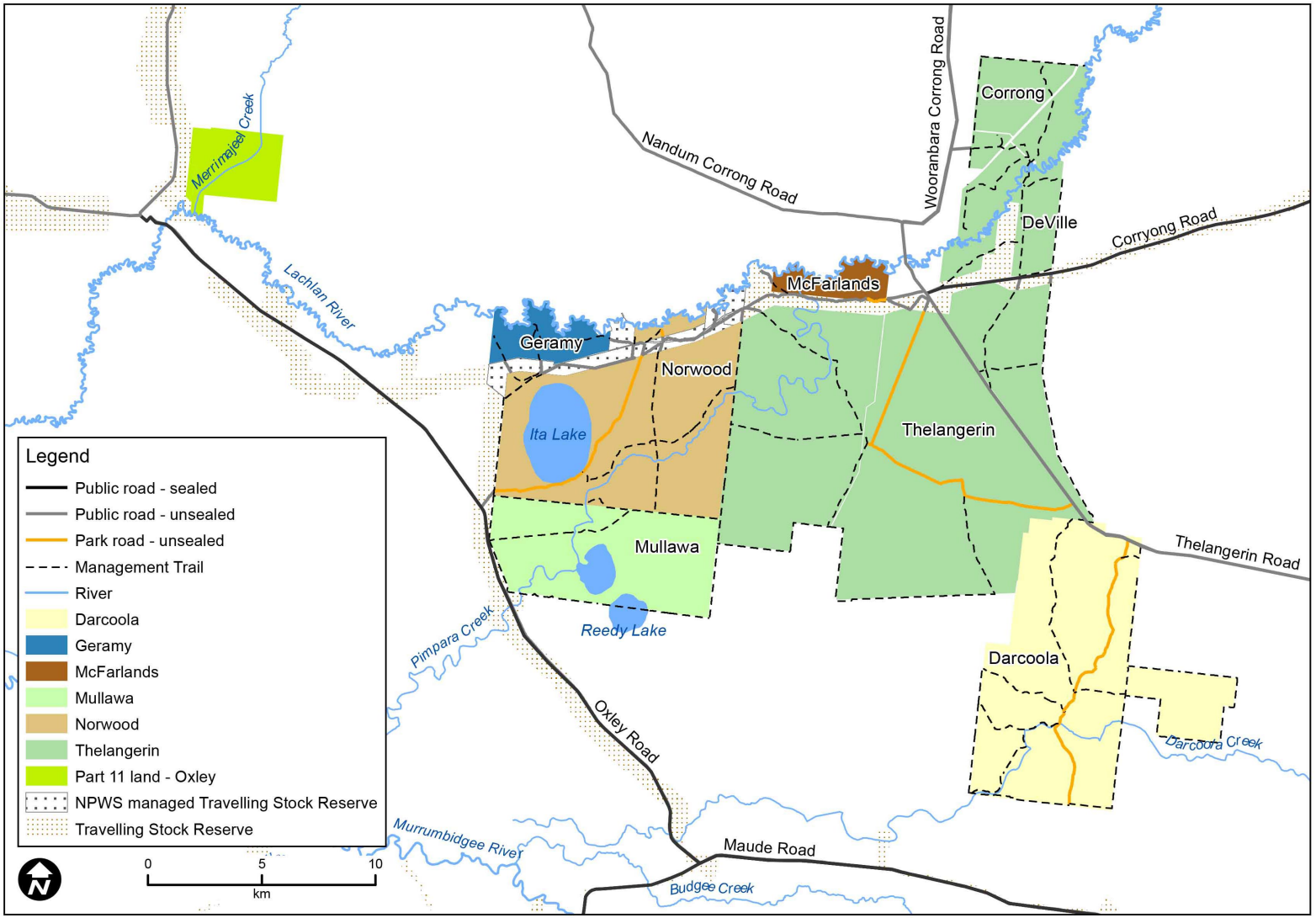

Figure 2 Former property boundaries in Kalyarr National Park

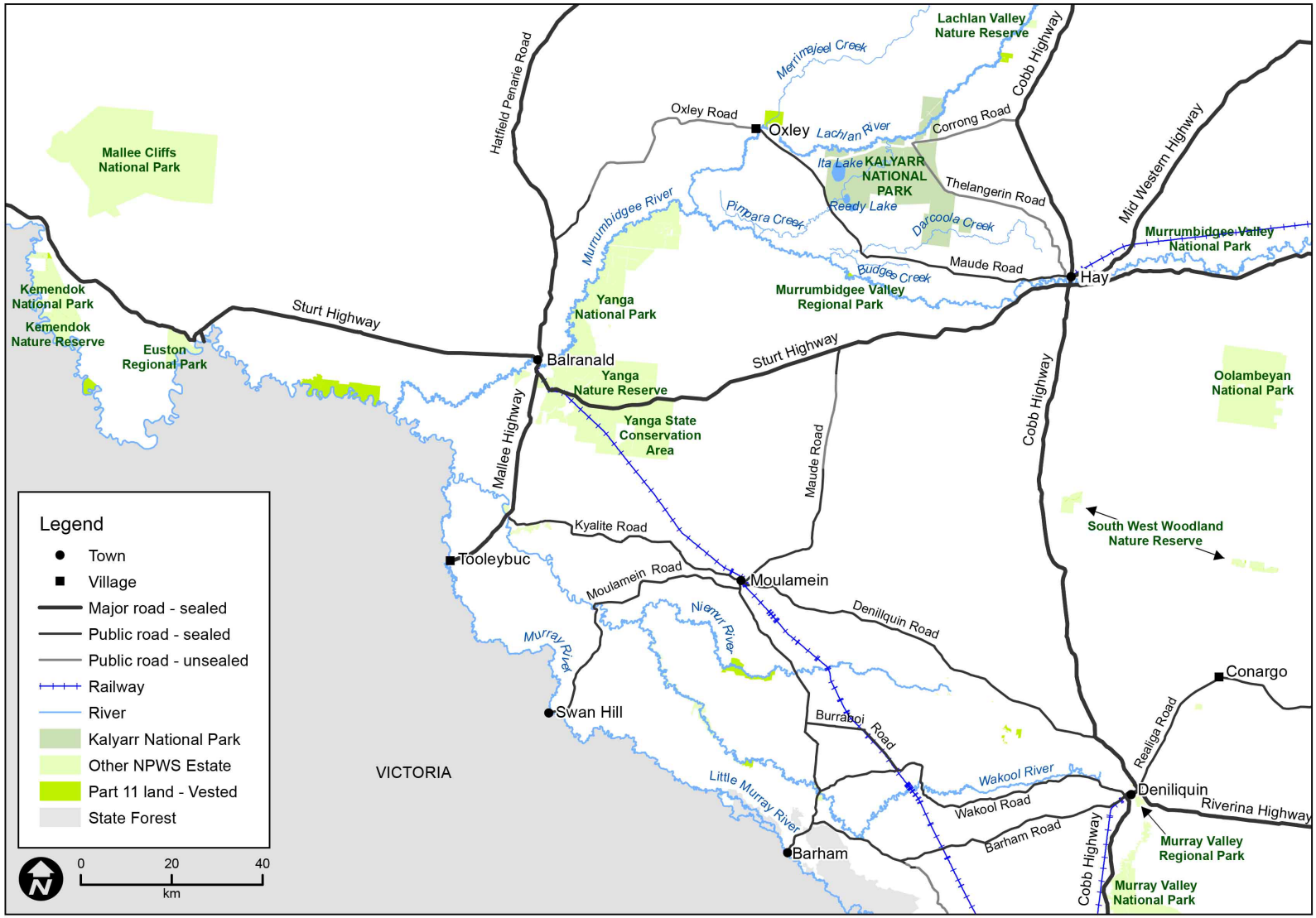

Figure 3 Kalyarr National Park regional setting

1.1 Connection to Country

The land, water, plants and animals within a landscape are central to Aboriginal peoples' spirituality and contribute to their identity and connection. Aboriginal communities connect with natural resources when collecting foods and medicines, caring for the land, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal peoples' world view sees no separation between 'natural' and 'cultural' values and therefore they need to be managed in an integrated manner across the landscape. Cultural knowledge, including traditional ecological knowledge, is passed on to the next generation through oral traditions involving ceremony, dance, song and storytelling.

The Nari Nari have a strong and enduring connection to Country, including the land now in Kalyarr National Park. Nari Nari are landowners and custodians of large parcels of land in the Riverina region. This includes Toogimbie Indigenous Protected Area on the Murrumbidgee floodplain about 30 km south of Kalyarr, and Gayini (previously called Nimmie Caira) on the Lowbidgee floodplain north-east of Balranald.

The alluvial plains, wetlands and lakes of the lower Lachlan and lower Murrumbidgee are rich in resources that continue to support Nari Nari traditions and culture. Nari Nari are actively engaged in caring for Country, including protecting and managing cultural values and features, facilitating cultural camps for teaching and healing, and participating in water resource planning and water management as it affects the lower Lachlan and lower Murrumbidgee floodplains.

In the past, Nari Nari and other Aboriginal groups accessed an abundance of food and raw materials for daily life in the river red gum forests, freshwater lakes and wetlands in the region (Gott 2008). Animal-based foods included fish, waterbirds and eggs, yabbies, mussels, turtles, possums, kangaroos, emus, echidnas, lizards and lerp (a source of sugar from psyllid insect larvae living on river red gums and other eucalypts [Bodenheimer 1951]).

Plant-based foods included cumbungi, reeds, waterlily, yams, nardoo, dandelion, angled pigface and sowthistle. Over 150 plant species from both flood-dependent and non-flood-dependent vegetation communities were harvested.

With changes to the inland rivers and reduction of red gum forests since European people occupied the landscape, some of these food sources may have disappeared. Others may exist only as relicts, and some may have increased in extent (Gott 2008).

The local environment also supplied other resources, including plant fibres for weaving baskets and making string and nets; bark for canoes, shields and shelter; reeds for spears; gum and resin for glue in toolmaking; timber for wooden tools and coolamons; and plant medicines.

Accounts by early European explorers such as Charles Sturt (1829, 1830) and Thomas Mitchell, Assistant Surveyor General of NSW (1836), describe large numbers of Aboriginal people occupying the lower Lachlan and lower Murrumbidgee. Sturt observed more people were to be seen as they progressed downstream, and groups in the vicinity of the Murrumbidgee–Lachlan confluence were as large as 120 people (Charles Sturt, writing in 1833, cited in Pardoe and Martin 2001 p. 35).

The abundance of Aboriginal features and values (Aboriginal heritage sites) across the landscape today, especially mounds demonstrating occupation of a long period of time, are evidence of those former large populations.

Typha and Aboriginal people

On his trip down the Lachlan and Murrumbidgee rivers in 1839, Mitchell recorded the importance of typha, the rhizome of cumbungi (also known as bulrush) for food and fibre, particularly around the reed beds, lagoons and swamps.

'The principal food of these inhabitants of the Kalare or Lachlan appeared to be "balyan", the rhizome of cumbungi. It contains so much gluten, that one of our party, Charles Webb, made, in short time, some excellent cakes of it; and they seemed to me lighter and sweeter than those prepared from common flour. The natives gather the roots and carry them on their heads in great bundles, within a piece of net. The old man came thus loaded to the fire … and indeed this was obviously their chief food among the marshes.

It struck me that this gluten which they call balyan must be the "staff of life" to the tribes inhabiting these morasses, where tumuli and other traces of human beings were more abundant than at any part of the Lachlan that I had visited.'

(Mitchell 1839, cited in Martin 2010, p.113).

This Country continues to provide important resources for Nari Nari who still love to fish, hunt and harvest bush tucker when they can. Nari Nari continue to use their traditional ecological knowledge as part of caring for Country and making sure it is passed on to the next generation.

A survey of contemporary Aboriginal values and uses on the Lachlan (Martin 2010) recorded current Nari Nari knowledge about traditional plant gathering locations and uses. Some of these traditional plants included quandong, bush tomato, ruby saltbush, dillon bush and mistletoe. It also included medicine plants such as old man weed, emu bush, pigface and cypress pine. Nari Nari continue to use plants for making wood artefacts, reed spears, and resins for glue.

Photo 1 Ita Lake during a dry period September 2019. Meredith Billington/DCCEEW

Nari Nari also continue to uphold their cultural obligations to share resources and look after cultural property, whether it is sites, artefacts, resources or cultural knowledge. The repatriation of ancestral remains and Aboriginal objects back to Country is a cultural responsibility for the Nari Nari People.

On Nari Nari Country, water management is closely related to management of Country. On Toogimbie Indigenous Protected Area and at Gayini Wetlands, Nari Nari are actively involved in water management to restore wetland values on the floodplain. Nari Nari are well placed to apply their experience in managing environmental and cultural water allocations to water management on Kalyarr (see Section 2.2).

1.2 Co-management with Nari Nari

The Mawambul Co Management Group (referred to as 'Mawambul' in this report) was formed in 2010 through a 'Working Together Agreement' and a memorandum of understanding (MoU). The group brings together representatives of the Nari Nari Tribal Council, the Hay Local Aboriginal Land Council and the NSW Department of Climate Change, Energy, the Environment and Water (the department).

The title of the agreement between Mawambul and the department, Mawambul Nungiyara, is taken from the Wiradjuri language. Mawambul, as the group is named, is a Wiradjuri word which means 'to work together', while Nungiyara means 'agreement'.

The purpose of this agreement is to formally acknowledge the department's commitment to working with Mawambul Co Management Group in the management of reserved lands and waters in the Hay Local Aboriginal Land Council Area. The agreement is complemented by the Charter of Mawambul Co-Vanagement Group and the MoU. The MoU identifies a series of priority aims and long-term objectives for the co-management group. Working together on a plan of management is one of the priority aims for Mawambul.

The Mawambul Co Management Group logo, which is shown on the cover of this report, has significance in expressing this definition. The logo represents 5 contributors to the group's work: the community (black), the land (green), the earth (brown), the rivers, billabongs and wetlands (blue) and the wider community (white). The group itself is represented by the concentric circle pattern, showing individuals coming together for a common cause and with a shared vision.

The co-management group provides Aboriginal community input into the management of NPWS reserves around Hay. It also provides support for Aboriginal employment and capacity building programs such as culture camps, identification and interpretation of cultural heritage values, and cultural tourism. Mawambul also seeks to encourage and promote the use of Aboriginal language, for example, in interpretative material for NPWS-managed parks.

Examples of Mawambul activities over the last few years include:

- the development of interpretative signage for Kalyarr National Park
- repatriation of Aboriginal ancestral remains
- preparation of a park brochure
- preparation of guidelines for the management of Aboriginal cultural heritage in Kalyarr (NPWS 2022).

Photo 2 **Mawambul and NPWS working together to install signage at Ita Lake Cultural Centre, Kalyarr National Park. Gary Currey/DCCEEW**

1.3 Aboriginal features and values

Aboriginal features and values are places that have significance for Aboriginal people for their tangible (physical) or non-tangible (non-physical) evidence of use and occupation. The story associated with a place may be more significant than the physical feature itself. Cultural features and values form part of Nari Nari culture and are important evidence of Aboriginal history.

Although the natural resources of the lower Lachlan and lower Murrumbidgee are extensively altered by agriculture and water management, this region has been described as a cultural landscape without parallel in Australia (Martin 2010). In her study of Aboriginal use and values, Martin recorded 1,168 locations with cultural resources from a sample of the region. In terms of current Aboriginal use, 57 plants and 30 animals with cultural uses were also identified.

To date, 575 sites in Kalyarr have been recorded on Heritage NSW's Aboriginal Heritage Information System (accessed 14 August 2023). These include artefacts, modified trees, ring trees (see below), hearths, middens, mounds, burials, ceremonial sites and resource gathering sites. The former property called Norwood has the greatest density of Aboriginal sites. It is likely that many more sites and features are unrecorded throughout the park.

Ita Lake, on the south side of the Lachlan River in Kalyarr, is of great cultural significance for the Nari Nari People and has a high concentration of features and values. These are concentrated along the lunette on the eastern margin and along the course of Ita Creek to the north of the lake. In this part of western New South Wales, lunettes typically contain

extensive evidence of past Aboriginal occupation and ancestral remains. The Ita Lake lunette contains earth mounds, modified trees, burials, artefacts and hearths.

Mounds are prolific on the Riverine Plain and are the most common and visible archaeological features present (Pardoe and Martin 2001). Mounds build up over time from repeated use of ground ovens and their size varies with age and site use. The analysis of where they occur in the landscape and their relationship with other site types provides useful information about past Aboriginal life.

Mounds derive from cooking ovens, plant processing and habitation sites and may occur with middens, oven complexes (which have no mounded material) and burials. As well as ash and bone fragments, mounds often contain ‘heat retainers’, which are balls of riverine grey cracking clay (Martin 2010) used in the absence of stone for cooking.

Nari Nari Country did not naturally possess stone resources, and instead, trade occurred among neighbouring nations for these resources and other materials. The present-day significance of natural stone for Aboriginal features and values on Kalyarr results from diverse sourcing. Some stone was traded down the Lachlan River from the north, while other varieties were obtained from interstate locations. Specifically, volcanic stone, commonly used for crafting stone axes, was sourced from interstate locations such as Mount William and Warrnambool in Victoria.

