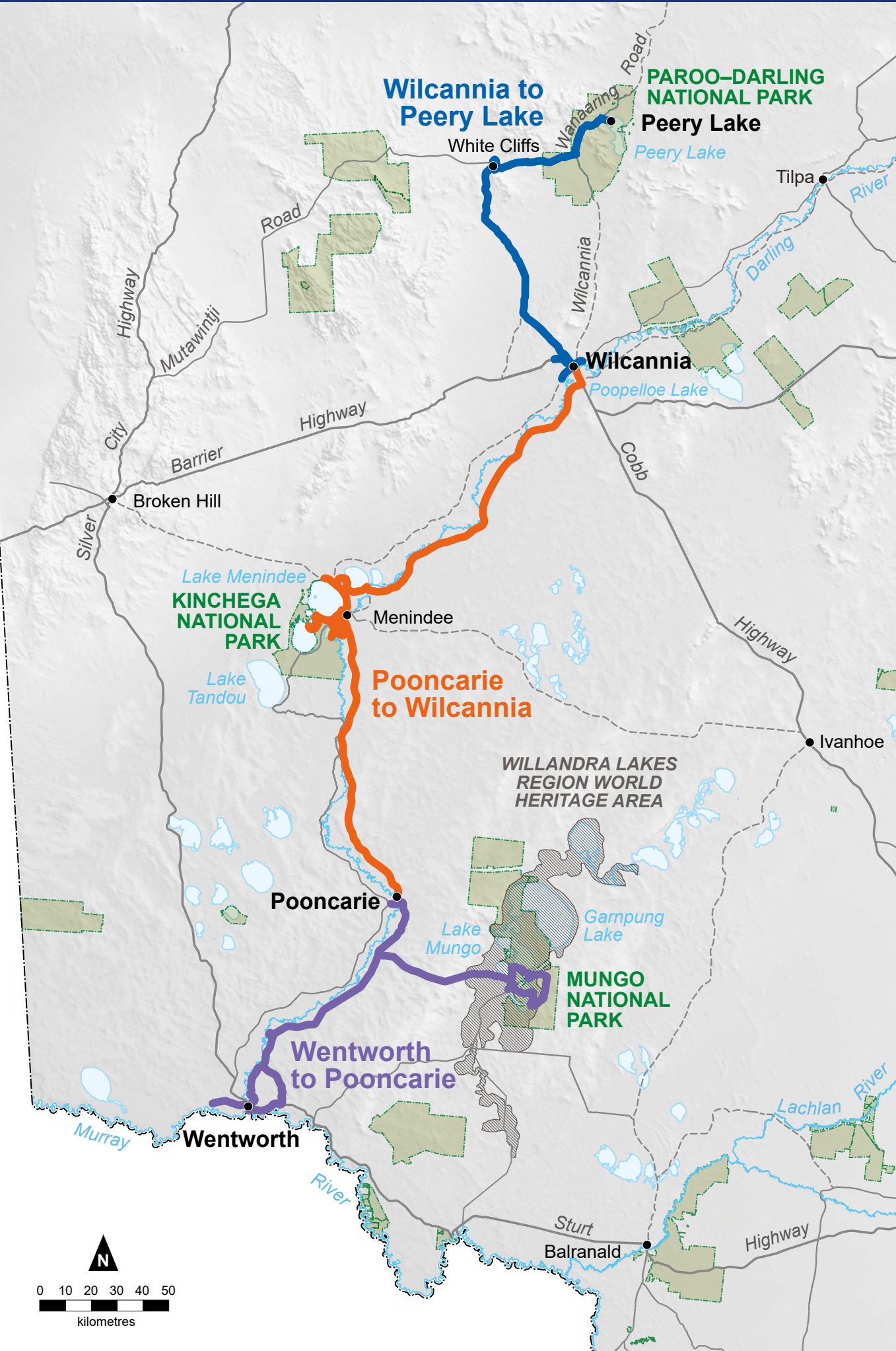


The Darling Barka Geotrail is an exciting self-guided road trip through western New South Wales (NSW). It covers hundreds of kilometres of outback roads, beginning in Wentworth at the mouth of the Darling River and extending north through Pooncarie, Menindee, Wilcannia, and then White Cliffs and Peery Lake. It includes stops at the Mungo, Kinchega and Paroo–Darling national parks. The geotrail is divided into 3 sections, so that you do not need to take the entire journey. It can take several days to complete the entire geotrail while enjoying towns and places along the way.

