



Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water Office Water Management Plan 2021–22

Chapter 4 Condamine–Balonne Valley Water Plan

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Cataloguing data

This publication (and any material sourced from it) should be attributed as: Commonwealth of Australia 2021, *Commonwealth Environmental Water Office Water Management Plan 2021–22: Condamine-Balonne Valley Water Plan*, Canberra. CC BY 4.0.

ISBN 978-1-76003-434-4

This publication is available at environment.gov.au/water/cewo/publications/water-management-plan-2021-22.

For more information about Commonwealth environmental water, contact us at:

Commonwealth Environmental Water Office

Department of Agriculture, Water and the Environment

GPO Box 858 Canberra ACT 2601

Telephone 1800 803 772

Email ewater@awe.gov.au

Web environment.gov.au/water/cewo

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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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4 Condamine–Balonne Valley Water Plan

4.1 Region overview

4.1.1 River system

The Condamine–Balonne Valley is one of the largest catchments in the Murray–Darling Basin and covers the north eastern corner of the Basin. The system is bounded by the Moonie Valley to the east, the Warrego Valley to the west and the Barwon River in the south (Map CB1 Condamine–Balonne Valley and surrounding systems, including an inset of the internationally significant Narran Lakes system.). The main rivers of the Valley, the Condamine and the Maranoa, originate in elevated country in Queensland to the east and north respectively. Two-thirds of the Valley is flat floodplain country further to the west and south, with a complex system of rivers and creeks joining and breaking away from the Balonne River as it moves downstream of St George – this region is generally referred to as the Lower Balonne Floodplain (MDBA 2021).

While the Culgoa and Bokhara rivers flow to the Barwon River, most rivers in the Valley end in lakes and wetlands in south west Queensland and north-west New South Wales (NSW). Most of the Valley is located in Queensland with only 16% in NSW (MDBA 2021).

The Valley’s extensive floodplains provide habitat for a diverse range of plants, including endangered vegetation communities. The region also provides habitat for waterbirds, native fish and many vulnerable and endangered species. There are several wetlands of national importance in the region, as well as the Ramsar-listed Narran Lake Nature Reserve.

The extent of river regulation in the Condamine–Balonne is relatively low. Public dams account for only 13 % of stored water in the Valley. The two largest public storages are Leslie Dam (106 gigitalitres) near Warwick, and Beardmore Dam (82 gigitalitres) near St George, which were built in the 1960s to secure town water and irrigation supplies (MDBA 2021).

Large-scale irrigation in the region is supported by large capacity pumps or regulating structures that divert water during natural flow events into private on-farm storages for later use. Most of the water use and entitlement is in the form of diversion of river flows and water during natural flow events that breaks out of rivers and becomes overland flows across floodplains.

4.1.2 Traditional Owners

The lands of the Condamine–Balonne Valley have been important to Aboriginal people for thousands of years. Many First Nations retain a connection with the region, and their history, culture and livelihoods are closely intertwined with its river systems. First Nations of the region include Barunggam, Bidjara, Bigambul, Euahlayi, Gomeroi/Kamilaroi, Giabel, Githabul, Gunggari, Guwamu/Kooma, Jarowair, Kambuwal, Mandandanji, Murrawarri, and Wakka Wakka. The Commonwealth Environmental Water Office (CEWO) respectfully acknowledges these Nations, their Elders past and present, as the Traditional Custodians of the lands on which this chapter is focused.

4.1.3 Important sites and values

The floodplains of the Condamine–Balonne Valley are ecologically significant because they support endangered ecological communities, such as the brigalow–gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions (DSITI and DNRM 2017). The wetlands support a diverse range of flora and fauna, provide habitat for migratory birds and vulnerable and endangered species, such as silver perch, Murray cod, freckled duck, Australian painted snipe, the great egret and the cattle egret.

The Lower Balonne is a complex floodplain channel system containing a number of nationally significant wetlands, as well as the internationally significant Narran Lakes Ramsar-listed wetlands. Wetlands of national importance include the Great Artesian Basin Springs, Lake Broadwater, the Gums Lagoon, the Culgoa River Floodplain, and the Dalrymple and Blackfellow creeks (MDBA 2021).

Narran Lake Nature Reserve

The Ramsar site within the Narran Lake Nature Reserve is in north-west NSW about 50 km east of Brewarrina. One section of the site was listed under the convention in 1999, and a further 3,104 ha section was added in 2015. The site was extended to encompass more breeding and feeding habitat for waterbirds. Currently the site covers a total area of 8,447 ha and comprises the whole floodplain area within Narran Lake Nature Reserve. The site was listed under the Ramsar Convention because of its significant values, which include:

- some of the largest expanses of lignum in NSW
- the ability to support:
 - three wetland dependent threatened species – Australasian bittern, Murray cod and winged peppergrass
 - a large number of migratory bird species, including 19 listed under international agreements
 - substantial breeding of waterbirds, including colonial nesting species such as ibises, cormorants, egrets and spoonbills.
- the capacity to provide drought refuge for waterbirds following floods (Butcher et al. 2011).