Kalyarr has physical evidence demonstrating the persistence of cultural practices well beyond the point of contact with non-Aboriginal people. This evidence indicates a transition in practices occurred as people adapted to using different resources that became available post-contact to continue their cultural practices. Mounds and occupation sites that exist in Kalyarr today likely feature evidence of worked glass and clay pipes and require confirmation via an archaeological survey.

Modified trees are one of the most numerous Aboriginal site types recorded in the park, and mainly appear on river red gum and black box trees. Scars on these modified trees range from small holes for accessing grubs, honey, eggs or small animals; to long scars for canoes and ‘drag-alongs’, used by women for gathering mussels, roots and birds’ eggs. Several ring trees have also been recorded. This is where 2 or more branches of a young tree were tied into a circular shape which, as it grew, became a ring. The purpose of these trees may have been to provide permanent markers, perhaps for ceremonial use (Martin 2010).

Photo 3 **Exposed hearth site on the former Norwood property. Mawambul Co Management Group**

Photo 4 Stone artefacts, Kalyarr National Park. Mawambul Co Management Group

Photo 5 Modified tree, Kalyarr National Park. Mawambul Co Management Group

1.4 Management considerations and opportunities

NPWS and Mawambul continue to build on their co-management practice through regular meetings and joint management operations in Kalyarr. As partners in managing Kalyarr, we together recognise the importance of exchanging information and making time for our co-management relationship to evolve.

Maintaining connection to Country for the Nari Nari People in Kalyarr remains a high priority. Mawambul continue to hold culture camps using Norwood Cottage for accommodation. To date culture camps have been attended by local and city-based Aboriginal people and are proving an effective and enjoyable means of providing social and cultural healing. These camps, and other cultural activities at Kalyarr, foster enduring connections with neighbouring nations and serve as a valuable means to introduce young people to cultural practices and activities.

A variety of different cultural activities, including both men's and women's business, can be incorporated into the camps. This includes toolmaking, learning about bush medicine, ceremonies, gathering bush tucker, and engaging in storytelling.

A great deal of Aboriginal cultural heritage in the Riverina has been permanently lost through agricultural activity. NPWS works closely with Mawambul to ensure cultural heritage on Kalyarr is appropriately identified, recorded and managed.

Aboriginal site surveys in preparation for on-ground works also provide an opportunity for NPWS staff to learn more about Nari Nari culture and values. NPWS and Mawambul have agreed protocols for staff and contractors to ensure the risk of adverse impacts on Aboriginal features and values from works are minimised.

Photo 6 **Aerial image of Ita Lake taken in December 2022 during a peak inundation period. Mal Carnegie/DCCEEW**

Language and other traditions are now being recorded as a means of protecting and sharing cultural traditions and practices for future generations. NPWS works closely with the Mawambul Co Management Group to ensure correct protocols are followed when collecting and storing information, and where appropriate sharing this information.

Several surveys for Aboriginal cultural heritage have been undertaken in the park as part of planning for on-ground works. This includes the Darcoola Water Efficiency Project and rationalising the road and management trail network. However, it is likely there are numerous unrecorded sites across the park.

In 2017, maintenance works on the trail network in Kalyarr disturbed Aboriginal sites. A subsequent survey of the network identified 330 new Aboriginal sites. In consultation with the Mawambul Co Management Group, actions were taken to avoid damage to significant cultural heritage by closing some trails and covering some sites.

Previous survey work has informed the preparation of maps that identify 3 levels of Aboriginal cultural heritage sensitivity to help predict where additional sites (features and values) may occur in the park. This mapping has been used to develop an Aboriginal cultural heritage management plan for Kalyarr (NPWS 2022), which further refines agreed approaches to avoid disturbance to Aboriginal sites.

Mawambul advocates for additional survey and research work to improve knowledge relating to Aboriginal features and values. This could include:

- ground-truthing predictive maps that identify sensitive areas
- core sampling and dating (comparison to neighbouring properties where sites have been dated to 48,000 years ago)
- detailed maps of sensitive sand hill areas
- ancient trade routes, for example, to determine source of stone used for tools found in Kalyarr
- cultural values, for example, bush tucker.

Due to the significance of Ita Lake for Nari Nari, interpretative signage has been developed by Mawambul, drawing attention to Aboriginal cultural heritage values and their sensitivity. Visitor facilities for use by the Aboriginal community and the general public have been developed overlooking the lakebed (see Section 4). There is also a proposal for dual naming of Ita Lake to reflect Nari Nari language.

2. Protecting and managing Country

2.1 Geology, landform and hydrology

Kalyarr National Park is underlain by the vast Murray Geological Basin, a shallow crustal depression which was formed during the Cainozoic era approximately 60 million years ago (Scott 1992). The basin extends into 3 states and covers about 300,000 km^2 (Lawson and Webb 1998, cited in Wen, Saintilan and Ling 2011). It consists largely of marine sediments derived from the ancient seas which occupied the western half of the basin and moved back and forth across the plains several times.

The surface landscape of the Murray Geological Basin formed during the Quaternary period (the last 2.588 million years to the present) overlaying some lacustrine elements formed during the previous Tertiary period (approximately 66 to 2.588 million years ago) (Pels 1969).

The eastern part of the Murray Geological Basin, where Kalyarr is located, is occupied by the vast Riverine Plain (76,800 km^2) or Riverina Bioregion, which contains the fluvial plains of the major west-flowing rivers of inland New South Wales – the Murray, Murrumbidgee, Goulburn and Lachlan rivers (Butler et al. 1973) (see Figure 3). The plain is incredibly flat, with an average gradient of 20 cm/km from 120 m above sea level (ASL) on the east near the Great Dividing Range, to 65 m ASL in the west (Soil Conservation Service 1990, cited in Martin 2010). While rivers are prominent features in the modern landscape, they have not significantly shaped the present topography. With the exception of a few small riparian areas, the landscape is primarily a relict landform (Pels 1969). The plain is composed of deep, unconsolidated sediments; and rock (dating from the Palaeozoic era) only occurs on the margins. There is evidence of prior streams that carried sand far onto the clay plains in wide channels with long meanders. Prior streams are remnants of former, ancient drainage systems that operated under the natural cycles of flooding and channel migration on the floodplains. They are also known as palaeo-channels and consist of low, winding sandy levees and areas of texture-contrast soil that flank the depression marking the old stream channel. Prior streams are also easily identified by a distinctive pattern of scalding, which is visible in aerial photographs (SCS 1987).

Kalyarr's low-relief landscape is typical of the western Riverina Bioregion, including flat treeless plains, ephemeral watercourses, an ephemeral lake (the 1,200-ha Ita Lake) and overflow creek systems. As with the other rivers on the Riverine Plain, the Lachlan River is deep and narrow with steep clay banks. Other named watercourses in the park are Pimpara Creek, an ephemeral creek aligned south-west to north-east through the northern section of Norwood; and Darcoola Creek, also ephemeral, aligned west to east through the lower part of Darcoola (see Figure 1). Other than the Lachlan River, there is no permanent natural water on Kalyarr. Patchy ephemeral wetlands occasionally form for a short time at Ita Lake (see Figure 1), and in black box creek lines and depressions known as gilgais across the floodplain (see Section 2.3).

Gilgai depressions are small ephemeral pools, usually only a few metres across and less than 30 cm deep, however, they can be wider and deeper. They are reasonably common through the mid and lower Lachlan (Barma Water Resources 2011). They often support weeping myall, belah, black box, bimble box, rosewood and river cooba.

Gilgais have traditionally served as a means for graziers to seasonally graze livestock in areas without permanent water sources. However, many farmers also view them as a nuisance due to the soil movement associated with gilgai formation, which can lead to infrastructure damage and crop harvesting disruptions. Ecologically, gilgais are of great significance as a source of water for animal and plant life.

Photo 7 **Black box lignum community under dry conditions, 2019. Meredith Billington/DCCEEW**

Photo 8 **Pimpara Creek after rain, October 2020. Jess Murphy/DCCEEW**

As well as being highly significant for the Nari Nari People, the lunette on the eastern edge of Ita Lake is of particular scientific interest as the pattern of lakes, lunettes and prior stream

beds on the Riverine Plain are evidence of changed Quaternary environments and human history. In this environment, lunettes occur as crescent-shaped sandy rises and dunes on the eastern perimeter of lakes and can be up to 15 m high.

Lunettes occur as a result of the seasonal flooding and drying out of a lake leaving a salt residue on the lakebed, which helps break up the clay soil. The clay particles are then blown by uni-directional winds and deposited to form a dune (Bowler 1976, cited in Scott 1992).

The lake is intricately connected with the significance of the lunettes, as these environments were not merely passive settings but rather vital spaces where people lived and interacted. People's presence in this region was intrinsically tied to the presence of the lake itself, underlining the inseparable connection between the lake's significance and lunette's role within the larger landscape. This interconnectedness underscores the broader narrative of how Aboriginal people adapted and thrived in response to changing environmental conditions.

Soil testing of Ita Lake lunettes, lakebed, and mound sites holds the potential to unearth invaluable insights into climatic shifts and the life and culture of Aboriginal people in the lower Lachlan region. Soil testing of the lunette at Yanga Lake on the Lowbidgee (in Yanga National Park) dated the lowest sediments to be about 66,000 years old (Cupper 2008).

Soils in the park are mostly deep, heavy, grey and brown cracking clays on the plains, with sandy soils limited to the channel of the Lachlan River. Sandy soils are also evident in levees, old channels, dunes and lunettes. There are no rock outcrops in the park.

This area experiences a persistently dry, semi-arid climate characterised by hot summers and cold winters. Average rainfall of 314 mm per year has been recorded at the nearest Bureau of Meteorology weather station, Hay (Corrong), which has recorded over 134 years of data.

Kalyarr National Park makes an important contribution to the reservation of 5 landscape types (DECC 2002) described in Table 1.

Table 1 Mitchell landscapes conserved in Kalyarr National Park

Mitchell landscape	Description
Lachlan Channels and Floodplains	Quaternary alluvium on floodplains, active and inactive channels, billabongs, levees, swamps and source-bordering dunes of the Lachlan River and its effluent streams. Some areas of associated sandplain, remnant lunettes, and slightly high river terrace. Relief 2–10 m. Grey, red and brown cracking clays on lakes and plains, red, yellow and brown texture-contrast soils on levees. Deep self-mulching and cracking clays in channels; low rises of deep brownish sands and solonized brown soils; fluvial backplains of scalded yellow texture-contrast soils. Prior streams and lunettes of loamy red texture-contrast soils and calcareous earths.
Lachlan Depression Plains	Quaternary alluvial plains with numerous circular depressions interpreted as high floodplains or low terraces beyond the reach of average floodwaters. Sandy rises and levees trace ancestral streams and stand above the general plain. Relief 1–3 m. Grey and brown cracking and non-cracking clays often with gilgai on the plains. Sand and red or brown texture-contrast soils on the higher ground.
Lachlan Lakes, Swamps and Lunettes	Quaternary alluvium in lakebeds, swamps, salinas, shorelines, lunettes, feed channels and terraces of the river wetlands. Associated extensive sandplains and dunes. Relief to 7 m. Include large relict lakes upstream of the Mungo system partially overlain by sandplains and unstable dunes, flanked by high unstable lunettes, relief to 30 me. Grey cracking clays with gilgai on active lake beds and channels. Calcareous red earths on shorelines and shallow sandy, calcareous soils, or deep brownish sands and solonized brown soils on lunettes. Red-brown or grey, often saline clays on relic lakebeds. Sandplains of loamy to clay loam calcareous earths with limestone nodules frequently exposed, dunes of deep red, yellow or white sands. Prior streams and relic lunettes of loamy red texture-contrast soils and calcareous earths.
Lachlan Sandplains	Extensive slightly undulating Quaternary aeolian sands with isolated sandy hummocks and depressions. Relief 4–8 m. Loams to clay loam calcareous earths with limestone nodules frequently exposed, solonized brown soils and sandy red and brown texture-contrast soils, deep red sands on hummocks and dunes, grey clays in depressions.
Murrumbidgee Scalded Plains	Quaternary alluvial plains with extensive scalding interpreted as relic floodplains or terraces. Levee traces evident, relief generally <1 m, up to 5 m on associated pans, swamps and lunettes. Grey, brown and red cracking clays, red-brown texture-contrast soils with scalds.

2.2 Managing water and wetlands

2.2.1 Connection to Country – water values for Nari Nari

The following information has been sourced from consultations with Aboriginal peoples regarding the preparation of water resource plans (DoI 2019).

> The Nari Nari word for water is 'gayini'. Gayini was central to Nari Nari life. When gayini was abundant, that meant that the Nari Nari People would thrive. Lots of gayini meant plentiful food resources and a rich and strong culture.

The health of the Riverine Plain, which makes up Nari Nari Country is inextricably linked to water – both its availability and its quality. Nari Nari are acutely aware of the importance of water and the management of water for the health of their Country. They believe that water sharing arrangements should take account of cultural values and assets and provide water for cultural flows (DoI 2019, p.2).

Prior to European occupation of the Riverine Plain, the Nari Nari Country was a rich and bountiful landscape. Despite the low rainfall, water would have been abundant most of the time, coming from the large and permanently flowing Lachlan and Murrumbidgee rivers. During high flow events, these rivers spilled into vast wetland areas, triggering breeding events for swamp species and fish. Yellow belly, mussels, crayfish and waterbirds would have been available in large numbers in the wetlands. Cod yellow belly inhabited the rivers. Bush tucker was seasonal but plentiful. As high flows receded, Nari Nari People would move around their lands, following the food resources and seasons, but still remaining on Nari Nari Country.

Photo 9 Nardoo, Kalyarr National Park. Jess Murphy/DCCEEW

The Nari Nari People have attachments to all of their nation's Country, however, Ita Lake, Pimpara Creek and Reedy Lake have been identified as high value in relation to water resource management on Kalyarr. More broadly and outside of the park boundaries, the following water systems have also been identified as high value: Great Cumbung Swamp, Gayini (previously known as Nimmie Caira) and Uara Creek, Fiddlers Creek, Dry Lake and Abercrombie Creek. Each of these unique systems occurs in either the lower Lachlan and/or lower Murrumbidgee river systems.

Traditionally, flows were highest in late winter and spring. At these times, Ita Lake was an abundant source of waterbirds and yellow belly. As the flows subsided and the season warmed, the Great Cumbung Swamp became accessible and waterbirds were plentiful. Quandong and nardoo would be in season. During the warmer months, the Gayini (Nimmie Caira) wetlands became the focus. The lower areas had semi-permanent water, and waterbirds were present, even through dry spells. During extended dry periods, often corresponding with late summer and autumn, the Murrumbidgee and Lachlan rivers always held water. Yellow belly, Murray River cod, mussels and crayfish became the food staple for the Nari Nari People.

Cultural and spiritual activities of the Nari Nari People corresponded with the seasons and water. These water features were the focus, and really important meeting places for both Nari Nari People, and people from neighbouring nations, especially the Muthi Muthi, Ngiyampaa and Paakantji peoples, who have powerful and deep connections to the Nari Nari Nation. Ita Lake in particular is known as a meeting place for the Nari Nari and Muthi Muthi peoples. Trading took place. For example, the Nari Nari traded for rock resources which were used to make tools for hunting and in food preparation. This was very important business as there is no natural rock on Nari Nari Country. Ceremonies were performed. Men and women each had their own special places to complete their spiritual activities.

These cultural pursuits are extremely important today. The Nari Nari Nation hold large parcels of land within their nation's area. Much of this country is riverine wetland systems. These properties are central to Nari Nari contemporary connections to the land. Gatherings are still crucial for cultural wellbeing. Nari Nari land nourishes the Nari Nari People. A healthy landscape makes for healthy people, and in Nari Nari Country the health of the landscape is inextricably linked to gayini (water). Water use and extraction from the Lachlan River is regulated by the department under the Water Sharing Plan for the Lachlan Regulated River Water Source 2020 (referred to as the Lachlan regulated water sharing plan), which was prepared in accordance with the Murray–Darling Basin Plan (the Basin Plan). Both Commonwealth and state governments have committed to providing water for the environment with the aim of improving the health of the Lachlan's riverine and floodplain ecosystems. The Lachlan regulated water sharing plan makes provision for environmental water to be provided to key environmental assets which have been identified through the Basin Plan. This occurs under the Lachlan long-term water plan (DPIE 2020).

Lachlan Swamp and Ita Lake are 2 of the priority environmental assets (see Figure 4) identified in the *Lachlan long-term water plan*, made in accordance with the Basin Plan. Annual spring waterbird diversity and abundance surveys have been conducted by the department since 2016 to monitor progress towards the Lachlan water plan objectives and targets for waterbirds, while frog surveys, including targeted southern bell frog, have been conducted since 2021. Regular vegetation community and condition surveys are carried out under the Commonwealth Government's Monitoring, Evaluation and Research program, which replaced the Long-term Intervention Monitoring program (Cth DCCEEW n.d. a). The purpose of this program is to determine how Commonwealth Environmental Water is achieving expected outcomes at the asset and broader basin scale.

It provides useful information about the health and condition of the lower Lachlan and how it responds to specific environmental watering events. Ita Lake is one of several sites being monitored under this program for hydrology, vegetation diversity and frogs (see Section 2.4).

Cultural and environmental values of Ita Lake

Ita Lake has great significance for the Nari Nari and is a well-known focus for cultural connection in this part of the lower Lachlan. Ita Lake used to receive water more regularly from overland flooding before regulation of waterways. Flooding used to occur about every 5 years or so, resulting in pulses of food resources. For the Nari Nari, being able to access resources such as cod, yellow belly, mussels, yabbies and catfish means Country is healthy.

