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Commonwealth Environmental Water Office

Commonwealth Environmental Water Office

# Water Management Plan

Chapter 3.8 – Lower Darling River

2020–21



This document represents a sub-chapter of 'Commonwealth Environmental Water Office Water Management Plan 2020-21, Commonwealth of Australia, 2020'.

Please visit: <https://www.environment.gov.au/water/cewo/publications/water-management-plan-2020-21> for links to the main document.

#### Acknowledgement of the Traditional Owners of the Murray–Darling Basin

The Commonwealth Environmental Water Office respectfully acknowledges the Traditional Owners, their Elders past and present, their Nations of the Murray–Darling Basin, and their cultural, social, environmental, spiritual and economic connection to their lands and waters.

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## 3.8 Lower Darling River

### 3.8.1 Region overview

#### (a) *River valley*

Travelling approximately 700 km, the lower Darling River includes the river channel and adjacent billabongs and wetlands from the Menindee Lakes to the junction of the Murray and the Darling rivers at Wentworth (Figure 1). The catchment also includes the Great Darling Anabranch an ancestral path of the Darling River, including its lakes, floodplains and channel. The catchment is located on the semi-arid plains of south-western New South Wales.

The lower Darling valley relies on flows from rivers in southern Queensland and northern New South Wales, including ephemeral systems such as the Warrego, that flow into the Barwon-Darling River. Water is captured at the Menindee Lakes, a series of natural lakes that have been altered to improve water storage. Key storages include Menindee, Wetherell, Pamamaroo and Cawndilla. Water is released from lakes Menindee, Wetherell and Pamamaroo to provide flows into the Lower Darling River, while Lake Cawndilla can provide flows down the Great Darling Anabranch.

Of the 11 lakes that form the Menindee Lakes system, the two largest; lakes Menindee<sup>1</sup> and Cawndilla, as well as ~40 km of the lower Darling River and ~25 km of Great Darling Anabranch, are vested in the 44, 259 ha Kinchega National Park.

Land use in the catchment is largely based on pastoral industries, comprising mainly of sheep as well as rangeland goats and beef cattle production. There are also some small areas of lakebed cropping, and irrigated cropping, horticulture and viticulture. Tourism is vitally important to the local economy, with waterways and national parks supporting widespread recreational activities such as fishing and camping.

#### (b) *Traditional Owners*

The river and floodplains of the lower Darling River have long been important for sustenance and spirituality. In 2015, the Barkindji people received Native Title over much of the Darling River valley, extending from the South Australian border to Tilpa in the east, Wentworth in the south and north almost to Wanaaring. The lower Darling River flows through the traditional land of many other Aboriginal nations including the Maraura, Muthi Muthi, Nyeri Nyeri and Ngintait nations. The region contains many significant spiritual and cultural sites, including Lake Mungo in the Willandra Lakes Region and Menindee Lakes.

#### (c) *Important sites and values*

The Menindee Lakes are listed in the Directory of Important Wetlands in Australia as an exceptional example of the Ephemeral Deflation Basin Lakes (EDBL) wetland type within the bioregion. They provide important waterbird habitat with more than 30 species recorded on the main lakes, including threatened species such as freckled duck and migratory waders. It also provides critical habitat for native fish including golden perch and threatened species such as Murray cod, silver perch and freshwater catfish. The ephemeral nature of the large shallow lakes makes them very productive and support diverse food sources for fish at a range of life-stages. The Menindee Lakes also provide important refuge for wildlife during drought or adverse conditions.

<sup>1</sup> Half of Lake Menindee in Kinchega National Park

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) lists the Coolibah-Black Box community, Menindee nightshade, silver perch, Murray cod and 37 waterbirds as conservation dependent. Eighteen migratory bird species recorded at Menindee Lakes are listed under international agreements (JAMBA and CAMBA). The Lakes are listed by the Murray-Darling Basin Authority as key environmental assets and are used as hydrological indicator sites. The Menindee Lakes including Lakes Cawndilla and Menindee, lower Darling River and Great Darling Anabranch are listed by the *Fisheries Management Act NSW 1994* as an Endangered Ecological Community.