The geotrail reveals hidden stories and features in the arid landscape, and brings to life the geology, ancient rivers, anabranches, floodplains, sand dunes, lakes, rocky hills, opals and ancient artesian groundwaters. The region has a rich and ancient cultural history, including many significant places for First Nations people, particularly the Barkandji or River People. It also includes important archaeological sites for Australian megafauna from the Pleistocene Epoch.



Geological overview

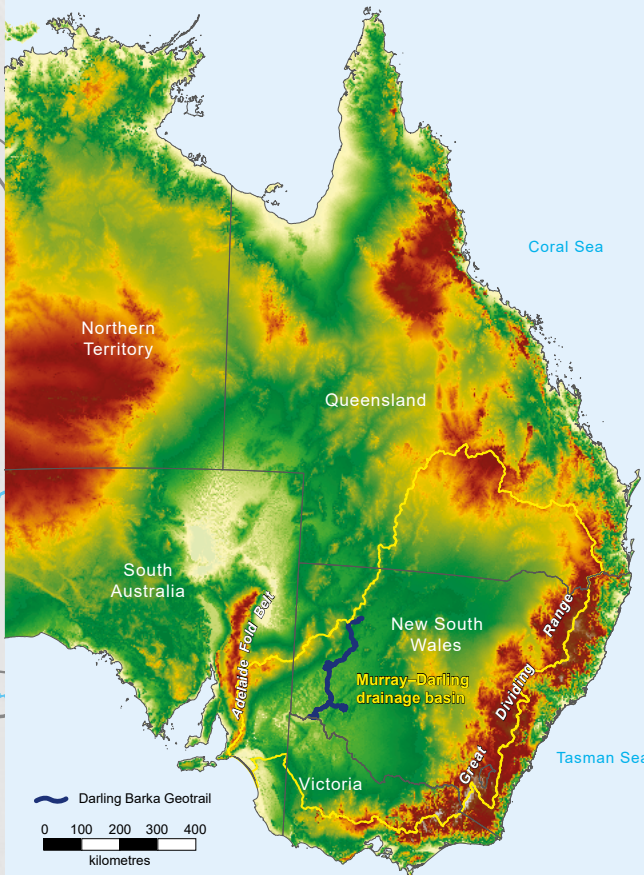
The unique landscape in western NSW was formed over hundreds of millions of years, and has been shaped by ancient river systems, inland shallow seas and vast lakes. The effects of these surface processes are preserved in the rocks and sediments that make up 3 sedimentary basins – the older Darling Basin, the younger Eromanga Basin, and the more recent Murray Basin. These basins are flanked by ancient, uplifted mountain ranges. These are the Adelaide Fold Belt to the west in South Australia, and the Great Dividing Range to the east in NSW.

The Darling Basin is mostly comprised of Devonian (419–359 million years ago [Ma]) sedimentary rocks that are up to 8 km thick and cover an area greater than 100,000 km². It is largely overlain by the younger Eromanga and Murray basins, and can only be seen at the surface to the north-west of Wilcannia. This is where ancient rivers flowed eastward 380 Ma, but later eroded to form the sandstone mesas and low hills seen today. Recent tectonic processes have produced stress in the subsurface of the basin. This resulted in subtle faults that uplifted the land and valleys that control the course of the Darling River, as well as forming lowlands filled by the Menindee and Willandra lakes.

Subsidence associated with the formation of the Eromanga Basin in the Early Jurassic to Late Cretaceous periods (201–66 Ma), resulted in a shallow sea with a shoreline along northern NSW. This initially deposited mud and later soil with conditions suitable for opal formation at White Cliffs. It also helped transport artesian groundwater to Peery Lake.

Further south, subsidence of the land associated with the formation of the younger Murray Basin in the Paleogene to Neogene periods (66–2.6 Ma) formed a shallow inland sea connected to the Southern Ocean with shorelines advancing to the south-east as the sea closed. When a fault dammed up the basin drainage, a huge lake (Lake Bungunnia) formed in south-western NSW making the topography even flatter.

The landscape today remains mostly flat due to low levels of tectonic activity and prolonged erosion. There are highlands to the west and east, raised hills to the north in Queensland and the lowest elevations to the south along the coast of South Australia. This topography helped form the large inland drainage basin seen today where the Darling River and its tributaries collect precipitation and groundwater from most of inland southern Queensland and western NSW, and delivers it eventually to the Southern Ocean in South Australia. The low and variable rainfall over this flat drainage basin results in episodic floods, and ephemeral meandering river flows in the Darling River with frequent anabranches and overflow lakes.