The Water Sharing Plan for the Lachlan Regulated River Water Source 2020 (under the *Water Management Act 2000*) recognises the importance of water to Aboriginal people and makes provision for granting Aboriginal cultural water access licences. NPWS will continue to support Mawambul in seeking a cultural water allocation or targeted environmental water for Kalyarr in the future.

Cultural water or flows have been defined as 'water entitlements that are legally and beneficially owned by the Indigenous Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Aboriginal' (AIATSIS 2009). A cultural flow recognises that 'the right to take water is an essential part of the historical and contemporary lives of Indigenous Nations. Indigenous rights to waters are part of a holistic system of land and water management'.

The section of the Lachlan River that flows through Kalyarr is part of the Lachlan Swamp (Part of mid Lachlan Wetlands) riverine and floodplain wetland system, listed on the Directory of Important Wetlands in Australia (Cth DCCEEW n.d d). The listed wetlands extend from Lachlan Valley/Goonawarra Nature Reserve below Booligal, downstream past Oxley to just east of Great Cumbung Swamp (see Figure 4).

The criteria for listing Australia's nationally important wetlands were agreed to by the ANZECC Wetlands Network in 1994. The Lachlan Swamp meets 3 of the 6 criteria for inclusion, namely:

- it is a good example of a wetland type occurring within a biogeographic region in Australia
- it is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- it is a wetland important as habitat for animal taxa at a vulnerable stage in their life cycles and providing a refuge when adverse conditions such as drought prevail.

These wetlands are extremely significant for waterbirds, and in 1990 under flood, supported the largest colonies for breeding egrets and herons recorded and published in Australia (Magrath 1992). The wetlands also support a number of rare, endangered and vulnerable species.

Ita Lake covers 1,200 ha and is recognised as a regionally significant wetland for similar ecological values and functions. Ita Lake supports threatened species and communities, and significant biodiversity as it cycles through wet and dry, and can provide critical habitat for biota to complete life history stages. The Kalyarr semi-arid floodplain experiences a highly variable flooding regime which has structured the vegetation communities, and controls the observed ecological patterns and processes, such as exchange of nutrients and movement opportunities (Higgisson 2019). Such floodplains are characterised by high biodiversity and productivity, providing habitat and refugia for a range of native species.

2.2.2 Altered hydrology and water regimes

Kalyarr National Park is located on the lower reaches of the Lachlan River. The Lachlan River is the fourth longest river in Australia at 1,488 km and drains a catchment of nearly 8.5 million hectares. It starts near Goulburn in the Great Dividing Range and terminates at the Great Cumbung Swamp near Oxley, 20 km downstream of the western boundary of Kalyarr National Park.

In periods of high flow, the Great Cumbung Swamp connects to the Murrumbidgee River at the northern boundary of Yanga National Park. Likewise, Pimpara Creek, fed by the Lachlan River in Kalyarr, connects with the Pimpara Creek fed by the Murrumbidgee when both valleys experience extensive flooding, providing additional movement opportunities for water-dependent fauna and flora. Historically, the Great Cumbung Swamp was one of the most important breeding areas for waterbirds in eastern Australia, and home to 131 bird species and more than 200 plant species.

As with the other major inland rivers winding through the flat topography of western New South Wales, the Lachlan experiences highly variable rainfall and has a high evaporation rate of about 94% of rainfall (MDBA 2014).

Almost 1,300 km of the Lachlan River is regulated by water storages (DPIE 2019). Wyangala Dam, on the junction of the Lachlan and Abercrombie rivers about 48 km upstream of Cowra, is the major water storage used to regulate the supply of water for irrigation downstream via a series of regulating weirs including Lake Cargelligo and Lake Brewster (see Figure 4).

Regulation since the 1930s has substantially modified the Lachlan River's hydrology and natural watering regime, resulting in deterioration of its freshwater ecosystems. The effects of these changes are exacerbated at the terminal end of the catchment where reduction in flows, loss in regular flooding, changes in timing and season of flows, and loss of connectivity greatly impact wetland values. Riparian and wetland condition has also been affected by introducing several exotic species (e.g. willow trees, lippia and carp). Dyer et al. (2020) estimate that the total water volume that inundated the lower Lachlan floodplain is approximately half (54%) of what have occurred under natural flow conditions.

The *Sustainable rivers audit 2* (MDBA 2012a) examined the ecological health of rivers in the Murray–Darling Basin at the end of the Millennium Drought (1997 to 2009) and reported that the overall ecosystem health of the Lachlan River valley was very poor.

Drought had severely affected species abundance and diversity of fish, with the health of the fish community was rated as extremely poor. The degree of modification of the natural system has resulted in the lowland sections of the Lachlan River being listed as an endangered ecological community (EEC) under the NSW *Fisheries Management Act 1994* (see DPI 2006). Prior to reservation of the park, irrigation channels were constructed in the bed of Ita Lake to water crops. Evidence of these channels and culverts are still visible (see Photo 11).

Photo 10 Panoramic view of Ita Lake during flooding, January 2022. Mal Carnegie/DCCEEW

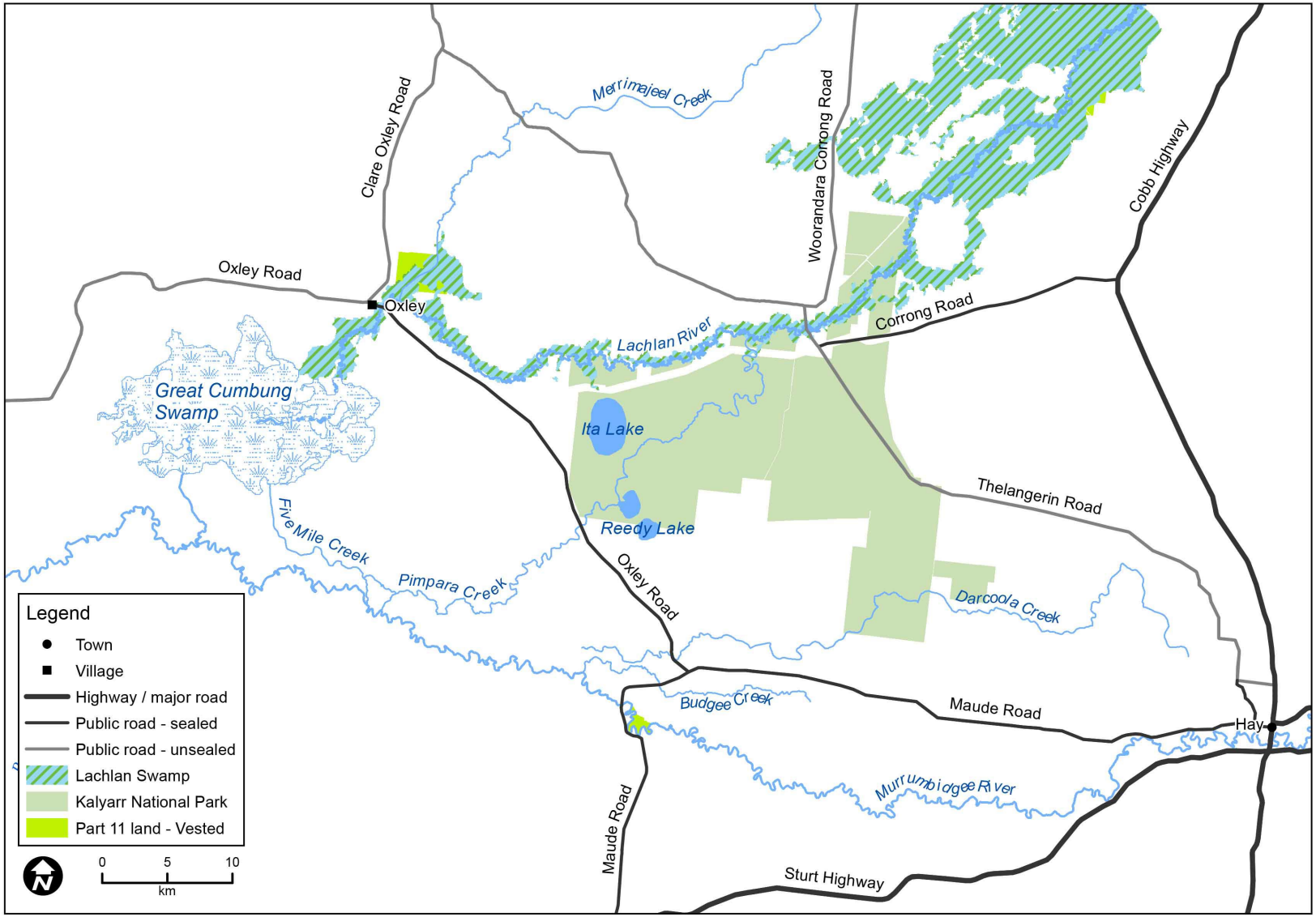

Figure 4 Location and extent of the Lachlan Swamps

Photo 11 Satellite image of Ita Lake in 2014 showing creeks and channels in blue. Landsat

2.2.3 Environmental watering in the lower Lachlan

Changes to the natural flow regime have reduced inundation of the lower Lachlan River's floodplains and wetlands, causing fragmentation and leading to a decline in the quality of aquatic habitats (DPI 2006). Providing and protecting **environmental water** to the lower reaches of the river is one of the key mechanisms being applied under the Basin Plan to restore natural values.

Environmental water

Environmental water, or 'water for the environment', is surface or groundwater that is managed specifically to improve the health of rivers, wetlands, floodplains and other water-dependent ecosystems.

Water for the environment is typically referred to as either 'planned environmental water' or 'held environmental water'.

- **Planned environmental water** is water committed for ecosystem health or other environmental purposes through rules in surface and groundwater sharing plans.
- **Held environmental water** is water allocated to a water access licence held for environmental purposes. Held environmental water is a commonly used term for 'licensed environmental water'.

(From What is water for the environment webpage)

Environmental water for the lower Lachlan is sourced from a combination of Commonwealth- and state-managed water that is set aside to support the long-term health of the river ecosystems.

The Commonwealth Environmental Water Holder has a greater portfolio of 'held' or licensed environmental water, but the State of New South Wales has access to and a role in the decision-making over a much larger portfolio of 'planned' environmental water under median to wet conditions (see box).

State-managed environmental water holdings and arrangements have also been in place since the 1980s, whereas the Commonwealth was first active in 2010. The specific ecological objective to restore a near-natural wetting pattern to Ita Lake was formalised in the NSW RiverBank water use plan for the Lachlan water management area in 2007.

RiverBank also had objectives for the Kalyarr Lachlan River corridor in the Lachlan Swamp, including to provide for ecologically beneficial flows in the Lachlan River channel, and to enhance river and wetland habitat for water-dependent biota, including threatened and other native fish and waterbird recruitment.

The department delivers and manages environmental watering actions on behalf of the Commonwealth Environmental Water Office, and the 2 agencies work in close partnership to maximise the ecological outcomes for lower Lachlan assets, including Ita Lake and Lachlan Swamp, using all sources of water in the most efficient and effective manner.

Annual planning for how environmental water should be applied in the lower Lachlan takes place each year and takes into account:

- expected availability of water in the coming year
- conditions of the previous year
- current health of the plants and animals in these ecosystems.

An annual statement of watering priorities is prepared by the department in consultation with the Lachlan Environmental Water Advisory Group.

This group draws on the expertise and experience of relevant community stakeholders and may include water managers, recreational fishers, landholders, Aboriginal peoples or groups, independent scientists, local government representatives and a variety of partner agencies.

Currently established and newly establishing groups (including regional Aboriginal water committees) fulfill an important function in facilitating knowledge exchange and pursuit of prospective environmental and cultural watering outcomes for Kalyarr.

Significant events in the region over the last 20 years that have had a direct impact on the availability of water in the lower Lachlan include:

- the Millennium Drought from 1997 to 2009
- flooding in 2010–11, 2012–13 and 2016
- drought from 2018 to 2020
- prolonged wet conditions and significant flooding from 2020 to 2023 associated with 3 consecutive La Niña events.

Comparisons during mainly dry (August 2020) and peak inundation (December 2022) conditions of the Lachlan River in relation to Kalyarr, and including Ita Lake, are shown in Figures 5 and 6, respectively (DPE 2023).

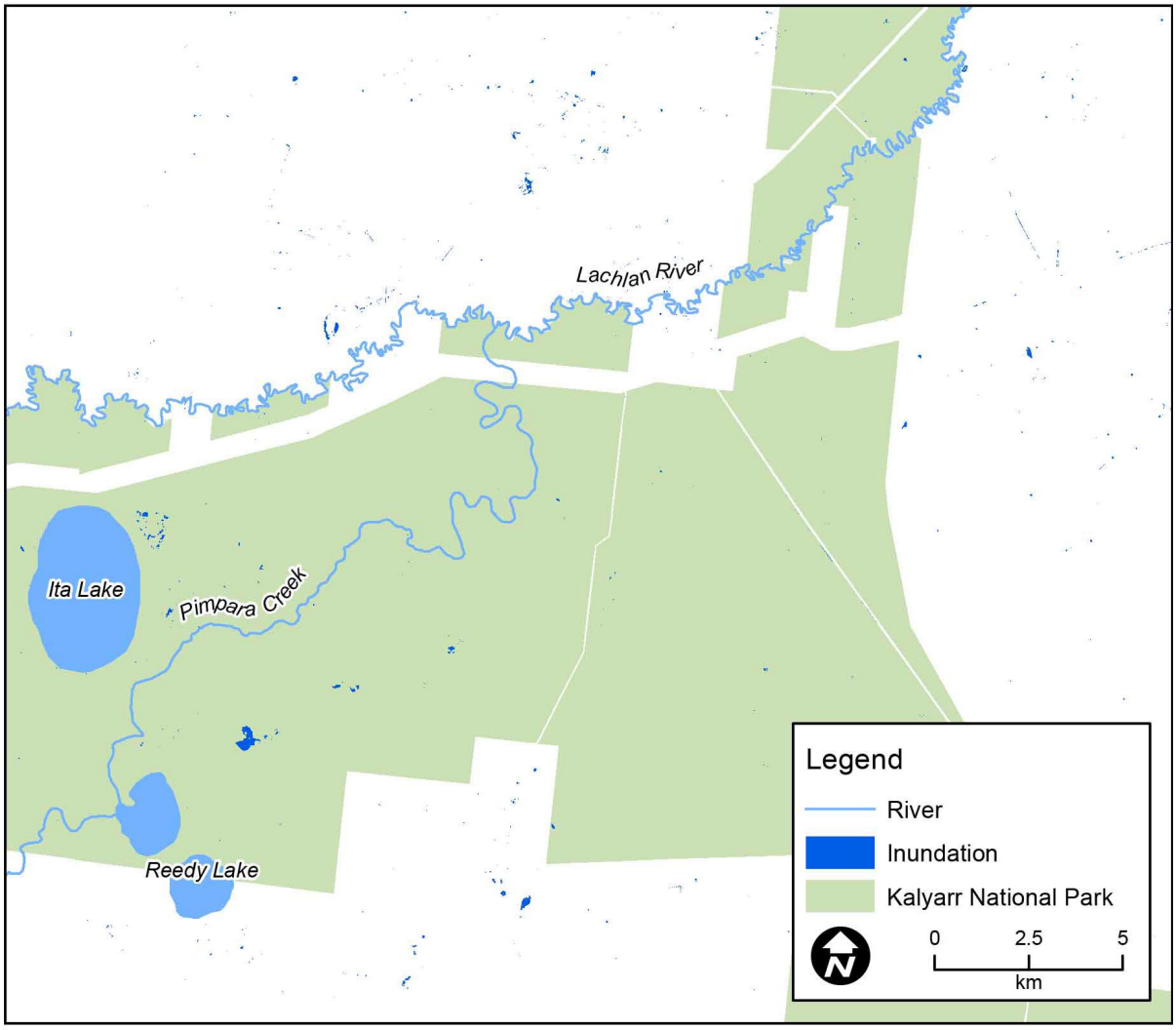

Figure 5 Kalyarr pre-flooding (mainly dry) conditions in August 2020 (dark blue areas indicate inundation)