The Menindee Lakes and lower Darling River represents a large area of highly connected aquatic and riparian habitat which supports a diverse native fish community. The natural flow variability of the lower Darling River supports fish breeding (particularly by Murray cod and golden perch) and contributes to recruitment and dispersal of native fish throughout the Southern-connected Basin (Stuart and Sharpe 2020, Sharpe and Stuart 2018b, Zampatti and Leigh 2013). For example, up to 60 per cent of golden perch in the Edward-Wakool, Goulburn, lower and mid-Murray have been found to originate from recruitment events in the Menindee Lakes/lower Darling (Zampatti et al. 2015). This is the only EDBL floodplain lake system remaining in the entire Murray-Darling Basin that has been recorded to sustain mass golden perch recruitment events (Sharpe 2011, Sharpe and Stuart 2018a, Stuart and Sharpe 2020). The Menindee Lakes are considered among the last, functional EDBL golden perch nursery habitat remaining in the Murray-Darling Basin, hence listed in Directory of Important Wetlands in Australia (Sharpe 2011, Stuart and Sharpe 2020).

The Great Darling Anabranch is the ancestral path of the Darling and, together with its ephemeral lakes, is highly significant in terms of its contribution to terrestrial and biodiversity value through natural wetting and drying cycles and diverse habitats. The lakes also provide important refuge for wildlife during drought. For example, Lake Cawndilla is an important fish nursery habitat and previous environmental flows have demonstrated its significance as a dispersal pathway for native fish, such as golden perch.

Flows in the lower Darling also promote other environmental outcomes such as the transport of propagules and nutrients that drive and support food webs and fish communities in the Lower Murray. In recent decades, protracted cease-to-flow and low-flow conditions have significantly compromised these values, including fish deaths events in 2004, 2008, 2015-16 and more recently in 2018-19 (NSW DPI Fisheries 2020).

Both the lower Darling River and the Great Darling Anabranch are identified in the *Basin-wide environmental watering strategy* as wetlands of Basin significance for native fish and birds.

#### *(d) Partners and stakeholder engagement*

In the lower Darling, Commonwealth environmental water is managed in partnership with the NSW Department of Planning, Infrastructure and Environment- Environment, Energy and Science (DPIE-EES). It is coordinated with other sources of water, including environmental water available through The Living Murray program, and operational flows managed by WaterNSW and/or the Murray-Darling Basin Authority (depending on who has operational control of Menindee Lakes at the time in accordance with the *Murray-Darling Basin Agreement*).

In addition to the above agencies, advice is regularly received from the NSW Department of Primary Industries (DPI) – Fisheries, the Lower Darling Technical Advisory Group and the Lower Darling Regional Operations Stakeholder Consultation Committee (LD ROSCCo), who provide advice to water managers to address stakeholder concerns and share river operation information. The Commonwealth Environmental Water Office (CEWO) also seeks guidance from representatives of the Barkindji Traditional Owners, Murray Lower Darling Rivers Indigenous Nations (MLDRIN), recreational fishers, landholders and irrigators.