Wentworth to Pooncarie (southern section)

📍 15 stops ↗ 350 km one way



Source: Destination NSW.

This section of the geotrail follows the Darling River and its valley between Wentworth and Pooncarie. It also includes a side trip to Lake Mungo. There are meandering and anabranching rivers, overflow lakes, floodplains and levees, billabongs, sand dunes, geological faults and point bars. You will also see how geological research can determine when First Nations people first came to this area, and how to understand our past climates.

The central theme of this section is the Darling River and its valley. The river transfers water from its sources in central Queensland and north-east NSW approximately 1,300 km to its junction with the Murray River at Wentworth. Along this journey, the river creates a unique flat landscape of sinuous meandering channels with multiple anabranching channels.

As seasons change, the waters vary from powerful floods to dry riverbeds. During major flood events, the river fills its floodplain with ephemeral seas over 50 km wide. It also forms and fills the many overflow lakes along its course, like the Menindee Lakes and Fletchers Lake.

Nearby Lake Mungo is an overflow lake of the Lachlan River. The dunes on the shores of the lake record the changing climates of the recent ice ages, and the sediments of the dune layers reveal their ages, and traces of the lives of the peoples that occupy them. Lake Mungo is significant as the resting place of the oldest known human inhabitants of Australia, over 42,000 years ago. The landscape outside the river valley is very different and consists mainly of dry plains dotted with sand dunes.

Source: Geological Survey of NSW. Ground surface elevation image from Digital Atlas of Australia, © Commonwealth of Australia (Geoscience Australia) 2011.



Source: Destination NSW.

Pooncarie to Wilcannia (central section)

📍 22 stops ↗ 400 km one way



Source: S Watson.

Along this section you can visit the mighty Darling River and its valley that stretches from Pooncarie to Wilcannia. It includes side trips to the iconic Menindee Lakes and Kinchega National Park. You will see the story of Australian megafauna (including giant kangaroos and marsupial lions) that lived around the Menindee Lakes around 60,000 years ago. The Barkandji people have occupied this lake and river country for tens of thousands of years. You can also explore the early European settlement around the original Kinchega Station of the 1850s, and the visit by Burke and Wills in 1860.

The focus of this section is the Menindee Lakes. This is a major engineering achievement that helps control floods, provides irrigation water to the lower Darling River and the Great Darling Anabranch, and drinking water to Broken Hill. This area is also known for meandering and anabranching rivers that flow across an extended floodplain that is more than 80 km wide. It is also a region of great natural beauty where you can experience the magnificent scenery along River Drive, or a sunset across Lake Menindee.

This section starts at Pooncarie and follows the river and its adjacent dune country outside the valley, before descending into the valley to view typical meandering river landscapes of channels, point bars and floodplains. Here we are in the Murray Basin at the surface, but this is different to the south, because stresses in Earth's crust beneath in the old Darling Basin have created a much wider floodplain. As a result, there are multiple anabranch courses of the river, which have been created over many hundreds of thousands of years.

This wide flat basin and floodplain has abundant overflow lakes including the 9 large lakes west of Menindee, Lake Tandue, and Bijijie, Balaka and Malta lakes. Further north the geotrail follows the valley to Wilcannia through a landscape of anabranches and dune islands occupying the wide floodplain.

Wilcannia to Peery Lake (northern section)

📍 16 stops ↗ 210 km one way



Source: B Churcher.

On this section the amazing landscapes explain how Earth was formed in north-western NSW over 120 million years. First you will leave the Darling River valley after viewing its point bars and overflow lakes, and its junction with the Paroo River, then traverse a landscape of dunes underlain by Devonian hills from Wilcannia to White Cliffs.

One of the highlights is the opal mining town of White Cliffs where you can fossick for opals (or buy them) and take an underground tour. From White Cliffs to Peery Lake is a land of ephemeral rivers and the characteristic landscape of silcrete mesas.

Another highlight is Peery Lake where, depending on the season, you will discover either a dry salt lake with 400 million year old river sandstones, or a lake teeming with wildlife and water. At low lake level you can visit the mound springs where water that has travelled over 500 km underground through the Great Artesian Basin bubbles to the surface surrounded by rare plants and lush growth in this desert country.