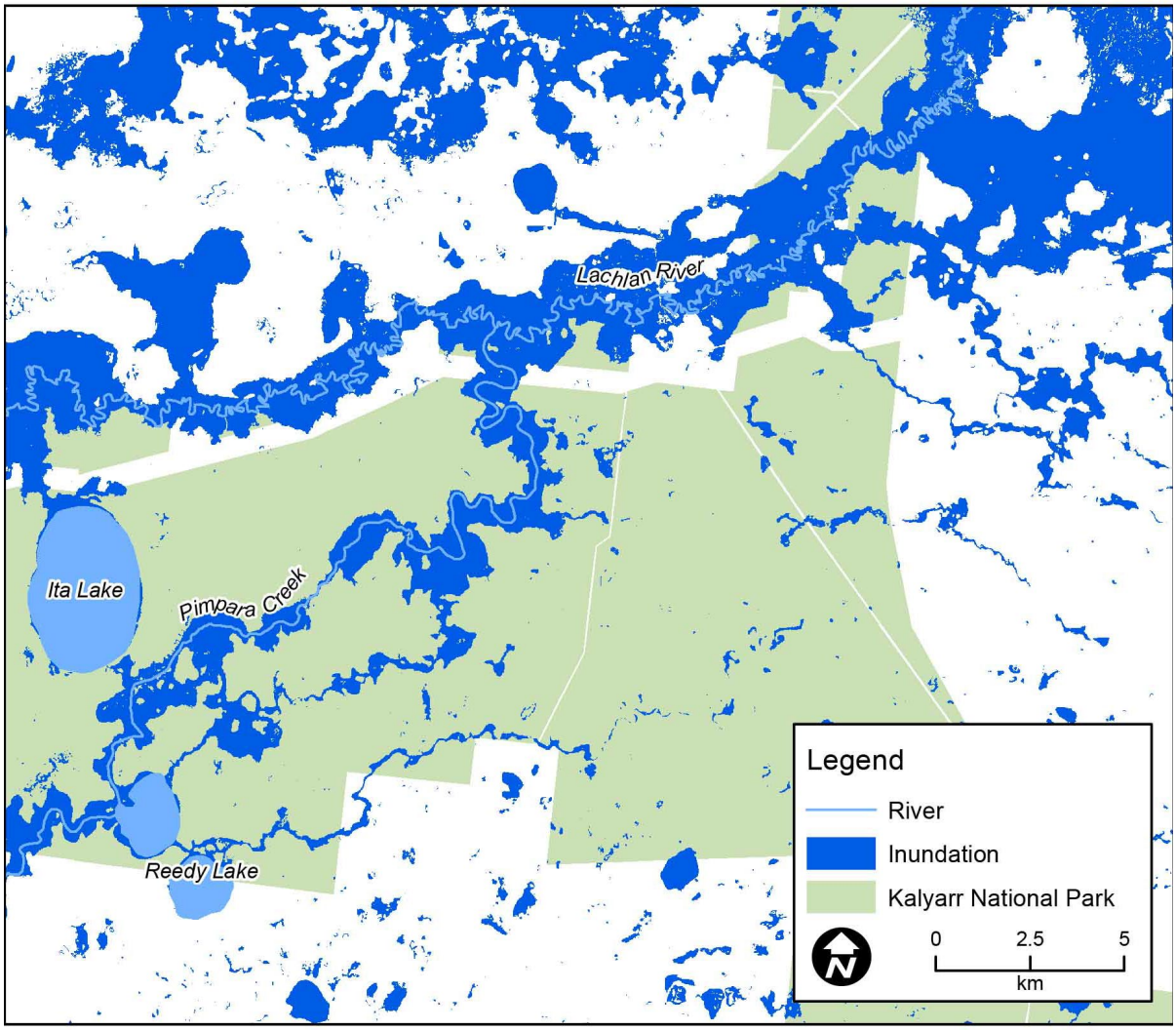

Figure 6 **Kalyarr peak inundation conditions following flooding in December 2022 (dark blue areas indicate inundation)**

2.2.4 Management considerations and opportunities

From the Nari Nari perspective, healthy Country is dependent on restoring a watering regime which is as natural as possible. For the flat lower Lachlan, this translates to occasional overland flows, which can refresh shallow ephemeral wetlands and help in restoring connections across the floodplain.

Ita Lake is an ephemeral wetland of high conservation and cultural value, and for this reason is identified as a target for environmental water delivery. It is an identified priority environmental asset under the *Lachlan long-term water plan* (DPIE 2020) using the criteria in the Basin Plan. The lake covers approximately 1,200 ha and is regionally significant for the waterbird habitat it provides in the semi-arid landscape. Nari Nari consider the lake should ideally contain some water every 2 to 3 years.

Ita Lake is typical of many wetlands fed by the lower Lachlan during medium to high flows – big enough to sustain significant ecological values and small enough to respond to the volumes that licensed environmental water can deliver (Barma Water Resources 2011). However, there are several challenges for supplying environmental water to Ita Lake. The lake is about 3 km from the Lachlan River. A series of inflow channels from the river feed into a main supply channel which flows into the north-west part of the lake (see Photo 10).

These channels cover a large area and it is likely they absorb considerable water before flows reach the lake bed. Additionally, Ita Lake has a high ‘commence to flow’ level, and there is currently no water management infrastructure in place for directing water from the river channel to the lake. Therefore, environmental water intended for the lake can only be delivered as a ‘piggyback’ event with other large flows or under ‘already-wet’ conditions after a flood.

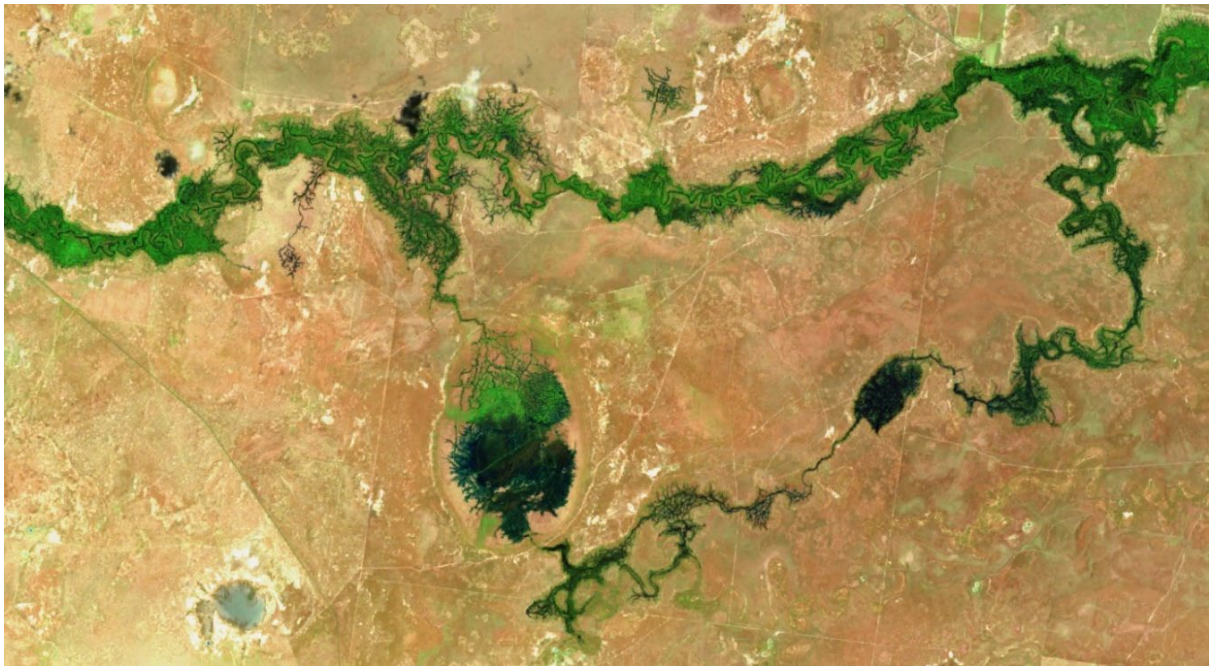

Photo 12 Ita Lake reconnected with Pimpara Creek (to the east and south of the lake) after prolonged rainfall and downstream flooding in 2021. Damian McRae/CEWO

NPWS and the department’s Biodiversity and Conservation Division are working with stakeholders, including the Commonwealth Environmental Water Office and Mawambul Co Management Group, to formulate appropriate watering objectives for Ita Lake as part of broader objectives for Lachlan Swamp and Great Cumbung Swamp.

In 2022, the Commonwealth Environmental Water Office committed to undertake a feasibility study to investigate additional options for getting water into the lake, including infrastructure-assisted flows.

There may also be scope for enhancing environmental watering outcomes for the lower Lachlan (including Kalyarr) under the NSW Government’s Lachlan regional water strategy (in preparation).

This is one of 13 regional strategies being developed by the department across New South Wales in partnership with water service providers, local councils, communities and other stakeholders. The aim of these strategies is to bring together the best and latest climate evidence with a wide range of tools and solutions for managing each region’s water needs over the next 20 to 40 years.

The Nari Nari Tribal Council has secured water for wetlands on Toogimbie Indigenous Protected Area under a cultural access licence provided for in the Murrumbidgee water sharing plan. Watering of the wetlands resulted in substantial restorative benefits for the land and for the community (MLDRIN 2017) in a heavily modified agricultural landscape.

The Lachlan regulated water sharing plan similarly recognises the importance of water to Aboriginal people and makes provision for cultural access licences. These provisions for native title determination through the Commonwealth *Native Title Act 1993* and high security cultural water access licences have been in place since 2004.

These licences provide up to 10 ML/year per applicant for drinking, food preparation, washing and watering domestic gardens, as well as for Aboriginal cultural uses.

As of 2023, no determinations of native title in relation to the water source have been made nor any applications for cultural access licences granted. A framework for the assessment of cultural water licences is being developed under the Lachlan regional water strategy (explained in Section 2.2) together with other actions aimed at supporting access to water by Aboriginal communities.

2.3 Native plants

2.3.1 Aboriginal knowledge and use of plants

In the lower Lachlan and lower Murrumbidgee, the margins of ephemeral lakes supported sedges and rushes used for food and fibres by Aboriginal people in the past. As lakes dried out, the wetter edges provided spike rushes, nardoo, neverfail, copperburrs, saltbushes, millet and common pigweed. Grazing animals attracted to the feed were an obvious target for hunting and many of the plants were harvested for their seeds. Many grinding stones have been located near the lakes and in living areas nearby, though some have also been taken for private collections. There were also edible grasses and hibiscus. Typha (bulrush rhizomes) was a particularly valuable source of gluten. Reed beds provided material for thatched huts and habitat for swarms of edible frogs and snakes.

As explained in Section 1.1, Nari Nari continue to use their extensive knowledge of locally occurring plants for food, medicine and other purposes. Some of this important knowledge has been documented in *Wiradjuri plant use in the Murrumbidgee catchment* (Murrumbidgee CMA 2008).

Traditional knowledge includes the ability to weave string, baskets, mats and fish traps from sedges, rushes, grasses, vines and reeds. Fibres from *Poa*, *Lomandra* and *Dianella* species are commonly used. Many Aboriginal women from Nari Nari and other river-based groups are skilled weavers and basket-makers and use techniques handed down over many generations. Harvesting of materials and weaving is often practiced by groups of women and represents an important aspect of culture for these women.

2.3.2 Vegetation communities

A total of 14 native vegetation communities have been identified in Kalyarr (see descriptions in Appendix C). These occur across 5 Keith classes (Keith 2004). Due to the extensive clearing of the Riverina Bioregion and low level of conserved lands in the bioregion (3.84%), each of these vegetation classes are of regional conservation significance. The majority of Kalyarr National Park is vegetated by chenopod shrublands (dominated by various saltbush species in the park) that are not flood-dependent. But along the Lachlan River corridor, and in drainage depressions, river red gum, river cooba, black box, nitre goosefoot and lignum communities require inundation in varying frequencies.

Consistent with the flooding regime of inland rivers, river red gum dominates the river corridor, and black box woodlands occur on the outer margins of the floodplains where they receive less regular inundation. Lignum and nitre goosefoot also occur in parts of the floodplain that experience occasional and sometimes prolonged flooding. These ephemeral freshwater wetlands are important habitat for breeding waterbirds and frogs (see Section 2.4).

Less dominant species which are also associated with lower Lachlan floodplains include river cooba and myall. River cooba in the Lachlan is mostly found in the lower catchment and is often associated with river red gum, black box or lignum.

High-flow events of significant duration are crucial for species like river cooba, as they need a flood event to create suitable conditions for seed dispersal and germination.

River cooba require a flood event for a duration of approximately one month to achieve seed dispersal and germination (Higginsson et al. 2022a). River cooba's distribution along rivers allows for consistent seed dispersal by water, irrespective of river levels, while the dispersal of tangled lignum seeds between patches relies on specific flooding events (Higgisson et al. 2020b).

River cooba provides valuable nesting habitat, especially for colonial nesting species (MDBA 2012a).

The vast open plains of Kalyarr National Park support significant riverine chenopod shrublands that thrive in the sporadic rainfall and low soil moisture of the semi-arid climate which is unable to support tree-dominated vegetation. Riverine chenopod shrublands occur on seldom flooded parts of the lower Murray, Murrumbidgee and Lachlan floodplains, and on the upper Darling and Paroo floodplains, principally in New South Wales.

The chenopod shrublands at Kalyarr comprise 74.5% of the native vegetation in the park and are dominated by saltbush species: bladder saltbush, old man saltbush, ruby saltbush, thorny saltbush and black bluebush. These are perennial species, able to tolerate severe drought, periodic flooding, frost and salt, and are palatable to sheep. For these reasons, saltbush has been extensively used as fodder throughout arid and semi-arid parts of the state and the extent of the community has diminished dramatically since European settlement (Kent et al. 2002).

In southern New South Wales, the riverine chenopod shrublands have been extensively degraded by overgrazing and although not listed as threatened, the communities are regionally significant. At the time Thelangerin was acquired, more than 80% of the property consisted of fertile flat areas that had been managed with conservative stocking rates and so the vegetation communities were considered to be in very good condition (Porteners 2013).

Photo 13 Vast open plain landscape characteristic of Kalyarr National Park, 2021. Samantha Ellis/DCCEEW

2.3.3 Threatened species and communities

One threatened ecological community listed under the *Biodiversity Conservation Act 2016* is found in Kalyarr. Sandhill Pine Woodland endangered ecological community (EEC) occurs over 27.9 ha in an area known as the Darcoola sandhills (Porteners 2013).

This community is typically associated with prior streams and aeolian source-bordering dunes within extensive alluvial clay plain dominated by chenopod shrublands. In the Riverina Bioregion the community has been extensively cleared and grazed by feral herbivores, particularly goats, and rabbits, which favour the sandy soils for their warrens and cause severe erosion. As a result, regeneration and recruitment, even after rain events, is extremely limited.

Often the only indication of a once extensive stand is an isolated cypress tree (Porteners 2013). Currently there are only a few patches in good condition or with a variety of understorey shrubs.

Three **threatened plant species** listed under the Biodiversity Conservation Act have been recorded in or close to Kalyarr:

- winged peppercress has been recorded in wallaby grass and speargrass open grassland on Benara property north-west of Darcoola, east of Thelangerin (Porteners 2013, p.82)
- silky Swainson-pea was recorded within the Sandhill Pine Woodland EEC in Darcoola sandhills (Porteners 2013, p.84)
- Mossgiel daisy was recorded on the northern fringe of Pimpara Creek (Whiting 2003a).

Porteners (2013) also identified another 20 threatened plant species with potential to occur in the park.

Several other plant species found in Kalyarr are considered to be regionally significant, including many-horned copperburr, pearl copperburr and tall bluebell.

Photo 14 Silky Swainson-pea in flower, 2020. Jess Murphy/DCCEEW

2.3.4 Management considerations and opportunities

The Sandhill Pine Woodland EEC vegetation at Darcoola was fenced by the former landowners in the late 1990s to exclude stock. Since it became part of the national park, in 2003, the area has been known as the Darcoola exclosure area (although it no longer functions as an exclosure because the fence is damaged; see Section 5). Management activities conducted in this area include rabbit control, fox baiting and selective removal of African boxthorn and peppercorn trees in the most heavily infested areas. Clay seed balls for the propagation of understorey species were distributed within the sandhill pine community in late 2016, but the success of this initiative is likely to have been severely affected by continuing dry conditions.

Despite management efforts, the sandhill pine community has continued to deteriorate. The understorey is degraded and many of the cypress trees are experiencing increased stress during prolonged dry conditions. A shift from below-average rainfall seasons plus renewed restoration effort may lead to improvement in the condition of the EEC vegetation.

All vegetation communities in the park experience additional stress during persistently dry conditions. They are vulnerable to increased predation by both native and non-native animals as there is limited forage available. Infestations of introduced plant species also threaten the integrity of native vegetation communities throughout the park. Ongoing feral animal and weed control and fire management are aimed at maintaining native vegetation communities throughout the park (see Sections 2.5 and 2.6).

Ita Lake's black box and river red gum stands are surveyed annually as part of the Commonwealth Government's Monitoring, Evaluation and Research Program for the Lachlan (which replaced the Long-term Intervention Monitoring program, which commenced in 2014–15). The survey records the condition of long-lived tree species (river red gum, black box and cooba), regeneration, and ground storey diversity and composition.

NPWS continues to observe and assess the presence and condition of regionally significant and threatened plant species in the park. The period after rain events usually presents a good opportunity for assessing vegetation health.

Photo 15 Sandhill Pine Woodland endangered ecological community, Darcoola sandhills, September 2019. Meredith Billington/DCCEEW

2.4 Native animals

2.4.1 Animals of significance to Nari Nari

The goanna is the animal totem of the Nari Nari People and is highly significant as ‘keeper of the land’. This means it is valued highly and never eaten. Goanna is often referred to in Dreaming stories, dancing and other cultural practices. The Nari Nari also endeavour to protect the goanna’s habitat, for example, from rabbits and feral animals.

Other animals of significance to the Nari Nari are those associated with water, namely waterbirds, fish (such as yellow belly, cod and catfish), mussels and yabbies. Threatened waterbirds such as painted snipe, blue-billed duck and magpie goose are of special significance because of their rarity. All of these animals respond positively under the right conditions following rain. When they are abundant the Country is thriving, even if only for a short time.

Pelicans and black swans have a spiritual connection for Nari Nari and are held close to everyone’s heart. They are always mentioned in stories and the whole community enthusiastically takes part in searching for nests and collecting eggs in season.