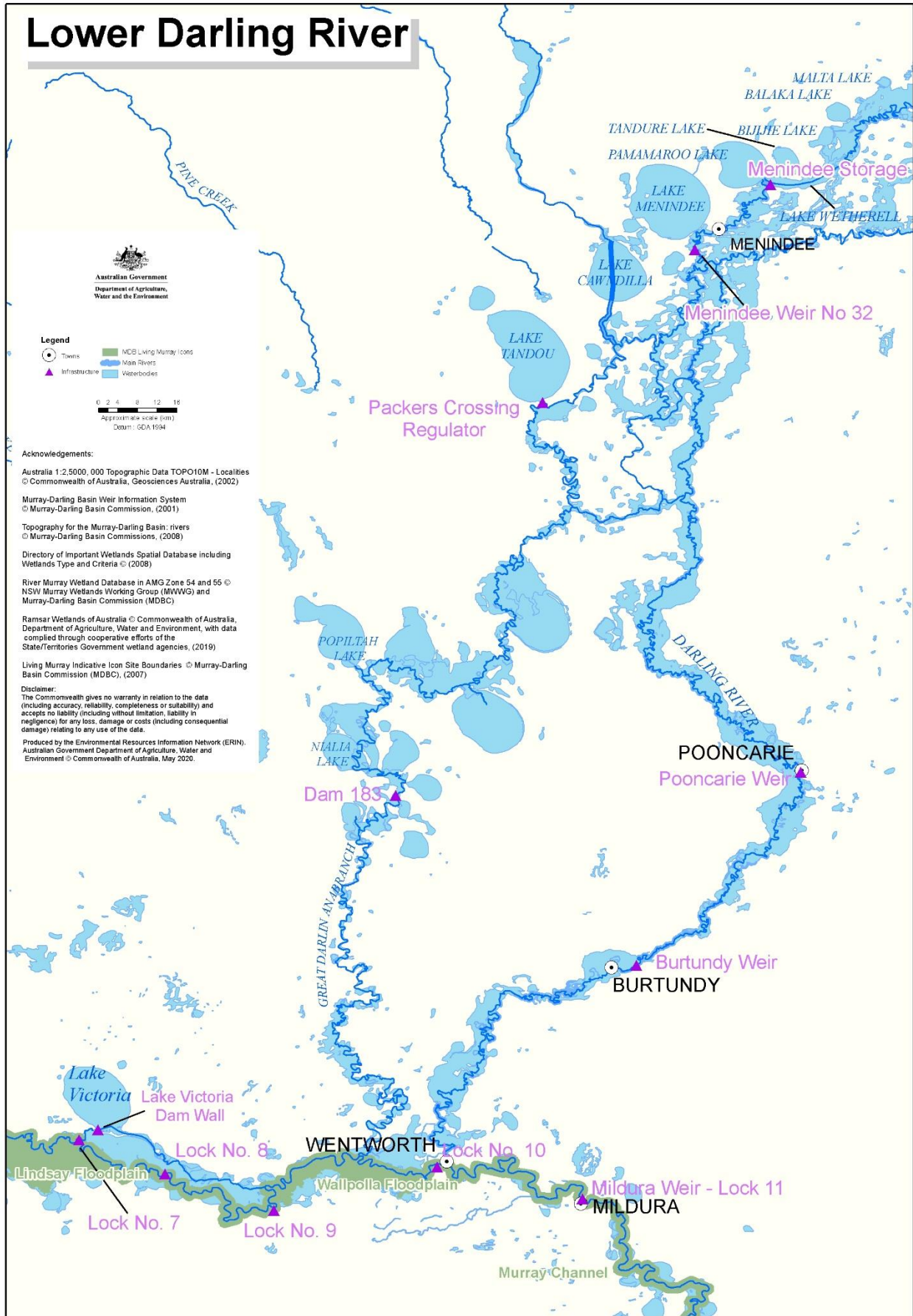


Figure 1: Map of the lower Darling River

### 3.8.2 Environmental objectives

Based on long-term environmental objectives in the Basin Plan, draft state long-term watering plans, site management plans (including Ramsar site ecological character descriptions), and best available knowledge, the following objectives have been developed for environmental water planning in the lower Darling River region.

The objectives targeted in a particular year may vary depending on available water, catchment conditions, operational feasibility, and demand for environmental water. These objectives will continue to be revised as part of the Commonwealth Environmental Water Office's commitment to adaptive management.

**Vegetation:** Maintain riparian and in-channel vegetation condition. Increase periods of growth for non-woody vegetation communities that closely fringe or occur within river channels.

**Waterbirds:** Provide habitat and food sources to support waterbird survival and recruitment and maintain condition and current species diversity.

**Native fish:** Provide flows to support habitat and food resources and promote increased movement, recruitment and survival/condition of native fish.

**Invertebrates:** Provide habitat to support increased microinvertebrate and macroinvertebrate survival, diversity, abundance and condition.

**Other vertebrates:** Provide habitat to support survival, maintain condition and provide recruitment opportunities for frogs and turtles.

**Connectivity:** Maintain longitudinal connectivity along the lower Darling and with the Murray river, to support important environmental functions (see next objective).