This section starts at the Darling River in the Murray Basin, travels across the Darling Basin into the Eromanga Basin and its Paleogene to Neogene silcrete and opals. It finishes in an overflow lake of the Paroo River, a tributary of the Darling River. This area is different to the rest of the geotrail where the landscape is formed from recent Quaternary (2.6–0 Ma) sediments overlying the Paleogene to Neogene (66–2.6 Ma) Murray Basin.

In the north the underlying older sediments of the Devonian Darling and Barka basins (380 Ma) occur at the surface between Wilcannia, White Cliffs and Peery Lake. On the northern side, the Mesozoic Eromanga Basin sediments (120 Ma) thin-out to the south onto the Devonian highlands and host the waters of the Great Artesian Basin. In the south, the Paleogene to Neogene sediments of the Murray Basin thin-out northwards, also onto the Devonian highlands. This area of NSW has been exposed to extensive weathering for 60 million years under mainly arid climates. As a result, extensive silcrete soils formed a resistant cap over the Eromanga Sea sediments, and opals formed.

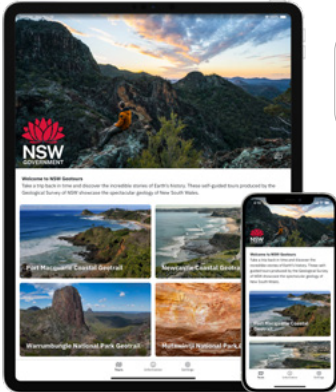
Credits

Authors: Ron Boyd and Bernadette Drabsch
Figures: Cassie Yarnold and Phillip Carter

This collaborative geotrail project was led by the Geological Survey of NSW with support from NSW National Parks and Wildlife Service, local Aboriginal traditional owners and the Baaka Cultural Centre. We acknowledge that the geotrail is on the land of the Barkandji, Mutthi Mutthi and Ngiyampa peoples and pay our respects to their Elders past, present and emerging.

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Darling Barka Geotrail



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Highlights

Wentworth – where the rivers meet



Source: B Churcher.

The Darling Barka Geotrail starts at the town of Wentworth. This iconic location is where 3 river valleys meet: the Darling, the Great Darling Anabranch and the Murray River landscapes dominate this region. The Darling River ends where it meets the Murray River at Wentworth.

The ancient course of the Darling River, the Great Darling Anabranch, still flows in major floods and it enters the Murray River around 13 km west of Wentworth. These are all large river systems with the Murray River valley which is over 11 km wide, the Darling River over 8 km and the remains of the Great Darling Anabranch river valley up to 2 km wide.

People of the river



Source: State Library of Victoria. Photograph by Fred Kruger c. 1870.

The First Nations peoples who live along the Darling River from Wentworth to Bourke are a large group of hunter–fisher–gatherers, known as the Paakantyi, sometimes written as Barkindji or Barkandji. Their name derives from the watercourse itself, the Paaka (Barka or Baaka) meaning river, plus ntyi, meaning belonging to. The Paakantyi occupy not just the banks of the river and floodplain, but vast areas on both sides of the river. They consist of many different groups, who all speak dialects of the one language. Some of these First Nations peoples are the:

- Marawarra – who live along the lower anabranch and the lowermost Darling River
- PaaRuntyi – who live around the Paroo River
- Nhawalku – who live around Wilcannia
- Paakantyi (Barkandji) – who live along the Darling River below Wilcannia.

Although the northern dialects were quite different to the southern ones, their language is vastly different from the surrounding languages.

Lake Mungo: a World Heritage site

Lake Mungo is one of the natural highlights of the Darling Barka Geotrail. It is in the World Heritage-listed Mungo National Park and Willandra Lakes Region. The national park achieved this listing for being an outstanding example of a major stage in Earth's evolutionary history, an example of significant ongoing geological processes, and an exceptional testimony to a past civilisation. It is also an area of great natural beauty.

At its peak, when melting snow and ice fed this course of the Lachlan River, the lake was 6–8 m deep and 120 km² in area. The dry lake now has a steeper western side, a flat lake floor and a crescent-shaped lunette dune on the eastern side. The eastern margin of the lake contains a geological history of changing lake levels and shorelines over the past 150,000 years. Preserved here are 4 main layers with the youngest 3 containing evidence of human occupation that includes hearths, middens, stone tools and burials from over 42,000 years ago, as well as the remains of megafauna. While the original dunes were continuous, today they are dissected by wind and water erosion, leaving a fragmented jigsaw of dune remnants of different ages.

Lake Mungo lies around 50 km east of the Darling River, but, contrary to its name, it is actually a dry overflow lake of an ancient Lachlan River course.