Nari Nari protect and enhance suitable water conditions for black swans to encourage their ongoing presence and breeding. Other waterbirds are also considered in water planning to make sure they have suitable foraging resources and depth of water to complete their breeding cycle.

Photo 16 Blue-billed duck, Kalyarr National Park. Warren Chad

2.4.2 Kalyarr's animals and their habitat

Kalyarr is an important refuge for native animals in a region under extensive agriculture. The variety of vegetation in the park provides habitat for an equally varied suite of fauna. Among the most abundant species are:

- woodland species – south-eastern morethia skink, little forest bat, willie wagtail, tessellated gecko, ragged snake-eyed skink
- saltbush plain species – galah, emu, shingleback lizard, white-winged fairy-wren, southern whiteface, wedge-tailed eagle, crested pigeon, brown falcon, nankeen kestrel, Australian magpie, little raven
- aquatic habitat species – grey teal, straw-necked ibis, Australian wood duck, spotted grass frog, pink-eared duck, hardhead, white-faced heron.

The fauna record for the park is strongly influenced by the availability of water and therefore seasonal conditions. NPWS carried out a fauna survey of the **Norwood** section of the park in the early stages of the Millenium Drought in 2002, before the property was acquired (NPWS 2002). Ita Lake was dry at the time, and not included in the survey. From 3 survey sites in different habitats, 97 native animal species and 6 introduced animal species were recorded. These included 75 bird species, 15 reptile species, 5 mammals and 2 amphibians.

This survey found the river red gum habitat in the Lachlan River corridor to have the highest biodiversity overall, while the black box woodland site recorded the most reptiles. The survey also noted the abundance of small woodland birds, many of which have declined throughout much of inland eastern Australia. Those found in Kalyarr include grey-crowned babbler, jacky winter, rufous whistler, restless flycatcher and brown treecreeper. Another interesting record in the survey was that of a broad-shelled river turtle, considered rare in the Western Division of New South Wales, and the first record for this species from the Lachlan.

A fauna survey of the **Thelangerin** section of the park was carried out in 2013 and identified 96 native animal species and 8 introduced species in 6 different habitats (Ecosystems Environmental Consultants 2013). These included 66 bird species, 20 mammals, 12 reptiles and 6 amphibians. The most abundant species recorded were bats, with 10 species recorded.

Photo 17 Emus on the run at Kalyarr. Kristy Lawrie/DCCEEW

Of the 6 habitat types surveyed, the river red gum site on the bank of the Lachlan River had the highest overall biodiversity. The black box site had the highest number of bats recorded. The survey was carried out in 'dry conditions', however, residual pooled water was present in the landscape, including lignum depressions, some creek lines and lagoons. These would have been filled during heavy rain events in 2012, which caused widespread flooding. Significant rainfall for this region also occurred in 2016. Since the irrigation channels were replaced by an underground pipeline in 2018–19, ground tanks no longer receive water and the only source of permanent water available to animals has been the Lachlan River.

Waterbirds are a valued component of the Lachlan Valley, making up a large proportion of the faunal biomass within the lower catchment (Barma Water Resources 2011). Waterbirds tend to have preferred locations and vegetation for shelter and nest sites. The significance of the lower Lachlan habitat is reflected in the Basin Plan and *Lachlan long-term water plan* (DPIE 2020), which includes specific objectives and targets for maintaining and enhancing waterbird values. Species that have been recorded using habitats within the lower Lachlan, and that are under international agreements, include glossy ibis, bar-tailed godwit, common greenshank, sharp-tailed sandpiper, Latham's snipe and long-toed stint.

Photo 18 Red-necked avocet, Kalyarr National Park. Warren Chad

Waterbird survey data for Kalyarr has been collected and continues to be collected from various sources. Waterbird surveys have been conducted by the department in Kalyarr every spring since 2016 with a total of 36 waterbird species recorded so far. These annual surveys typically record large numbers of breeding waterbirds following rainfall or flood events.

An opportunistic waterbird survey during the 2016 floods recorded 42 species of waterbirds, including blue-billed duck, glossy ibis, dotterels, crakes and rails in an area of particularly complex habitat where Pimpara Creek runs into Ita Lake (Dr Joanne Lenehan pers. comm.). Waterbird surveys at Kalyarr from 2018 to 2021 were under largely dry conditions, with no bird species recorded during spring surveys between 2018 to 2020 and only 3 species recorded during 2021.

There were no spring surveys in 2022 due to lack of access after high widespread natural flooding. Over the 2022–23 season, a total of 28 waterbird species were recorded. This included 4 threatened species (NSW Biodiversity and Conservation Act), and breeding was confirmed in 10 waterbird species. Since 2010, the University of NSW has conducted aerial surveys in spring as part of the specified environmental asset program (funded by the Murray–Darling Basin Authority) that covers the nearby Great Cumbung Swamp.

Expected outcomes for waterbirds

The basin-wide environmental watering strategy prepared by the Murray–Darling Basin Authority (MDBA 2014) articulates expected outcomes for 4 important components of the Murray–Darling Basin's water-dependent ecosystems: river flows and connectivity, native vegetation, native fish and waterbirds. These are based on a series of environmental objectives for water-dependent ecosystems set down in the Murray–Darling Basin Plan.

The overall expected outcomes for waterbirds are increased abundance and the maintenance of current species diversity.

From 2024 onwards, the MDBA's expected outcomes are:

- that the number and type of waterbird species present in the basin will not fall below current observations
- a significant improvement in waterbird populations in the order of 20–25% over the baseline scenario, with increases in all waterbird functional groups
- breeding events (the opportunities to breed rather than the magnitude of breeding per se) of colonial nesting waterbirds to increase by up to 50% compared to the baseline scenario
- breeding abundance (nests and broods) for all of the other functional groups to increase by 30–40% compared to the baseline scenario, especially in locations where the Basin Plan improves over-bank flows.

Achieving these outcomes would result in waterbird populations similar to those in the early 1990s, which is necessary to ensure resilience of populations across the basin (MDBA 2014).

2.4.3 Threatened animal species

The fauna records for Kalyarr include 13 **threatened species** listed under the Biodiversity Conservation Act (see Table 2).

Strategies for the protection and recovery of threatened fauna species and populations are set out in the zero extinctions – threatened species framework (DPIE 2021) and Biodiversity Conservation Program (DPE 2019). Actions for the protection of threatened species are included in conservation action plans for declared assets of intergenerational significance. Actions under the Biodiversity Conservation Program are implemented through the Saving our Species initiative. There are currently no declared Assets of Intergenerational Significance in the park however, this may change in future.

The Commonwealth prepares recovery plans for nationally listed threatened species under the Environment Protection and Biodiversity Conservation Act. These plans apply to nationally listed threatened species occurring in the park.

Table 2 Threatened animal species recorded in Kalyarr National Park

Common name	Scientific name	BC Act	EPBC Act
Birds			
Black falcon	*Falco subniger*	V	–
Blue-billed duck	*Oxyura australis*	V	–
Freckled duck	*Stictonetta naevosa*	V	–
Grey-crowned babbler	*Pomatostomus temporalis temporalis*	V	–
Little eagle	*Hieraaetus morphnoides*	V	–
Pied honeyeater	*Certhionyx variegatus*	V	–
Plains-wanderer	*Pedionomus torquatus*	E	CE
Sharp-tailed sandpiper	*Calidris acuminata*	–	V
Spotted harrier	*Circus assimilis*	V	–
White-bellied sea eagle	*Haliaeetus leucogaster*	V	–
White-fronted chat	*Epthianura albifrons*	V	–
Mammals			
Yellow-bellied sheath-tailed bat	*Saccolaimus flaviventris*	V	–
Reptiles			
Western blue-tongued lizard	*Tiliqua occipitalis*	V	–
Amphibians			
Southern bell frog	*Litoria raniformis*	E	E

E= endangered, V = vulnerable, CE = critically endangered.

BC Act = (NSW) Biodiversity Conservation Act; EPBC = (Commonwealth) Environment Biodiversity Conservation Act.

Photo 19 **Little forest bat, the smallest bat in Australia, captured on Norwood 2002. Marc Irvin/DCCEEW**

Photo 20 **Chocolate wattled bat, captured on Norwood 2002. Marc Irvin/DCCEEW**

Incidental sightings of the endangered plains-wanderer were recorded in native grassland in Kalyarr in 2009 (Thelangerin) and 2012 (Darcoola). More recently, records were obtained in the eastern part of Thelangerin in 2018 and in Thelangerin and Darcoola in 2022 using song meters.

The NSW Riverine Plain is the recognised national stronghold for plains-wanderers and recordings made over a number of years may suggest a resident population. Long-term monitoring has shown this species has undergone a significant decline and the known population currently sits at historically low levels.

Broader departmental recovery efforts include captive breeding, private land stewardship and funding for enhanced threat abatement at Oolambeyan National Park under the Saving our Species program.

Photo 21 Plains-wanderer (female). David Parker/DCCEEW

The endangered southern bell frog has been recorded in Ita Lake following wet conditions in 2021, and at 2 sites near De Ville Homestead in the 2013 survey of Thelangerin. These records are significant as the southern bell frog has been in decline in terms of both distribution and abundance since the 1970s, and notably during the more recent Millennium Drought.

Records over the last few years have been in the mid-Murray, lower Murray–Darling and Murrumbidgee River system, including at Yanga National Park and Gayini (previously known as Nimmie Caira) in the Lowbidgee, and in the Coleambally Irrigation Area south-east of Griffith.

Monitoring for southern bell frogs has occurred sporadically in Kalyarr since 2013, focusing on De Ville Homestead dams. Since spring 2021, sites on De Ville, Pimpara Creek and at Ita Lake have been incorporated into the Saving our Species and Water for the Environment Monitoring, Evaluation and Reporting program for southern bell frog and bitterns. The monitoring program covers over 21 sites in the lower Lachlan, using a combination of in situ acoustic recorders and night ground surveys (Waudby et al. 2022).

NSW and Commonwealth Environmental Water holders commissioned a metapopulation model analysis and report (Heard 2023) to assess the feasibility of establishing an environmental watering program for southern bell frog in the lower Lachlan region.

The feasibility assessment focussed on the capacity of the Great Cumbung Swamp and sites near Yanga National Park and Gayini (Nimmie Caira) to provide high quality wetlands as permanent refuges outside of the breeding season and during drought. This feasibility study also considered the long-term potential of seasonal and ephemeral wetlands on Kalyarr, such as Ita Lake, to provide breeding habitat when flooded.

2.4.4 Management considerations and opportunities

Comprehensive fauna surveys have not yet been undertaken in McFarlands and Darcoola areas of the park (see Figure 2). Some of the surveys undertaken to date elsewhere in the park were in less than optimal conditions and there are several additional threatened species which could potentially be found in the park based on the available habitat. NPWS plans to carry out further fauna surveys, targeting wetter conditions.

Additional baseline surveys and long-term monitoring continues to add to our understanding of the value of the park for waterbirds, southern bell frog, plains-wanderer and potentially other threatened animals of the lower Lachlan.

In addition to listed threatened species, Kalyarr is home to 13 woodland birds whose populations have been identified by Reid (1999) and Traill and Duncan (2000) as declining in the NSW Temperate Woodlands Region. These include emu, chestnut-rumped thornbill, southern whiteface, grey-crowned babbler, white-browed babbler and red-capped robin. These species may be listed as threatened in the future. Despite the emu's declining status in NSW Temperate Woodlands Region, Kalyarr is home to a heathy emu population.

Populations of feral animals impact native vegetation communities and damage habitat features used by native animals. They also compete for scarce water and herbage particularly in dry seasons, and pigs predate on the young of native animals.

Ongoing feral animal and weed control and fire management are aimed at maintaining native vegetation communities throughout the park, especially those used by threatened animal species (see Sections 2.5 and 2.6).

2.5 Feral animals and weeds

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

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

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

NPWS prepares pest management strategies that identify the operations and control actions undertaken by NPWS to meet the priorities from LLS regional strategic pest and weed management plans. This also includes actions and priorities in other important programs such as conservation action plans for declared Assets of Intergenerational Significance and the Biodiversity Conservation Program (see Sections 2.3 and 2.4).

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

NPWS prepares and implements operational management plans for control of feral animals and weeds in Kalyarr. These plans address things such as site-specific issues and control considerations, for example cultural site considerations for control methods and are reviewed and updated, as necessary.

Feral animal and weed species that are also key threatening processes may be managed under the Biodiversity Conservation Program where it includes key threatening processes strategies.

The Saving our Species program has developed targeted strategies for managing key threatening processes using the best available information to minimise current and future impacts of key threatening processes on priority biodiversity values, including threatened species and ecological integrity.

2.5.1 Weeds

At the time the former sheep properties were acquired, several weeds of concern were present: African boxthorn, Bathurst burr, horehound, peppercorn trees and willows (see Table 3). African boxthorn and willow are identified as priority species in the *Riverina regional strategic weed management plan* (Riverina LLS 2017).

African boxthorn

African boxthorn is the highest priority weed for Kalyarr due to its impact on habitat for the endangered plains-wanderer and declining woodland birds, as well as the economic impact of the spread of boxthorn to neighbouring land. NPWS carried out intense weed management in 2005 soon after acquiring Darcoola, targeting African boxthorn in the Darcoola sandhills, which was having a serious impact on the Sandhill Pine Woodland EEC, and other locations.

Peppercorn trees were also treated selectively to minimise impact and allow areas of native vegetation to regenerate. Since then, follow-up work was carried out by the Green Army in both Darcoola and Norwood in 2015 and 2016.

Ongoing management of African boxthorn is targeting areas of habitat for known threatened species, including native grassland in Thelangerin, river red gum riparian woodland along the Lachlan River corridor, Sandhill Pine Woodland in Darcoola, black box woodland along waterways (Pimpara Creek, Ita Lake), reedbeds and adjacent woodland near De Ville Homestead.

The travelling stock reserve (TSR) running east to west through Norwood and Thelangerin also contains a significant number of African boxthorns (and possibly other weeds of concern) which can spread to the national park.

Other weeds

In addition to the weeds listed in Table 3, seasonal weeds can show significant increases after high rainfall and become established in the understorey of riparian and floodplain woodland communities or in disturbed areas along roadsides, old yards and along cleared fence lines. Kalyarr also has some scalded areas and sites of wind-sheeting, which could be vulnerable to introduced species. In general, the intact native vegetation on the plains and limited flooding in Kalyarr have contributed to a low level of weediness. The absence of stock moving through the TSR and dry conditions over the last few years have also limited the spread of weeds. Weeds of concern continue to be targeted in specific locations in accordance with the priorities in the relevant NPWS pest management strategy and LLS regional strategic pest management plans.

Table 3 Weeds of concern in Kalyarr National Park

Common name	Status	Occurrence
African boxthorn	WONS LLS priority species	Occurs throughout the park, in higher densities in woodland, and very little in the open chenopod plains. Darcoola: • former infestations in Darcoola sandhills, impacting on the Sandhill Pine Woodland EEC • frequently found under black box along Darcoola Creek • also occurred as scattered bushes throughout Darcoola in seasonally damp areas, in lighter soils near relict streams, often under peppercorn trees. Norwood: • frequently found under black box stands • densest infestation in woodlands on sandier soils adjacent to Ita Lake, including Red Hill on north-east side of the lake. Thelangerin: • dispersed locations.
Bathurst burr	General biosecurity duty under the Biosecurity Act	Dispersed commonly in the fleece of sheep, therefore infestations common in areas where sheep previously congregated e.g. dams, paddock gates, along trails and sheepyards.
Horehound	General biosecurity duty under the Biosecurity Act	Commonly occurs along fence lines, roadsides, channel banks, around buildings, areas frequented by sheep and neglected areas. Thrives on poor soil and invades disturbed areas where there is little competition.
Peppercorn trees	Environmental weed in NSW, Victoria, South Australia and Northern Territory	Native to South America, formerly commonly planted by graziers to provide shade for homesteads, sheepyards and elsewhere on sheep properties. Peppercorn trees are posing a challenge within the Sandhill Pine Woodland EEC by absorbing water that could otherwise support the growth of native pine trees.
Willow	WONS LLS priority species	In-channel reaches of the Lachlan at De Ville Homestead and in northern parts of Thelangerin.

WONS = Weed of National Significance; LLS = Local Land Services.

Source: Whiting 2003a, 2003a; Porteners 2013.

2.5.2 Feral animals

In the semi-arid landscape of western New South Wales, availability of water is a key limiting factor for feral animals. Permanent water and denser vegetation in the Lachlan River corridor in an otherwise dry landscape concentrates feral animal activity in these areas.

The former sheep properties that now make up Kalyarr National Park previously received irrigation (and stock and domestic) water via a system of open earth channels and dams which provided a ready source of permanent water for animals.

The open channels and dams were replaced with an underground pipeline in 2018 through the Darcoola East Water Efficiency Project (see Section 6) and the channels received their last flow in January 2019. Prior to this, flows were delivered twice a year over a period of about 6 weeks depending on conditions, to fill 7 dams on Darcoola.

The dams have been left to dry out since the last flow. Elsewhere in the park (i.e. Thelangerin and Norwood/Mullawa) there are at least 3 remaining naturally filling dams which were constructed by previous owners.