**Processes/water quality/resilience:** Increase primary productivity, nutrient and carbon cycling, biotic dispersal and movement. Maintain suitable water quality for native plants and animals and provide refuge from adverse water quality events (e.g. hypoxic blackwater in the Murray). Maintain drought refuge habitat and maintenance/condition of native biota (e.g. fish and other aquatic fauna).

### 3.8.3 First Nations environmental objectives

Advice on environmental water objectives in the Lower Darling valley has been provided by the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) through the First Nations Environmental Water Guidance project. Table 1 includes just some of the common objectives for the Lower Darling catchment, selected as they were raised by 2 or more participating Nations for the region. It is important to note these objectives are not fully representative nor do they represent the detail, depth and complexity of Nations' localised water-related objectives.

Some of these objectives sit outside the scope of water for the environment to influence, while for others, the link between water for the environment and the site or issues is not well understood. Environmental flows will aim to contribute to identified objectives, where possible. The Commonwealth Environmental Water Holder (CEWH) is committed to continuing to strengthen engagement with all Southern Basin First Nations to support those Nations to articulate objectives for water management.

Whilst not all Traditional Owner groups participated in the project, the importance of the Baaka (Darling River) was not lost. Many participating Nations noted the Baaka as a priority for watering, despite the fact that this river is not part of their Traditional Country. This highlights the interconnectedness of cultural outcomes and the importance of a whole-of-system perspective. First Nations understand that cultural responsibility for sustaining river health, and the outcomes of custodianship, extend beyond the boundaries of one Nation's Country. Declining river health and low flows in the Baaka affects outcomes across the whole Southern Basin. It should be noted that the spelling of Baaka is being consulted on by the NSW Geographical Names Board for dual naming, and there are other spellings and pronunciations. Through place naming, communities have the opportunity to unlock past stories, preserve traditions, reawaken language and

provide a sense of belonging and identity. Barkindji were not provided full opportunity to input into the plan for 2020-21, and the CEWO aims to do better in working with Barkindji in our planning for future years.

**Table 1:** First Nations environmental water objectives for the Lower Darling for 2020-21 (MLDRIN, 2020)

<b>Waterways and Places in Need of watering</b>
Wetlands, Billabongs and Floodplains, Creeks, Major rivers, Other places, parks, forests, islands, Baaka.
<b>River Flows and Connectivity</b>
Improve water quality, Restore flows in degraded rivers, Improve timing and seasonality of flows, Improve tributary flows, Remove barriers and constraints.
<b>Vegetation</b>
Grasses, Lignum, Old Man Weed, Black Box, Reeds and Rushes.
<b>Fish</b>
Catfish, Murray Cod, Yellowbelly.
<b>Waterbirds</b>
Pelican, Birds, Swan, Ducks, Sea eagle <sup>i</sup> .
<b>Other species</b>
Frogs, Shrimp, Turtles, Mussels, Platypus, Yabbies, Emu <sup>i</sup> , Kangaroo <sup>i</sup> .

<sup>i</sup> Water for the environment targeting other environmental outcomes may influence this species or objective

### 3.8.4 Recent conditions and seasonal outlook

#### (a) *Recent conditions and environmental water use*

For the past 20 years, the lower Darling River has experienced increased frequency and duration of low-flow (most recently in 2014-15, 2018) or cease-to-flow (most recently 2015-16, 2019-20) conditions (DPI Fisheries 2020). The exception being between September 2016 to the start of December 2017, when environmental and consumptive flows provided welcome relief to both the lower Darling and the Great Darling Anabranh.

In the lower Darling River, environmental flows in spring of 2016 and 2017 supported Murray cod spawning and recruitment. A population census in winter 2018 found that the resulting cohorts comprised 28 per cent of the overall population structure, with 14 per cent from each cohort (Sharpe and Stuart 2018a). Subsequent water releases from the Menindee Lakes and down the Lower Darling in 2017 to meet consumptive needs were 'shaped' by ecologists and environmental water managers in collaboration with the river operators to promote the spawning and dispersal of other large-bodied native fish species such as golden perch and silver perch.