You could spend at least one day visiting Lake Mungo, exploring the Mungo Visitor Centre and nearby cultural walking trails. You can see the sunrise from the western Mungo Lookout, take a guided tour of the Walls of China lunette site, visit the eroded landscape of the eastern Red Top Lookout and, if the roads are open, complete a driving tour around the lake and through the surrounding area to Vigars Well.

Mungo National Park and Willandra Lakes Region include the Country of the Barkandji, Mutthi Mutthi and Ngiyampa peoples. Aboriginal peoples have occupied the lands around Lake Mungo for over 42,000 years with the oldest known human remains in Australia of Mungo Man and Mungo Lady found here. Lake Mungo is an immensely important place for Aboriginal cultural history. Please be respectful of Aboriginal cultural heritage when you visit, and stay on marked tracks and boardwalks when walking.

Lakes in the desert

The Menindee Lakes are a series of overflow or deflation lakes supplied by the Darling River near Menindee. They are located along the western margin of the valley and are like many other overflow lakes encountered on the geotrail such as Lake Woytchugga, Lake Mungo or Fletchers Lake. They are wide, shallow and have lunettes on their eastern shores.

During the 1950s and 1960s the Menindee Lakes were modified for storage, regulation, irrigation, water supply and recreation. There are 4 larger lakes in the system, from north to south being Lake Wetherell (artificial), Lake Pamamaroo, Lake Menindee and Lake Cawndilla (modified natural depressions), and 5 smaller lakes. The system was formed by the construction of the Main Weir on the Darling River 19 km north of Menindee. This weir can raise the



Source: S Watson.

water level in the river by 12 m, which, in turn, floods the valley up to 35 km north of the weir, creates Lake Wetherell, and supplies the smaller Tandure and Bijjije lakes to the north-west.

Once the water level has been raised at the weir, the water can be diverted using gravity, first into Lake Pamamaroo, then via an artificial channel at Copi Hollow into Lake Menindee. From there water can be released back into the river, and then via the Morton Boulka channel into Lake Cawndilla, where the water can be released into the Great Darling Anabranch. The lakes are ephemeral, and only fill every 5–10 years which is an opportunity to see spectacular water scenery, birds and fish. The lakes are large by NSW standards, containing 2,000 gegalitres (GL) when full (this is 2 billion litres or 3.5 times the volume of Sydney Harbour) and cover an area of 457 km², averaging 7 m deep. Because the lakes are so wide and shallow, they lose 426 GL per year through evaporation. When the volume of the lakes reaches 640 GL it is shared to meet downstream needs, but once it falls below 480 GL it is controlled to meet local needs. Downstream Weir 32 also raises the water level, and this is used to supply the water pipeline to Broken Hill.

Kinchega National Park



Source: P Carter.

Kinchega National Park is around 15 km south of Menindee, along the Old Pooncarie Road and Woolshed Drive. The geotrail in the Kinchega area begins at the town of Menindee on the western side of the Darling River and then travels west to the entry of Kinchega National Park at the Menindee Outlet Regulator. From there you can travel south to the Kinchega Visitor Centre and historical Kinchega Woolshed.

The national park provides one of the few locations along the Darling River where you can drive along the levee next to the channel for over 20 km of spectacular river landscape and ideal camping

spots. You can see Weir 32 that controls the water level downstream of Menindee, the re-entry of the Talyawalka Creek anabranch into the Darling River, and the regulators that control water flow from Lake Menindee back into the Darling River, and from Lake Menindee into Lake Cawndilla.

The national park consists of 3 main landscapes: red sand plains and dunes; the Darling River channels and floodplains; and the overflow lakes including the larger lakes of Menindee and Cawndilla as well as a range of smaller lakes like Emu and Kangaroo lakes, all with associated lunettes. Information, educational tours and activities are available from the visitors’ centre near the Kinchega Woolshed.

White Cliffs



Source: Destination NSW.

White Cliffs is a small town of around 100 people, which is famous in NSW for its opal mining history. Opals were first discovered here in 1884 and first mined in the late 1890s. By 1899, 2,000 people lived in or near White Cliffs and it was the main source of Australian opals for over 25 years. White Cliffs produces mainly seam opal (formed in horizontal and vertical seams in the ground) and occasionally rare opal pineapples.