It is difficult to determine to what extent the removal of the open channel system has reduced feral animal populations. Continuing dry conditions and broadscale drought may have had a greater influence and caused feral animal populations to retract to water sources well beyond the park boundaries. Feral animal populations also fluctuate in response to the level of control applied by landowners collectively.

The main feral animals that occur in the park are listed in Table 4. Each of these species are listed as key threatening processes under the Biodiversity Conservation Act and are considered ‘landscape pests’ because they occur widely across riverine and floodplain environments. All of these species are listed as a regional priority for control (Riverina LLS 2018a) and are subject to ongoing control activities. All except for deer are listed as a key threatening process nationally under the Environment Protection and Biodiversity Conservation Act (see Cth DCCEEW n.d, b).

Table 4 Feral animals recorded in Kalyarr National Park

Common name	KTP * (NSW/national)	Distribution and scale
Red fox	NSW SC (1998) / Cth DCCEEW (n.d. b)	Occur across the landscape posing a major threat to small mammals, ground-dwelling birds such as the threatened plains-wanderer, also woodland birds, waterbirds, turtles and frogs.
Feral pig	NSW SC (2004c) / Cth DCCEEW (n.d. b)	Population fluctuates seasonally. Norwood and De Ville traditionally have higher numbers, also occurring around Darcoola. Preference for more mesic vegetation in the river corridor threatening the nationally important Lachlan Swamp wetlands, but they are also attracted to standing water throughout the park when available. Presence of pigs attracts illegal pig hunting and creates nuisance for neighbouring landowners.
Rabbit	NSW SC (2002) / Cth DCCEEW (n.d. b)	A recurring problem in the Darcoola sandhills, due to sandy soils favoured for warrens, impacting on groundcover and the regeneration of native species in the Sandhill Pine Woodland EEC. Also present in homestead precincts which receive regular watering.
Feral goat	NSW SC (2004a) / Cth DCCEEW (n.d. b)	A population persists in Norwood and McFarlands but size varies in response to management effort.

Common name	KTP * (NSW/national)	Distribution and scale
Feral cat	NSW SC (2000a)	Occur across the landscape and observed around woolsheds and other old buildings in the park. Presents a threat to all native wildlife, especially small mammals, threatened plains-wanderers and other birds
Fallow deer Rusa deer	NSW SC (2004b)	An emerging threat in Kalyarr, most commonly in the Lachlan River corridor, travelling from both west and east. Numbers not known.

* KTP = This column provides citations to the relevant key threatening process under the NSW Biodiversity Conservation Act (NSW Scientific Committee), or the Commonwealth Environment Protection Biodiversity Conservation Act list of key threatening processes (Cth DCCEEW).

Red fox

Foxes suppress native animal populations, particularly medium-sized ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Foxes have also been implicated in the spread of a number of weed species and are known to prey on domestic stock, including lambs and poultry (OEH 2012a).

Foxes are highly mobile and can rapidly repopulate treated areas. Foxes are a declared pest throughout New South Wales under the *Local Land Services Act 2013*.

Fox baiting is systematically carried out twice-yearly in Kalyarr to reduce fox numbers. Riverina LLS coordinates fox baiting by local farmers, including those on neighbouring properties, which is aimed at coinciding with lambing times and fox breeding cycles.

Feral pigs

Feral pigs have long occupied the wetland forests and woodlands of inland rivers in western New South Wales and are a priority pest species in the Riverina LLS region due to the extensive economic, environmental and social damage they cause.

The impact of feral pigs on conservation values is substantial, especially in wetlands. Their foraging, wallowing and digging habits cause considerable damage to soils, roots, ground plants, waterbird nesting habitat, culturally important plants and Aboriginal heritage. Areas disturbed by feral pigs are at risk from subsequent weed invasion and soil erosion.

Pigs are also a potential host of diseases transmittable to animals and humans, such as leptospirosis and brucellosis. The presence of pig populations also attracts illegal hunting activity in Kalyarr.

The Feral Pig Program is currently being implemented over an area of 750,000 ha in the Riverina, Murray and Western LLS regions. This program is a coordinated cross-tenure pig research and control program undertaken in areas known to have significant pig populations.

NPWS continues to work with LLS and neighbours in Kalyarr (and other parks) to achieve project outcomes. Aerial control programs are estimated to have resulted in up to 70% of the feral pig population being culled and complement other control measures such as ground baiting and trapping (Riverina LLS 2018b).

Pigs are controlled in Kalyarr by baiting, trapping and shooting. Dry conditions have helped to reduce pig numbers.

Rabbits

Rabbits can have both a severe short-term and long-term impact on vegetation by grazing on seedlings of regenerating trees, shrubs and ground layer vegetation.

In dry periods, rabbits may ringbark established plants. In semi-arid habitats they cause the decline and limited regeneration of many native plant species, including cypress pine, wattles, hakeas and belah/rosewood communities. Rabbits are a major food source of large predators, notably foxes and raptors, although predation by these animals alone does not significantly reduce rabbit numbers or distribution.

Rabbit activity can disturb and damage Aboriginal burials and other cultural heritage sites and has the potential to cause structural damage to historic heritage buildings (such as burrows undermining foundations).

After acquisition, rabbit warrens in Kalyarr were mapped and controls implemented. Control is ongoing using a variety of methods, including warren ripping, fumigating and baiting, depending on the landscape context.

Feral goats

Feral goats are a significant problem in the semi-arid regions of central and western New South Wales, particularly as they can tolerate extended dry conditions and are unimpeded by standard stock fencing.

The foraging habits of goats are extremely destructive, they can breed rapidly and are able to cover many kilometres in a day. Feral goats have considerable impacts on conservation values: they graze native plants including suppressing natural recruitment and regeneration of floodplain vegetation, compete with native animals for shelter, spread weeds, trample vegetation, and damage Aboriginal heritage sites. The sustained use of an area by goats results in erosion.

The feral goat is identified as one of the 100 worst invasive species in the Global Invasive Species Database (IUCN 2017).

The number of goats on Kalyarr is observed to be small. A combination of aerial and ground operations are used to control feral goats.

Feral cats

Together with foxes, feral cats are known to have caused the decline of many native species, including the extinction of mammals, and continue to pose a serious threat to Australian wildlife (Short et al. 1992 and Priddel and Wheeler 2002, both cited in Moseby and Hill 2011). Cats are notoriously good hunters and can endure the harsh conditions of the semi-arid and arid zones where other feral predators fail.

The way cats move through the landscape is also less predictable than for foxes which tend to use trails and roads. Predation by feral cats has been listed as a key threatening process under both the Biodiversity Conservation Act and the Environment Protection and Biodiversity Conservation Act (NSW SC 2000a and Cth DCCEEW n.d. c, respectively).

Although 1080 poisoning may reduce cat numbers, cats are not on the list of approved species for control by 1080 poisoning and special permission is required from Local Land Services for such programs. Shooting at night with spotlights has been used in the past, however, this method is not considered cost-effective for the scale of the problem and therefore better methods are needed.

Large-scale control methods for feral cats are not yet available. Preliminary work is being undertaken to develop new types of cat bait such as Curiosity® (Cth DCCEEW n.d. c) and specially designed cat-baiting stations. Subject to further research and approvals, effective controls may be suitable for use in the park in the medium to long-term.

Feral deer

Five species of deer have established feral populations in New South Wales. Those occurring on an occasional basis in Kalyarr include rusa and fallow deer.

Deer have a range of major negative impacts on NPWS parks and reserves, including fouling of waterholes, destruction of habitat through grazing and ringbarking, spreading weeds, causing erosion in sensitive areas and increasing the risk of vehicle accidents on roads and trails.

As an emerging threat in Kalyarr, deer are monitored and control programs developed as needed.

2.5.3 Management considerations and opportunities

The Biosecurity Act and its regulations provide specific legal requirements for the response, management and control of biosecurity risks, including feral animals and weeds. These requirements apply equally to public lands and private lands. 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 Riverina Region (Riverina LLS 2017, 2018a). These plans identify priority feral animals and weeds in each of the regions, plus the appropriate management response for the region (that is, prevention/alert, eradication, containment or asset protection).

The NPWS branch pest management strategies identify feral animals, weeds and priority control programs for Kalyarr National Park. The overriding objective of the pest management strategy is to minimise adverse impacts of feral animals and weeds on biodiversity and other park and community values while complying with legislative responsibilities. The strategy also identifies where other site-specific or species-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.

2.6 Fire

The primary objectives of NPWS fire management are to protect life, property, community assets and cultural heritage from the adverse impacts of fire, while also managing fire regimes in parks to maintain and enhance biodiversity. NPWS also assists in developing fire management practices that contribute to conserving biodiversity and cultural heritage across the landscape and implements cooperative and coordinated fire management arrangements with other fire authorities, neighbours and the community (OEH 2013).

Fire is a natural feature of many environments and is essential for the survival of some plant communities. However, inappropriate fire regimes can lead to loss of particular plant and animal species and communities, and high frequency fires have been listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000b).

The fire history in the park may be incomplete as there is no verbal record or documentation of large-scale fires occurring across Kalyarr. Since the park was purchased, the only fires recorded were a small 24-ha grassfire in Thelangerin in February 2013, and a fire which burnt 45 ha north of the river (off-park) in March 2016.

Dry lightning storms occur frequently in this region and typical fire conditions include winds from the west to the north, high day time temperatures and low humidity. The native vegetation communities found in Kalyarr will generally not carry fire but when high ephemeral fuel loads develop following flooding events and grasses have cured, landscape-scale fires are possible.

The fire management strategy for Kalyarr National Park (OEH 2012b) identifies key assets within and adjoining the park including sites of natural and cultural heritage value, fire management zones and fire control advantages such as management trails and water supply points. The strategy applies a broadscale land management zone across the entire park and in this zone the objective is to conserve biodiversity and protect cultural and historic heritage. Asset protection zones are identified around built assets including the homestead complexes.

The strategy also establishes fire regime guidelines for conservation of the park's vegetation communities based on the following biodiversity thresholds:

- river red gum forests – allow an interval between fire of not less than 10 years, as river red gums will only tolerate low intensity fire
- lignum wetland and swamp cane grass grassland – allow an interval of not less than 10 years and not greater than 35 years
- black box woodland with chenopod understorey and sandhill pine woodland – allow an interval of not less than 9 years; there is no maximum as there is insufficient data available; fire should be avoided where chenopod species occur
- bladder saltbush, blue blackbush and copperburr shrublands – fire should be avoided
- grasslands – allow an interval of not less than 3 years and not greater than 10 years.

The vegetation in the park has been evaluated and the majority of the park, namely the chenopod shrublands, are considered to be within the recommended threshold. All threshold recommendations are based on available science and are subject to reconsideration based on new information.

The NPWS *Cultural fire management policy* defines cultural fire management as the involvement of Aboriginal people in fire management. This covers both culturally informed burning and community (low risk) involvement in cultural burning activities. Cultural burning provides opportunities for sharing knowledge with a diverse range of individuals, including the younger generation and NPWS staff.

Mawambul would like to pursue cultural burning on Kalyarr in accordance with the NPWS policy as a means of supporting active management of the park's vegetation and as a cultural activity for Nari Nari. The Nari Nari Tribal Council recently published a *Cultural burning guide* (Nari Nari Tribal Council 2021), which explains the Nari Nari's approach to cultural burning of lands they hold title to on the Hay Plains. This is a '2 ways' approach to using fire as a land management tool which combines traditional cultural knowledge and scientific knowledge. These principles and experiences are also relevant to Kalyarr. For example, burns can be applied to reduce fuel hazards, promote patchiness to provide refuge for wildlife in unburned patches, gain better access to Country, clean up important cultural pathways, control invasive weeds and maintain cultural responsibilities. In this landscape it is important to ensure that burns are slow and cool, to avoid impact on rare canopy trees and built assets, while stimulating native revegetation and habitat in lignum and box woodlands. NPWS and Mawambul plan to integrate cultural burning with the fire management strategy for the park.

NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service and is actively involved with the Mid Lachlan Valley Bush Fire Management Committee. Cooperative arrangements include fire planning, fuel management and information sharing. Hazard reduction programs, ecological burning proposals and fire trail works are reported to the bush fire management committee.

A solid fuel fire ban is implemented in Kalyarr (usually between 1 October and 31 March) depending on seasonal fire conditions.

2.7 Climate change

Human-induced climate change is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000c) and habitat loss caused by human-induced greenhouse gas emissions is listed under the Environment Protection and Biodiversity Conservation Act (TSSC 2001a). NPWS's approach to managing climate change in Kalyarr National Park is outlined in this section.

The region is presently characterised by winter-dominated rainfall and low rainfall in summer. The *NSW Climate impact profile* (DECCW 2010) prepared for the Riverina Murray Region predicts that by 2050, the region's climate will be hotter and the impact of the El Niño – Southern Oscillation is likely to become more severe. Total annual rainfall will be reduced and a shift to summer-dominated rainfall is likely. Droughts are likely to become more severe and flooding behaviour is likely to change. Predicted physical responses from climate change include an increase in evaporation, drier soil conditions and poorer conditions for plant growth. These changes could result in reduced fuel availability and a decrease in the frequency of wildfire however, they could be countered by an increase in the number of very high to extreme fire danger days per year.

The average annual Forest Fire Danger Index under the present climate has been calculated as 9.4 which indicates low to moderate fire weather, but this is predicted to increase under climate change (AdaptNSW 2023). It is also acknowledged that fire frequency in the region is already highly variable (DECCW 2010).

A more likely impact of soil drying and reduced vegetation cover will be the increased vulnerability of many soils to sheet, rill and gully erosion. This could be exacerbated by increased summer rain with more intense storms. Wind erosion is also likely to increase. This could mean that Aboriginal mounds and burial sites in the Ita Lake lunette become more vulnerable to exposure and erosion. A hotter, drier climate would also have an impact on the old timbers of historic heritage buildings and see a greater loss of modified (scarred) trees.

Climate change modelling

Climate change modelling has been produced for 12 defined regions in south-east Australia. The following is a snapshot of the predicted changes to climate for the Murray Murrumbidgee Region, which covers Kalyarr National Park on its western edge (AdaptNSW 2023):

- Maximum temperatures are projected to increase in the near future by 0.4–1.0°C
- Minimum temperatures are projected to increase in the near future by 0.4–0.8°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 far future by 1.3–2.4°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 increase in summer and autumn
- Average fire weather is projected to increase in spring and summer by 2070
- Severe fire weather days are projected to increase in summer and spring by 2070

Near future = 2020 to 2039; far future = 2060 to 2079.

The combined effect of higher temperatures, changes in the volume and seasonal occurrence of rainfall, and decreases in river flows will have impacts on all natural systems in the region but especially the riverine, floodplain and wetland ecosystems of the lower Lachlan which are already under stress from the combined effects of water regulation, drought, land clearing and cumulative vegetation loss. Increased aridity will result in a decline in nutrient cycling and overall ecosystem productivity and therefore entire food webs are likely to be affected.

Commonwealth and state government effort is being applied to restoring environmental flows to the Lachlan River and its tributaries through the legislation of water sharing rules, buyback programs, use of water infrastructure for manipulating flows, and other initiatives. These measures are being developed and applied throughout the Murray–Darling Basin under an adaptive management approach to sustainable water use and will contribute to building resilience for facing climate change at a basin-wide level. The high commence-to-flow level for Ita Lake means that not all environmental flows made available to the lower Lachlan reach the lake. Those that do reach the lake contribute to improving the resilience of waterbirds and other environmental values in the region by enhancing bird habitat in the lake. River red gum communities in the park also benefit from environmental flows.

The potential impacts of climate change are difficult to assess given the compounding effects of other pressures, particularly habitat loss and fragmentation. Climate change may significantly affect biodiversity by changing the size of populations and the distribution of species, modifying species composition, and altering the geographical extent of habitats and ecosystems. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates. The lower Lachlan Wetlands and river channel could provide refuge habitat during drought, for example, for southern bell frogs as the Lowbidgee wetlands do.

Replacement of the open channel irrigation system in 2018 with an underground pipeline may have helped reduce permanent populations of feral animals in Kalyarr. NPWS will continue managing Kalyarr to reduce the pressures arising from invasive species and other threats in an effort to help lessen the severity of the effects of climate change. NPWS will also continue to work with environmental water managers, neighbouring landowners and other stakeholders to ensure the benefits of environmental watering help to build the resilience of the park.

Photo 22 Former water delivery channel in Darcoola. Meredith Billington/DCCEEW

3. Looking after historic heritage

Many places today have particular significance to Aboriginal people. Other places are significant to Aboriginal and non-Aboriginal people, and the history of these places may be shared. The shared history of the first Australians – Aboriginal people – and others since European settlement, is represented through our historic heritage.

Heritage places and landscapes are made up of living stories as well as connections to the past that individuals and communities have inherited and wish to conserve for current and future generations, and can include natural resources, objects, customs and traditions.

Cultural heritage comprises places and items that may have historical, scientific, cultural, social, archaeological, natural or aesthetic significance. NPWS conserves the significant heritage features of the parks and reserves that it manages.

Kalyarr is part of a broad cultural landscape, having been shaped by thousands of years of human occupation. It has links with both a rich Aboriginal history and with the first European pioneers of western New South Wales in the early 19th century.