In the Great Darling Anabranh, environmental water releases contributed to positive responses in river red gum and black box vegetation communities fringing the anabranh, and facilitated the successful dispersal of native fish, particularly golden perch juveniles, from Lake Cawndilla, down the anabranh and ultimately to the River Murray (Sharpe and Stuart 2018a).

Details of these and other Commonwealth environmental water actions in the lower Darling River catchment are available at: <https://www.environment.gov.au/water/cewo/catchment/lower-murray-darling/history>.

The return of dry conditions in early 2018 had catastrophic impacts on the local ecology. Mass deaths of millions of fish occurred in the Darling River adjacent to the town of Menindee in in December 2018 and January 2019. As the lower Darling contracted to disconnected pools through 2019, many thousands more fish perished. Small remnant fish populations were supported through intervention such as relocation to

more secure waters and deployment of mechanical aerators at 10 locations in the Lower Darling and Menindee Lakes region.

Following rainfall across the northern Basin in early 2020, water again flowed to the Menindee Lakes. This provided an opportunity to 'restart' the lower Darling River, with a pulsed flow to reconnect with the River Murray in March/April 2020. This flow, along with subsequent provision of baseflows, has provided relief and improved conditions for remnant fish populations. As of 15 June 2020, the Menindee Lakes system collectively held approximately 27 per cent of active capacity. For the latest storage and release details for the lower Darling valley, visit: <https://www.waternsw.com.au/supply/regional-nsw/availability>.

#### *(b) Seasonal outlook*

According to the Bureau of Meteorology outlook (BoM 2020) there is an 75-80 per cent chance of above median rainfall in the lower Darling River valley between July and September 2020. Across the northern catchments that provide inflows to the lower Darling system, there is a 65 to 80 percent chance of above median rainfall - noting that inflows to Menindee Lakes can vary within and between seasons.

While this forecast indicates that the severe dry conditions are somewhat eased, several months of above average rainfall are needed to see a recovery from the current long-term drought. Additionally, maximum temperatures are likely to remain average over the coming months.

#### *(c) Water availability*

The volume of Commonwealth environmental water to be carried over in the lower Darling for use in 2020-21 is approximately 10.8 gigalitres.

Water resource availability remains low, with the potential for any improvement reliant on further inflows to the Menindee Lakes system from the northern Basin. As at 1 July 2020, full (100 per cent) allocation has been provided for high security entitlements and 30 per cent allocation has been provided for general security entitlements (DPIE-Water 2020), which adds an additional 10.7 gigalitres available against the Commonwealth's entitlements for use in 2020-21. A total of 21.5 gigalitres is available as at 1 July 2020.

#### *(d) Environmental demands*

The environmental water demands for assets in the lower Darling River valley in 2020-21 are represented in Table 2. Note that the capacity to contribute to some of these environmental demands is contingent on a substantial improvement in water availability in the catchment.



**Table 2:** Environmental demands, priority for watering in 2020–21 and outlook for coming year in the lower Darling River valley.