White Cliffs is in a harsh desert environment, with summer temperatures approaching 50°C. To avoid the heat, many people live underground in ‘dugout’ houses. Visitors can stay in an underground motel. Underground tours of the mines are possible as well as visiting opal showrooms, fossicking, and viewing the surface outcrops to understand the geology of the White Cliffs opalfields.

Peery Lake



Source: John Spencer/DCCEEW.

Peery Lake is part of the Paroo–Darling National Park. It is an overflow lake of the Paroo River with a water entry at the southern end, around 90 km upstream from its junction with the Darling River at Kallyanka Creek. It has a maximum width of 4 km and a length around 14 km. The region around Peery Lake has typical desert landscapes of ephemeral creeks, deltas, lakes and dunes. There are 5 large lake deltas on the western shore supplied by 5 intermittent creeks. Longitudinal dunes cover the peninsulas to the east of the lake.

The main features of interest at Peery Lake are the artesian mound springs, the Devonian sandstone outcrops on the lakeshore and the surrounding walking trails. Three hundred and sixty million years ago, this was an area of arid rivers and ephemeral lakes. If you are lucky, in the sandstones you may find some Devonian fossils including vertical burrows formed by worms and a form of ancient platy fish called *Wuttagoonaspis*.

Mound Springs

Along the north-west margin of Peery Lake are a series of 8 active artesian mound springs. These are raised mounds or islands that produce salty water and minerals from deep in the subsurface.

Water flowing into rocks from as far away as Charleville and Longreach (500–800 km to the north-east) are the main underground source for the water in the Peery Lake area. The water flows under gravity from these upland sources to the south-west margin of the basin where it emerges from underground aquifers such as the Hooray Sandstone to the surface under pressure in the mound springs.

Throughout NSW artesian mounds originate from the combined chemical precipitation of calcium carbonate out of the artesian groundwater, aided by algae and bacteria.

Each spring is surrounded by a small accumulation of sediment and carbonate deposits, as well as distinctive plants including the salt pipewort which only grows on these mound springs.



Source: B Churcher.

Glossary

Anabranch a section of a river or stream that deviates from the main channel and rejoins the main channel further downstream.

Artesian mound springs formed by springs or water seepages at the surface where mineral bearing groundwaters (in this case from the Great Australian Basin) precipitate minerals and other sediments accumulate in layers, resulting in mounds building up over thousands of years.

Barka or Baaka the Barkandji peoples’ name for the Darling River in western NSW.

Ephemeral lasting a short period of time. An ephemeral creek only contains water briefly after rain.

Erosion the action of wind, water, gravity or ice that moves soil, sediments and rock.

Fault a fracture in Earth’s crust along which rocks on either side have moved relative to each other.

Lunette a crescent shaped fixed sand or silt layered dune often found at the edge of a lake in arid and semi-arid lands, formed over thousands of years, such as at Lake Mungo in NSW.

Mesa a landform with a flat top and bounded by steep rock walls, occurring in areas of inland Australia.

Opal a gemstone made of hydrated or water-containing amorphous silica, usually semi-transparent, containing flecks of shifting or iridescent colour.

Paakantyi the collective name often used for the Aboriginal language and dialects of a large part of western NSW. Also known as Wiimpatja Parlku.

Pleistocene is a geological period from about 2.58 million to 11,700 years ago, often referred to as the ice age.

Point bar a low, curved ridge of sand and gravel accumulated along the inner bank of a meandering stream or river.

Sandstone a sedimentary rock made up of sand-size grains of mineral, rock or organic material.

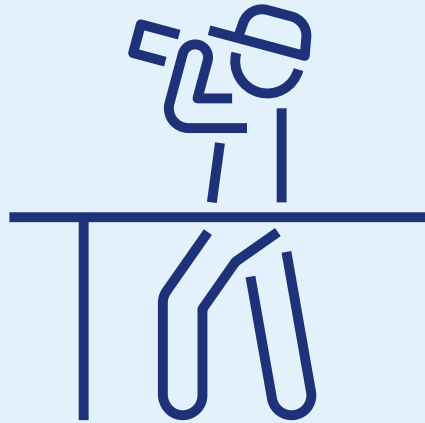
Sedimentary basin a large regional sized depression of Earth’s surface or crust where subsidence has created a basin, with thick layers of sediments deposited and building up over geologic time.

Weathering the decomposition of rocks, soil or minerals in place through physical, chemical or biological processes.

the largest spheres produce red colours. Opal can be deposited by itself, by replacing other rocks and fossils, or by replacing other minerals and crystals.



Source: G Fleming.



Source: P Carter.