The first European explorer to pass through this area was John Oxley who traced the course of the Lachlan River in 1817. In 1829 Charles Sturt passed along the Murrumbidgee River on horses and drays before launching a whale boat near the confluence of the Murrumbidgee and Lachlan rivers and continuing by boat to the Murray River. These expeditions led to the displacement of Aboriginal people and settlement of the country by Europeans, firstly along the inland rivers and then the ‘back blocks’.

The shared history of Kalyarr is essentially that of the wool industry which established on the Hay Plains from the late 1830s onwards. Pastoral runs were well-established in the western Riverina by the mid-1850s and the Hay Plains produced some of the best merino wool in Australia. The industry was an important employer of Aboriginal people and sustained many of their families through very difficult times after settlement.

Kalyarr National Park conserves a significant number of historic heritage buildings in the homestead and woolshed complexes of its former pastoral properties including Norwood, Darcoola, Corrong (now part of De Ville in the north of the park) and Thelangerin (see Figure 2). These stations are typical of the resourceful, self-sustaining pastoral life of graziers in western New South Wales during the late 19th and 20th centuries. Although not remote by today’s standards, in those times the farmers and their families pioneered their own ways of eking out a living on the land, learning how to cope with little water and developing their own technologies as new challenges came along.

Throughout the park there are reminders of this earlier way of life in the form of tank stands and windmills, slaughter blocks and gauze-covered meat houses, and various models of early farm machinery.

The collection of buildings on each of the former properties shows the sequence of the development of the stations, usually the work of the station owners themselves, learning as they went. There is also a large quantity of moveable heritage associated with each of the 5 woolsheds, including shears, presses, grading tables, wool bale brands.

Heritage assessments and heritage action statements have been prepared for key heritage buildings and structures in the park to inform NPWS management (McDougall and Vines 2007, 2013). The homesteads and woolshed complexes on Kalyarr have been assessed as generally being of local heritage significance.

3.1 Darcoola

The first owners of Darcoola were the McFarlanes who sold the property to Robert Weir in 1886. The property then remained in the Weir family for over 115 years until being purchased by the Commonwealth and NSW governments in 2003.

The present **Darcoola Homestead** was built from 1926 to 1928. It is the second homestead to be built on the property after the first was destroyed by fire. The late Brenda Weir was a passionate gardener and established a productive garden around the homestead. Her rose garden became famous in the Hay district for its more than 200 varieties of roses, including 19th century tea roses and other heritage varieties. This was no mean feat considering the distance from permanent water and the effort required to maintain a garden in dry conditions. Regrettably, the rose garden has now disappeared.

The first shearing shed was also destroyed by fire and the current **Darcoola Woolshed** was constructed in 1928. It was previously assessed as having regional heritage significance (a grading that is no longer in use) and possible state significance due to its early date of construction. It is constructed of a steel frame and corrugated iron cladding, with black box hardwood stumps, and timber flooring. The use of steel shows a high degree of creative and technical achievement at a time when most shearing sheds were constructed of timber (McDougall and Vines 2007).

The woolshed is approximately 1.2 km from the homestead, continuing the tradition of separating shearers from station owners. Around the shearing shed there are holding yards, a sheep dip, rainwater tanks and a generator shed. The shearers quarters are in a separate complex some 50 m further east and include a separate cook house, ablutions block and meat house.

Photo 23 Darcoola Homestead. Meredith Billington/DCCEEW

3.2 Norwood

Norwood and several neighbouring properties, Ita, Mullawa and De Ville, were excised from Thelangerin Station after the First World War as part of the Australian Government's soldier settlement scheme. This was enacted in New South Wales through the *Returned Soldiers Settlement Act 1916* and allowed soldiers who had served outside of Australia, either as a part of the Australian Imperial Forces or as a part of the British Defence Service, to apply for Crown lands. The soldier settlement scheme had varying success as not all returned soldiers were able to meet the challenges of isolated farming enterprises.

Ross Timms, a returned soldier, had drawn Norwood soon after returning from the war. In 1939 he sold the station to Archer ('Archie') and Ruth Smith for £4,000. After the Second World War the Smiths also acquired the adjoining property Ita and added it to Norwood. Archie served in the Second World War as an airman and after returning began flying a biplane for which he constructed an aircraft hangar at Norwood in 1957.

The rendered brick **Norwood homestead** was built on its current site in 1956 after the original timber homestead (date unknown) located north of the current homestead was flooded out. Norwood homestead is an excellent example of 1950s homestead vernacular (McDougall and Vines 2007). **Norwood Cottage** was added in the 1960s and later relocated to the river edge in about 1970.

Ita Cottage (also referred to as Ita Hut) is an isolated cottage off the main homestead track in an open clearing near Pimpara Creek. It was built by the original owner of Ita Station, Herb Farlow, and dates from about 1920. It is clad and roofed in corrugated iron and assessed as having local heritage significance. To the east of the hut, there is evidence of former holding yards and divided paddocks.

Photo 24 Ita Cottage in 2003 (prior to replacement of the galvanised roof in 2014). Bill Moller

Norwood Woolshed and shearing quarters date from 1939 onwards. This complex has been assessed as being of local heritage significance (McDougall and Vine 2007). The shearing shed is a good example of rustic home-crafted construction, built in stages, using local tree trunks and limbs, timber flooring and roof structure.

Only the third section of the shed was prefabricated and brought to the site. Interestingly, the comment was made that it was 'one of the most uncomfortable shearing sheds to work in',

presumably due to its low height, and piecemeal additions which made for inefficient handling of sheep and general operation (McDougall and Vine 2007).

Norwood was purchased by the NSW Government in 2003 (shortly after Darcoola). At the time of acquisition, the property was mainly used for grazing and 274 ha was cultivated for irrigated rice, oats and barley. The system of open irrigation channels and dams utilising water from the nearby Lachlan River was most likely constructed during the late 1950s and 1960s.

3.3 Thelangerin and De Ville

In this report we refer to Thelangerin as the portion of the park which encompasses the original Thelangerin, Corrong and De Ville stations (see Figure 2).

Thelangerin was part of a run taken up by Andrew McFarland in 1872 and was managed by generations of the McFarland family over the next 140 years. Derek McFarland took over management of the property in 1980 before selling it to the NSW Government in 2011–12. The original Thelangerin Homestead built in c. 1875 by Andrew McFarland is on the northern bank of the Lachlan River (outside of the park) and is now the home of Derek McFarland.

The section of park on the north side of the Lachlan River was formerly part of Corrong Station and was added to Thelangerin in 2005, together with **De Ville** which was on the opposite side of the river. The **Corrong Woolshed** complex is located in the park approximately 15 km east of the Corrong Homestead (which is outside the park).

Shearers quarters for accommodating up to 20 people are close by. The woolshed is large by local standards with 14 stands (compared to 4 stands at Norwood and Darcoola woolsheds for example), a reflection of the size of Corrong Station. The shed was built between 1900 and 1920 with a timber frame, red gum stumps and posts, Oregon structural timbers and corrugated iron cladding.

Until recently the Corrong Woolshed demonstrated a high degree of integrity and was arguably the most striking example of woolsheds on Kalyarr. Major maintenance works have been undertaken to stabilise the building, but severe windstorms caused significant damage to external sheeting. The interior remains in good condition.

Like Norwood, De Ville was originally excised from Thelangerin as a soldier settlement block. A house was built there in the 1920s but has since been demolished and was replaced by a modern brick house in 1993 (**De Ville Homestead**). The bridge built over the Lachlan River to the north of the house is an interesting feature because it provided access for sheep and vehicles to part of the former Corrong Station when this land was added to De Ville. The bridge was constructed most probably in 1976 using the base of 3 railway carriages which were welded together.

Thelangerin Woolshed, shearers quarters and associated buildings were relocated from a site closer to the Thelangerin Homestead in 1952 and are now about 15 km south-west of the homestead. The shearing shed complex — with the cook's quarters, kitchen, mess, ablutions and other buildings — has a high degree of integrity and provides an excellent example of the pastoral industry of its day.

It is also an important resource for understanding the history and development of the area and the evolution of the Riverina landscape. The original fittings are retained and include the overhead shearing gear, wool press, classing tables, wool bins. The shearing shed and ancillary structures have been assessed as having local heritage significance (McDougall and Vines 2013).

3.4 Management considerations and opportunities

Heritage assessments and heritage action statements have been prepared for key heritage buildings and structures in the park to inform NPWS management (McDougall and Vines 2007, 2013). Heritage action statements were prepared in 2007 and 2013 but the condition of the buildings may have changed since that time.

The homesteads and woolshed complexes on Kalyarr have been assessed as having local heritage significance except for the Darcoola shearing shed which was previously assessed as having regional significance, and possible state significance, due to its early date of construction (McDougall and Vines 2007).

It should be noted that regional significance is no longer used as a term under the Heritage Act or *Environmental Planning and Assessment Act 1979*. Items of regional significance are now designated as being of local significance unless they are assessed as being either state significant or not significant at all.

The condition of the built heritage buildings in Kalyarr National Park varies considerably as described in the heritage assessments. NPWS's responsibilities include protecting historic heritage items on its estate. As such, since reservation of the park stabilisation works have been completed for several buildings based on recommendations in the heritage action statements. These included:

- Darcoola Homestead (1926–1928) – restumping, termite damage, roof insulation, repair of dry rot
- Norwood Homestead (1956) – repair/replacement of guttering, sealing of windows and replacement of gauze
- Ita Hut (c.1920) – roof and verandah repairs
- Corrong Woolshed (1900–1920) – internal trusses and roofing repairs.

The impact of ageing and other natural processes means that some structures have deteriorated from their original state and may require further assessment to determine their future management.

These structures and their contribution to the park's historic heritage may not only inform their future management options, but further inform the work as part of the NPWS *Key heritage stories* (NPWS 2016)).

Dependent on future assessment outcomes, these structures may be managed in a number of ways which may include active or inactive management and monitoring, while being recognised for their contribution to the park's historic heritage through appropriate interpretation.

Kalyarr is only one of several national parks in western New South Wales which were created from former sheep stations and came with a legacy of multiple shearing shed complexes. The wealth of historic heritage contained in these parks represents a considerable maintenance liability.

A heritage assessment incorporating findings from NPWS's key heritage stories work and advice from the NPWS Historic Heritage Team based on prioritisation work and the asset stewardship strategy is needed to determine how the shearing shed complexes should be maintained in accordance with the Heritage Act to make best uses of NPWS resources and provide interpretation and satisfactory visitor experiences.

Photo 25 **Thelangerin Woolshed with shearers' quarters in the background. McDougall and Vines Heritage Consultants**

4. Providing for visitor use and enjoyment

Long-term residents and visitors to the Hay Plains of western New South Wales appreciate the sense of space and history inherent in the open landscape. Kalyarr typifies this open landscape and is most suited to providing low-key recreational activities for independent visitors such as camping, birdwatching and self-driving opportunities to interpret nature, culture and heritage.

Mawambul is keen to see visitors enjoying what Kalyarr has to offer. However, the park contains a wealth of sensitive Aboriginal features and values. For this reason, public vehicles must stay on park roads and within designated visitor areas to minimise adverse impacts on cultural values.

Progressive establishment of Kalyarr over the last few years has seen the collection of more information about park values, particularly Aboriginal cultural heritage, and experience in managing those values. An interim visitation plan was developed shortly after acquisition of Darcoola and Norwood. However, since then NPWS has developed a better appreciation of the operating environment, including the remoteness and climatic constraints of the park (particularly during prolonged dry conditions) and the cultural significance of the park. As a result, some previous suggestions for visitor facilities around Ita Lake, for example, are no longer considered feasible due to the concentration of Aboriginal cultural heritage sites.

To date the main **visitor facility** that has been developed in the park is the Ita Lake Cultural Centre consisting of toilets, a women's shelter, a men's shelter and a community shelter equipped with gas barbecues. This facility is available for public use as well as for culture camps and other gatherings by the Aboriginal community. Ita Lake provides birdwatching opportunities when flooded. As migratory and other rare waterbirds may take advantage of these conditions for foraging and breeding, kayaking is not allowed by the public on the lake.

Photo 26 **Night sky at Kalyarr showing the emu visible in the autumn sky, which is mentioned in many Aboriginal Dreaming stories. Mal Carnegie/Lake Cowal Foundation**

Basic camping facilities are provided off-park at the **Lachlan River campground** on the banks of the Lachlan River about 3 km east of Norwood Homestead. The campground is within the adjacent travelling stock reserve (TSR) that is managed by NPWS under licence. Facilities include a picnic shelter, toilet, fireplaces and unmarked campsites. There are no designated camping areas in the park and camping is not allowed elsewhere in the park. There are no immediate plans to establish a camping area in the park, however, if there is sufficient demand NPWS may consider establishing a camping area in the park subject to the outcome of cultural and environmental assessments.

At the time the campground was established, NPWS consulted with the Department of Lands and it indicated support for possible transfer of some of the TSR land to NPWS (DECC 2009). Further consultation will be needed with Crown Lands as part of broader considerations for the TSR (see Section 6).

In the vast, seemingly empty landscape of the Hay Plains, maps and signage (and where possible brochures) are important for providing assurance and information to visitors. The Mawambul Co Management Group oversaw a project for **interpretative signage** for the park. A series of interpretative signs were produced for park entrances and at Ita Lake incorporating the following themes:

- 'Welcome to Country'
- the history of Kalyarr
- the role of Nari Nari women in traditional life
- the role of Nari Nari men in traditional life.

Mawambul have recommended that information should also be provided about pre-European history as many of the visitors who venture into Kalyarr are interested in knowing what the country looked like before sheep farmers arrived. Additional directional and regulatory signage is an ongoing consideration for the park to identify access roads and convey relevant management and safety information about the park.

Photo 27 Picnic tables and barbecues at Norwood campground. Meredith Billington/DCCEEW

4.1 Management considerations and opportunities

Kalyarr's tourism potential is yet to be fully assessed. Being within a comfortable driving distance of Hay, and surrounded by working pastoral properties, the park is best suited to **low-key visitor experiences**. While self-guided driving routes offer more flexibility in a somewhat remote and challenging location, guided visitor experiences may also be considered so as to provide for visitor safety and security of heritage assets.

The National Parks and Wildlife Act and Heritage Act provide for adaptive reuse of existing buildings and structures in parks, including historic heritage. Adaptive reuse under the National Parks and Wildlife Act is permitted provided any proposed modification and use is carried out in a sustainable manner, is consistent with the conservation of the natural and cultural values of the land, and is compatible with the retention of the heritage significance of the buildings and structures. In Kalyarr, Norwood, De Ville and Darcoola homesteads are used for staff, Mawambul and researcher accommodation. There may also be scope for some component buildings of the shearing shed complexes to be relocated and repurposed.

Mawambul Co-Nanagement Group has expressed interest in using Norwood Cottage for gatherings and overnight accommodation.

Some preliminary consideration has been given to providing commercial hard-roofed accommodation for visitors in some of the buildings. The constraints of a relatively remote location, the age of the infrastructure and the cost of bringing them to a standard for commercial use are significant factors in this regard. NPWS is also mindful that other parks in western New South Wales have established visitor accommodation facilities while the presentation and promotion of Kalyarr National Park is only at an early stage. For these reasons, NPWS has no immediate plans to provide hard-roofed commercial visitor accommodation on Kalyarr.

An approach to visitation is needed that balances promotion of the park's natural, cultural and historic heritage values, with the limited resources available to develop and maintain new facilities, particularly in remote locations. Development of visitor experiences may also be enhanced through partnerships with regional tourism organisations including Hay Visitor Information Centre, Hay Shire Council, Shear Outback, Mawambul Co Management Group and others.

Due to its location and significant natural and cultural values, Kalyarr attracts researchers and naturalists, particularly when major rainfall events trigger bird breeding in ephemeral wetland habitats.

The park also has potential for community education through demonstrating the significant biodiversity values of the lower Lachlan environment. For example, post-flooding tours or community field days guided by researchers could provide a valuable opportunity to observe waterbird breeding events in the semi-arid Riverine Plain.

In future, commercial tour operators may bring visitors to the park through the NPWS EcoPass program or through other licence arrangements. It is important that these operators comply with any conditions relevant to the delivery of Aboriginal cultural heritage interpretation and any requirements for Aboriginal cultural awareness training. Compliance with Aboriginal cultural heritage policies are important for proposed commercial tourism operations to maximise the park's potential and safeguard its distinct features and values. The Mawambul Co Management Group may also consider commercial tourism options through a feasibility study.

Interpretative signage promotes understanding and appreciation of Kalyarr's natural, historic and cultural heritage values. Opportunities exist to use other digital and innovative technologies to interpret park values for visitors and the broader audience outside of the park.

5. NPWS infrastructure and services

A range of infrastructure is required in the park in order to protect park values, provide opportunities for visitors and to support management operations. This infrastructure includes park roads and management trails, fencing, walking tracks, works compounds, water supply and sewage infrastructure, buildings, and other visitor facilities.

These facilities are managed and maintained through the NPWS Asset Management System. This system helps NPWS maintain and renew assets necessary to support safe and sustainable visitor use, park management operations and enhance heritage conservation.

Assets no longer necessary for park management or visitor use may be decommissioned or removed and the site rehabilitated after relevant heritage and environmental impact assessments and approval.

5.1 Management considerations and opportunities

The park has over 500 km of unsealed **park roads and management trails** (see Figure 1). These roads and trails require regular maintenance due to the nature of the cracking clay soils, particularly when wet weather results in slippery conditions and vehicles form alternative tracks to avoid wheel rutting. For this reason, NPWS limits vehicle access during wet conditions.