Environmental assets	Indicative demand (for all sources of water in the system) <sup>1</sup>		Watering history  (from all sources of water)	2020–21		Implications for future demands  Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21	
	Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?		
<b>Menindee Lakes<sup>1</sup></b> · Native fish: survival, dispersal & recruitment of flow pulse specialists in Lakes and dispersal downstream · Vegetation: non-woody wetland, lignum, fringing river red gum, low-lying black box and coolibah · Waterbirds: maintain habitat, potential breeding · Ecosystems: refuge, productivity	<b>Lake Menindee:</b> 60 GL (1.5 m, 56 m AHD) <b>Lake Cawndilla:</b> 50 GL (1.5 m, 53.8 m AHD) Timing: anytime of year, filling to be triggered by upstream flows in the Barwon-Darling River system Min duration: 3-5 months    Max duration: 3 years	6-8 years in 10 (Menindee: 2 years, very important to have a refill event before it dries again) (Cawndilla: 3 years)	The lakes last refilled in 2016-17 (total storage ~1 730 GL). Forecast storage in 2020 is ~580 GL (i.e. < 35%).	Critical	Lake levels primarily rely on upstream inflows and larger natural events. Commonwealth environmental water deliveries will consider environmental needs in both the Lakes and lower Darling River system and will look to where the most effective use of available environmental water.	Critical	
	<b>Lake Menindee:</b> 116 GL (1.8 m, 56.5 m AHD) <b>Lake Cawndilla:</b> 84 GL (2.2 m, 54.5 m AHD) Timing: anytime of year, filling to be triggered by upstream flows in the Barwon-Darling River system Min duration: 3-5 months    Max duration: 1-2 years	3-5 years in 10 (4 years)		Moderate		Moderate	
	<b>Lake Menindee:</b> 57.5 m AHD <b>Lake Cawndilla:</b> 57.5 m AHD Timing: anytime of year, filling to be triggered by upstream flows in the Barwon-Darling River system Min duration: 3-5 months    Max duration: 1 year	1.5 year in 10 (8 years)		Moderate		Moderate	
<b>Lower Darling River<sup>1</sup></b> · Native fish: spawning, nesting and recruitment (riverine specialists, generalists). · Ecosystem functions: longitudinal connectivity, refuge habitat, small-scale productivity	Elevated baseflows above minimum releases through to River Murray for water quality and fish habitat requirements (400 ML/d at Weir 32).	Continuous (if limited water, focus on baseflows during spring and summer).	Very low and cease-to-flow conditions in 2014-15 and 2015-16. Small to moderate spring pulse was achieved in 2016-17 and, to a lesser extent, in 2017-18. Cease-to-flow conditions commenced in 2018–19 and persisted for most of 2019-20. Resumption of flows in late 2020 peaking at 3 500 ML for a few weeks in March and April 2020 with a return to baseflows of at least 200-400 ML/day expected for at least 12 months.	Critical	A high priority for Commonwealth environmental watering 2020-21 (likely to receive water even under low water resource availability)	High	
	Small to moderate river pulse (up to 800 ML/d at Weir 32 in spring and summer).	1-2 in 5 years (max interval unknown)		Critical			A high priority for Commonwealth environmental watering 2020-21 subject to water resource availability
	Small fresh (up to 2 000 ML/d at Weir 32 for ~60 days in summer) for Murray cod breeding.	2-4 years in 10 (5 years)		High			Option to be considered under a moderate to high water resource availability
<b>Floodrunners and fringing lakes<sup>1</sup></b> · Native fish: spawning (flow pulse specialists), dispersal (all species), · Waterbirds: foraging habitat, support natural breeding events · Ecosystem functions: lateral connectivity, dispersal of biota, channel maintenance, productivity, nutrient/carbon exchange · Other: frog habitat and breeding	10 000 – 12 000 ML/d at Weir 32, ideally August-October or January-April (or anytime) for a minimum of 14 days (to achieve 2-6 months of wetland inundation)	5-8 years in 10* (2 years) * annual event for 2-3 consecutive years for recovery of wetland vegetation	Small overbank flow in 2011-12.	Moderate	Reliant on large, unregulated flows.	Moderate	

Environmental assets	Indicative demand (for all sources of water in the system) <sup>1</sup>		Watering history  (from all sources of water)	2020–21		Implications for future demands  Likely urgency of demand in 2021–22 if watering occurred as planned in 2020–21
	Flow/Volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)	Potential Commonwealth environmental water contribution?	
<b>Great Darling Anabranch<sup>1</sup></b> · Native fish: recruitment and dispersal of flow pulse specialists · Native vegetation: non-woody, fringing river red gum, black box, lignum · Waterbirds: habitat and potential breeding · Ecosystem functions: refuge; productivity	> 800 ML/day (800-2 000 ML/day) from Menindee Lakes for minimum 21 days.	2-3 in 10 years (4 years)	Environmental water in-channel flows in spring 2013 to reconnect residual pools, supporting recovery of riverine and wetland communities through dispersal opportunities and improving riparian vegetation. A significant e-water action occurred in summer of 2017, allowing for dispersal of large bodied native fish and improved water quality and vegetation condition. No flows have been provided down the Anabranch since then.	Moderate	Lower priority for Commonwealth environmental water. Lower Darling is a higher priority, particularly given a very low to low resource availability forecast for 2020-21.	Moderate

**References:**

- Information on flow/volume and required frequency of indicative demands drawn from the draft Murray-Lower Darling Long Term Water Plan (DPIE-Water 2019), as appropriate.

**Key - potential watering in 2020-21**

High priority for Commonwealth environmental watering (likely to receive water even under low water resource availability)
Secondary priority for Commonwealth environmental watering (watering to occur only if natural trigger is met, or under moderate - high water resource availability); or water demand likely to be met via other means
Low priority for Commonwealth environmental watering (under high - very high water resource availability)
Unable to provide Commonwealth water because of constraints or insufficient water

**Key - environmental demands**

Critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage
High demand for water i.e. needed in that particular year
Moderate demand for water i.e. water needed that particular year and/or next
Low demand for water i.e. water generally not needed that particular year
Very low demand for water i.e. water generally not needed that particular year or the following year

Note that demand is considered at a generalised scale; there may be specific requirements that are more or less urgent within the flow regime

### 3.8.5 Water delivery in 2020–21

Based on the demand for water for the environment, water availability (supply), and catchment conditions, the overall purpose for managing Commonwealth water for the environment in the lower Darling River valley in 2020-21 is to avoid further damage or decline to environmental assets and support recovery of the system if water availability improves.

The highest priority will be to provide elevated baseflows in spring to support Murray cod breeding and recovery of a variety of other aquatic biota (e.g. mussels and snails). The magnitude of the flow will depend on water availability. A small spring fresh of up to 2 000 ML/day to target both Murray cod and golden perch recruitment may be considered if water availability significantly improves.

Golden perch spawning has also been recorded upstream in response to flow in the Barwon-Darling and its tributaries. Young fish have been recorded dispersing with these flows to the Menindee Lakes nursery habitat (Sharpe and Stuart, 2018a) and delivery of environmental water will provide an opportunity for some of these to ultimately disperse further into the lower Darling and potentially into the River Murray.

Deliveries to the Great Darling Anabranh will only be considered if water availability significantly improves and there is sufficient inflow into Lake Cawndilla.

Environmental flows will be designed with native fish ecologists and in close consultation with the local community, including First Nations people. Consideration will also be given on water levels in the Menindee Lakes and its associated environmental values.

### 3.8.6 Monitoring and Lessons learned

#### *(a) Monitoring*

In the lower Darling River, monitoring is primarily undertaken by NSW agencies including NSW DPIE (vegetation, waterbirds and frogs), NSW DPI – Fisheries (native fish), and WaterNSW (hydrology and flow delivery data).

Several short-term intervention monitoring projects were conducted to assess the success of environmental flows in 2016-17 and 2017-18. The projects both demonstrated the success of the flows in achieving the desired outcome and informing real-time adaptive management of the flows.

Technical reports from short term monitoring projects in the lower Darling can be found at:

<https://www.environment.gov.au/water/cewo/publications/assessment-murray-cod-recruitment-lower-darling-river-flows-2016-18> (Sharpe and Stuart 2018a).

<https://www.environment.gov.au/water/cewo/publications/environmental-flows-darling-river-fish-2016-17> (Sharpe and Stuart 2018b).

<https://www.environment.gov.au/water/cewo/publications/environmental-flows-support-murray-cod-spawning-lower-darling-river-2017> (Sharpe 2019).

A monitoring program drafted to assess environmental flows delivered in 2020-21 will be scoped early in the water year.

#### *(b) Lessons learned*

Outcomes from monitoring in previous years are critical in our commitment to the effective and efficient use of Commonwealth water for the environment.

Monitoring in the lower Darling River (2016-17 and 2017-18) and the Great Darling Anabranh (2016-17) showed environmental flows were successful in supporting tangible and significant multi-species outcomes for native fish. Where possible, maintaining the function of the Menindee Lakes and lower Darling River is critical for Murray cod spawning and recruitment, the dispersal and recruitment of golden perch from their nursery grounds in the Menindee Lakes, and spawning of golden perch and the nationally threatened silver perch in the lower Darling River channel (Sharpe and Stuart 2018a and b, Stuart and Sharpe 2020).

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