NPWS is also in the process of rationalising the road and trail network to identify the most suitable routes to be retained for public access through the park and for park management activities, particularly strategic fire management. Former property tracks which are no longer required may be closed and rehabilitated.

Protection of Aboriginal cultural heritage values is a high priority during road and trail maintenance activities and when deciding which roads and trails will be retained for park management and visitor access purposes.

The number and extent of Aboriginal cultural heritage features on the park means that it is important for visitors to stay on established park roads and follow directional signage. It is also important for NPWS staff and those authorised to work on park to stay on the designated management trails.

Park management activities are carried out subject to the Kalyarr National Park Aboriginal cultural heritage management plan (NPWS 2022).

The management trails in the park are an important fire management asset and many of the management trails are identified as strategic or tactical fire trails. Under the *Rural Fires Act 1997* the relevant bush fire management committee's **fire access and fire trail** plans identify access requirements for fire suppression and management purposes, including on land managed by NPWS.

In implementing works to establish and maintain trails at the prescribed fire trail standards, NPWS ensures these works are carried out in a manner that minimises impacts to the park's natural, historic and cultural heritage values.

The bridge over the Lachlan River north of De Ville Homestead is located off-park. It was previously used to access the north-west of the park, but now alternate accesses are used as the bridge has reached the end of its design life and requires replacement.

The homestead complexes including Norwood, Darcoola, Thelangerin, De Ville and Ita Cottage are managed in accordance with the Heritage Act, including the guidelines prepared under section 170A(3) of the Act, and subsidiary policies.

Norwood, Darcoola and De Ville are retained for staff accommodation and provide an important on-site presence for protecting park values and deterring illegal activities such as hunting. These homesteads are also used by Mawambul and approved researchers.

The shearing shed complexes containing woolsheds, shearers quarters, yards and other ancillary structures have been decommissioned but continue to be managed in accordance with the Heritage Act and subsidiary policies.

NPWS maintains compounds at Darcoola, Norwood and De Ville for storing and servicing plant and equipment used for park management purposes.

Visitor infrastructure includes campground and facilities on the Lachlan River near Norwood and day use facilities at Ita Lake (see Section 4). The campground facilities are within the TRS reserve managed by NPWS under licence.

The park boundary **fencing** is maintained in cooperation with neighbours, consistent with the NPWS *Boundary fencing policy*. Internal fences pose a hazard to wildlife. Fences not required for park management purposes are being progressively removed.

The fence around the Darcoola exclosure area on the former Darcoola Station has been damaged and no longer prevents incursions by feral animals into the Sandhill Pine Woodland EEC.

Repairing the fence presents a high risk to Aboriginal cultural heritage and the sensitive sandhill environment. Similarly, removing the fence also presents a risk to these values. The fence has been left in place and other control methods are used to minimise the impacts of feral animals, such as rabbits, on the EEC and sandhill environment.

Water supply tanks at Darcoola, Norwood and De Ville are maintained for a domestic water supply. Tanks along the Darcoola East Pipeline (see Section 6) are maintained for firefighting and other management activities.

There are several **ground tanks (dams)** in the park that are no longer connected to the stock and domestic water supply. Those not required for water supply or firefighting purposes are being decommissioned.

The directional, informational and interpretive **signage** plays an important role in promoting safe and sustainable visitor use and park operations. Opportunities exist to use other digital and innovative technologies to provide essential information to visitors while in the park and before they visit.

6. Non-NPWS infrastructure and services

6.1 Utilities

Powerlines owned and operated by private energy companies cross the park and provide power to homesteads and associated buildings, NPWS depots, and other infrastructure essential for park management.

6.2 Park access roads and road reserves

There are multiple access points into the park. Some of these access roads cross private or Crown land. Management access for NPWS and visitor access has been authorised where access has been identified on the reserve access strategy.

6.3 Darcoola East Pipeline

The Darcoola East Pipeline includes 110 km of pipeline and ancillary infrastructure (such as pumps, tanks and troughs) which delivers pumped water for stock and domestic use to the park and 6 nearby privately owned properties. The water comes from the Murrumbidgee River (approximately 13 km from the southern boundary of Kalyarr).

It was developed as the result of the Darcoola Water Efficiency Project as part of the Commonwealth and NSW government's Pipe the Channels Program. This program aims to achieve water savings by replacing inefficient open earth channels and dams with underground pipes to reduce evaporation losses and seepage. Removing open water sources in the park also reduces feral animal populations.

The pipeline enters the park on the south-western boundary of Darcoola, and extends northwards and westwards through Thelangerin and supplies water to all parts of the park except for De Ville which has its own supply.

Along the route of the Darcoola East Pipeline, 7 enclosed water tanks have been constructed to provide water for wildfire response and other park management activities. The route of the pipeline and the siting of the enclosed water tanks were determined through a consultative process with the Aboriginal community and other critical stakeholders, to minimise impacts on Aboriginal heritage and other important park values.

6.4 Travelling stock reserves

An extensive area of travelling stock reserve (TSR) passes east–west through Kalyarr along Corryong Road south of the Lachlan River, and then southwards along the western border of the park (see Figure 1). The area of TSR that abuts the park boundary is approximately 2,150 ha.

TSRs are Crown land managed by Local Land Services which may be temporarily leased for moving stock or supplementing stock feed during drought.

NPWS is licensed to use sections of the TSR, including the section where the Lachlan River campground is located (see Figure 1).

6.5 Management considerations and opportunities

Utilities such as power supply infrastructure maintained by external operators are managed consistent with protocols and/or NPWS policy. Access for maintenance purposes is also subject to compliance with the Aboriginal cultural heritage management plan for Kalyarr (NPWS 2020).

As the result of archaeological and Aboriginal cultural value assessments, the alignment of the **Darcoola East Pipeline** and the location of some tanks and troughs were moved to avoid harming Aboriginal sites (OzArk 2017). The alignment of the pipeline utilises already disturbed parts of the landscape such as former irrigation channels. The project also proposed ongoing grading and rehabilitation of open channels following decommissioning, where practical.

The grading and rehabilitation of open channels may continue more broadly across the park in future with the purpose of reducing the impact of channels from functioning as a manufactured barrier to unregulated floodplain flows.

Above-ground markers are used to indicate the location of the underground pipeline within a 10-m wide cleared corridor. This cleared corridor includes an access track to allow for ongoing maintenance.

Use of the access track is permitted subject to the Kalyarr National Park Aboriginal cultural heritage management plan (NPWS 2020). It is expected that pipeline maintenance will be required only infrequently. NPWS is now a member of the Darcoola East Joint Water Authority which was formed on completion of the water efficiency project. The authority is responsible for maintaining the pipeline.

TSRs can contribute to the conservation of native vegetation and habitat values in agricultural landscapes by protecting the seedbank of native species and retaining native vegetation. The boundaries of the TSR around the park are not well-defined and this may be why some sections of the TSR have not been managed for feral animals and weeds. Most of these reserves have not been used for grazing by adjoining owners or used for moving stock in many years. There may be potential for future additions to the park from these lands.

The **Lachlan River campground** is in the section of TSR that runs east–west through Kalyarr. NPWS has had preliminary discussions with Crown Lands regarding the location of visitor infrastructure on the TSR north-east of Norwood and the potential future addition of this land to the park. Consultation with the Department of Lands at the time the campground was established indicated support for possible transfer of some of the TSR land to NPWS (DECC 2009). Further consultation will be needed with Crown Lands as part of broader considerations for the TSR.

A **reserve access strategy** has been prepared for Kalyarr which identifies options for more secure park access arrangements in some instances. There are also a number of unused road reserves immediately adjoining the park which may be suitable for addition to the park.

Appendices

Appendix A Legislation and policy

Legislation and NPWS policies relevant to the management of this park include those listed below.

Commonwealth legislation and policy

- Environment Protection and Biodiversity Conservation Act 1999
- Native Title Act 1993

NSW legislation

- Biosecurity Act 2015
- Biodiversity Conservation Act 2016
- Environmental Planning and Assessment Act 1979
- Heritage Act 1977
- Local Land Services Act 2013
- National Parks and Wildlife Act 1974 and National Parks and Wildlife Regulation 2009
- Rural Fires Act 1997
- Water Sharing Plan for the Lachlan Regulated River Water Source 2020 (under the Water Management Act)

NPWS policies and strategies

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

- NPWS park management policies
- Fire management strategies
- Regional pest management strategies
- Riverina Area Historic Buildings Triage Project 2022 (DCCEEW unpublished).

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 plants and animals used in this plan. Species marked with an asterisk (*) are threatened species.

Common name	Scientific name
Plants	
Angled pigface	*Carpobrotus aequilaterus*
Belah	*Casuarina cristata*
Bimble box	*Eucalyptus populnea*
Black bluebush	*Maireana pyramidata*
Black box	*Eucalyptus largiflorens*
Bladder saltbush	*Atriplex vesicaria* subsp. *vesicaria*
Bush tomato	*Solanum species*
Common pigweed	*Portulaca oleracea*
Cumbungi (also known as bulrush)	*Typha domingensis*
Cypress pine	*Callitris species*
Dandelion	*Taraxacum officinale*
Dillon bush	*Nitraria billardieri*
Emu bush	*Eremophila longifolia*
Hibiscus	*Hibiscus heterophyllus*
Lippia	*Phyla canescens*
Many-horned copperburr	*Dissocarpus biflorus* var. *cephalocarpus*
Mistletoe	*Amyema species*
Mossgiel daisy*	*Brachyscome papillosa*
Myall	*Acacia pendula*
Nardoo	*Marsilea drummondii*
Neverfail	*Eragrostis setifolia*
Nitre goosefoot	*Chenopodium nitrariaceum*
Old man saltbush	*Atriplex nummularia*
Old man weed	*Centipeda cunninghamii*
Pearl copperburr	*Sclerolaena limbata*
Quandong	*Santalum acuminatum*
River cooba	*Acacia stenophylla*
River red gum	*Eucalyptus camaldulensis*
Rosewood	*Alectryon oleifolius*
Ruby saltbush	*Enchylaena tomentosa*
Sandhill pine	*Callitris glaucophylla*
Silky Swainson-pea*	*Swainsona sericea*
Sowthistle	*Sonchus* spp.

Common name	Scientific name
Speargrass	*Austrostipa*
Tall bluebell	*Wahlenbergia stricta subsp. stricta*
Tangled lignum	*Duma florulenta*
Thorny saltbush	*Rhagodia spinescens*
Wallaby grass	*Austrodanthonia* spp.
Waterlily	*Nymphaeaceae* spp.
Weeping myall (boree)	*Acacia pendula*
White cypress pine	*Callitris glaucophylla*
Winged peppercress*	*Lepidium monoplocoides*
Animals	
Australian magpie	*Cracticus tibicen*
Australian wood duck	*Chenonetta jubata*
Bar-tailed godwit	*Limosa lapponica*
Black falcon*	*Falco subniger*
Black swan	*Cygnus atratus*
Blue-billed duck*	*Oxyura australis*
Broad-shelled river turtle	*Chelodina (Macrochelodina) expansa*
Brown falcon	*Falco berigora*
Brown treecreeper	*Climacteris picumnus*
Carp	*Cyprinus carpio*
Chestnut-rumped thornbill	*Acanthiza uropygialis*
Chocolate wattled bat	*Chalinolobus morio*
Cod yellow belly	*Macquaria ambigua*
Common greenshank	*Tringa nebularia*
Common sandpiper	*Actitis hypoleucos*
Crested pigeon	*Ocyphaps lophotes*
Eastern grey kangaroo	*Macropus giganteus giganteus*
Emu	*Dromaius novaehollandiae*
Freckled duck*	*Stictonetta naevosa*
Galah	*Eolophus roseicapillus*
Glossy ibis	*Plegadis falcinellus*
Goanna	*Varanus* sp.
Great egret	*Ardea alba*
Grey-crowned babbler*	*Pomatostomus temporalis temporalis*
Grey teal	*Anas gracilis*
Hardhead	*Aythya australis*
Jacky winter	*Microeca fascinans*

Common name	Scientific name
Latham's snipe	*Gallinago hardwickii*
Little eagle*	*Hieraaetus morphnoides*
Little forest bat	*Vespadelus vulturnus*
Little raven	*Corvus mellori*
Long-toed stint	*Calidris subminuta*
Magpie goose	*Anseranas semipalmata*
Murray River cod	*Maccullochella peelii*
Nankeen kestrel	*Falco cenchroides*
Painted snipe	*Rostratulidae*
Pelican	*Pelecanus*
Pied honeyeater*	*Certhionyx variegatus*
Pink-eared duck	*Malacorhynchus membranaceus*
Plains-wanderer*	*Pedionomus torquatus*
Ragged snake-eyed skink	*Cryptoblepharus pannosus*
Rails	*Rallidae* sp.
Red-capped robin	*Petroica goodenovii*
Red-necked avocet	*Recurvirostra novaehollandiae*
Red kangaroo	*Osphranter rufus*
Restless flycatcher	*Myiagra inquieta*
Rufous whistler	*Pachycephala rufiventris*
Sharp-tailed sandpiper	*Calidris acuminata*
Shingleback	*Tiliqua rugosa*
Southern bell frog*	*Litoria raniformis*
South-eastern morethia skink	*Morethia boulengeri*
Southern whiteface	*Aphelocephala leucopsis*
Spotted grass frog	*Limnodynastes tasmaniensis*
Spotted harrier*	*Circus assimilis*
Straw-necked ibis	*Threskiornis spinicollis.*
Tessellated gecko	*Diplodactylus tessellatus*
Wedge-tailed eagle	*Aquila audax*
Western blue-tongue*	*Tiliqua occipitalis*
Western grey kangaroo	*Macropus fuliginosus*
White-bellied sea eagle*	*Haliaeetus leucogaster*
White-browed babbler	*Pomatostomus superciliosus*
White-faced heron	*Egretta novaehollandiae*
White-fronted chat*	*Epthianura albifrons*
White-winged fairy-wren	*Malurus leucopterus*

Common name	Scientific name
Willie wagtail	*Rhipidura leucophrys*
Yellow-bellied sheath-tailed bat*	*Saccolaimus flaviventris*

Appendix C Vegetation communities in Kalyarr National Park

Keith class	PCT ID	PCT Name	Area (ha)	% park
Inland riverine forests	7	River Red Gum – Warrego Grass – herbaceous riparian tall open forest wetland mainly in the Riverina Bioregion	1,012.0	2.5
Inland riverine forests	10	River Red Gum – Black Box woodland wetland of the semi-arid (warm) climatic zone(mainly Riverina Bioregion and Murray Darling Depression Bioregion)	579.8	1.4
Inland riverine forests	11	River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	204.7	0.5
Inland floodplain woodlands	15	Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south western NSW (mainly Riverina Bioregion and Murray Darling)	2,961.9	7.3
Inland floodplain shrublands	17	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	321.9	0.8
Inland floodplain shrublands	24	Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains	313.2	0.8
Riverine plain grasslands	46	Curly Windmill Grass – Speargrass – Wallaby Grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion	3,037.6	7.5
Aeolian chenopod shrublands	153	Black Bluebush low open shrubland of the alluvial plains and sandplains of the arid and semi-arid zones	3,234.8	7.9
Riverine chenopod shrublands	157	Bladder Saltbush shrubland on alluvial plains in the semi-arid (warm) zone including Riverina Bioregion	21,074.4	51.8
Riverine chenopod shrublands	159	Old Man Saltbush shrubland mainly of the semi-arid (warm) climate zone (south western NSW)	781.2	1.9
Riverine chenopod shrublands	163	Dillon Bush (Nitre Bush) shrubland of the semi-arid and arid zones	165.2	0.4
Riverine chenopod shrublands	236	Derived Giant Redburr low shrubland on alluvial plains of the semi-arid (warm) climate zone	5,096.8	12.5
Riverine sandhill woodlands	28	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	27.9	0.1
Riverine chenopod shrublands	160	Nitre Goosefoot shrubland wetland on clays of the inland floodplains	1,071.2	2.6
Open area		Open or cleared areas	831.8	2.0
		Total area	40,714.1	100

PCT = plant community type. Source: Porteners (2014)

Appendix D Feral animals and weeds in the park

The following tables summarises key information on feral animals and weeds in the park at the time of publication of this plan. Current information on the status of feral animals and weeds and whether they have a threat abatement plan can be found on the website. Further information is also available in the relevant NPWS regional pest management strategies.

Feral animals

Common name	Scientific name	KTP	LLS priority
Red fox	*Vulpes vulpes*	Y	Y
Rabbit	*Oryctolagus cuniculus*	Y	Y
Feral Cat	*Felis catus*	Y	Y
Feral deer	*Cervus* spp.	Y	Y
Feral goat	*Capra hircus*	Y	Y
Feral pig	*Sus scrofa*	Y	Y

Priority weeds

Common name	Scientific name	WONS	LLS priority
African boxthorn	*Lycium ferocissimum*	Y	Y
Bathurst burr	*Xanthium spinosum*	–	–
Horehound	*Marrubium vulgare*	–	–
Peppercorn	*Schinus* spp.	–	–
Willows	*Salix* spp.	Y	Y

WONS = weeds of national significance

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

LLS = Local Land Services (see Riverina LLS 2017, 2018a).

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  - Regional pest management strategies
  - Saving our Species program
  - Threat abatement plans
  - Zero extinctions – threatened species framework

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