The Nature Reserve is also important to Aboriginal people and they are involved in managing the site through the Narran Lake Nature Reserve Aboriginal Co-Management Committee. Key values of the site for Aboriginal people include:

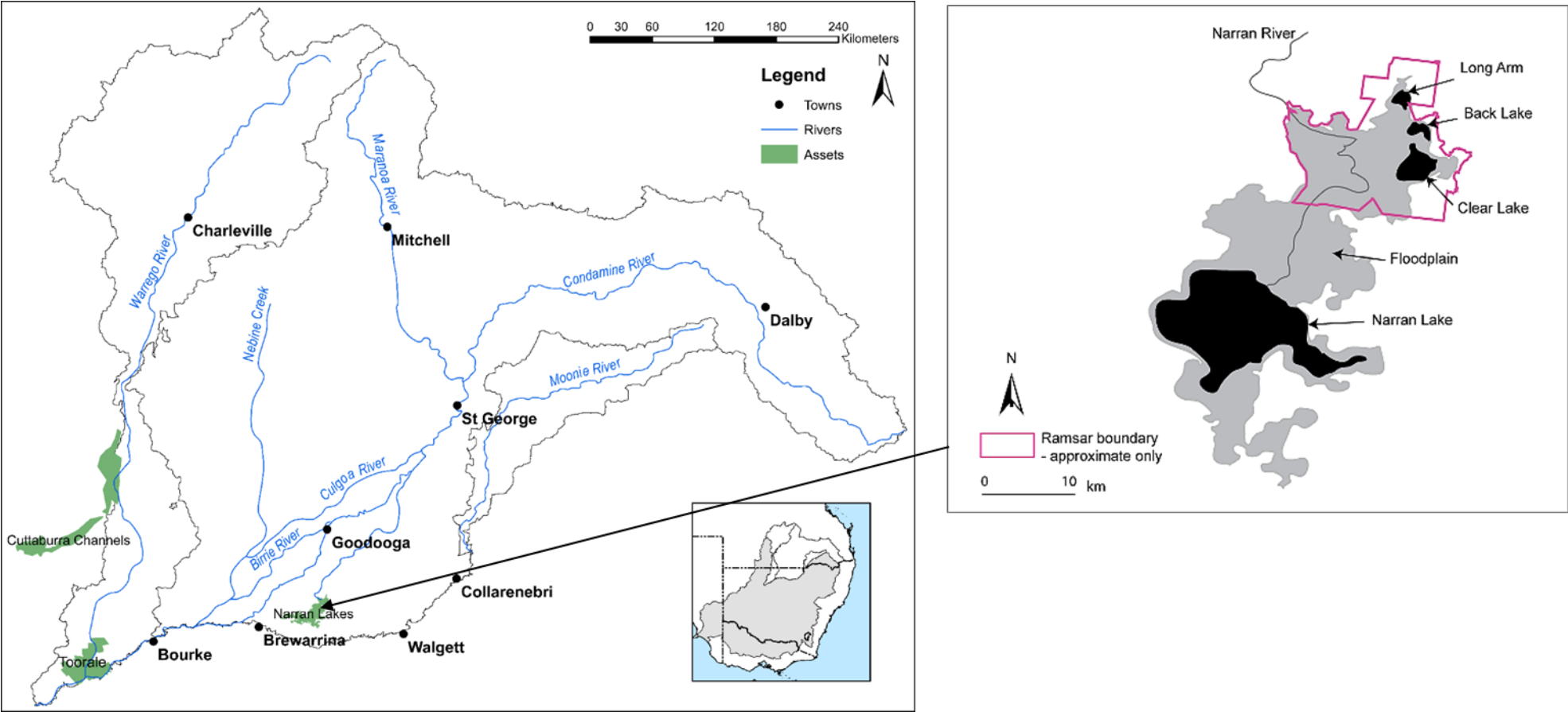
- its role as a traditional meeting place for Aboriginal tribes in the region
- the culmination of several Dreaming paths at the lakes
- many relatively undisturbed Aboriginal objects.

4.1.4 Stakeholder engagement

In the Condamine–Balonne system, the planning and management of Commonwealth water for the environment is undertaken in conjunction with a range of partners and stakeholder groups. Key stakeholders include: the Queensland Department of Regional Development, Manufacturing and Water (DRDMW); Queensland Department of Environment and Science (DES); Queensland Department of Agriculture and Fisheries (DAF); NSW Department of Planning, Industry and Environment (DPIE); NSW Department of Primary Industries (DPI) – Fisheries, NSW National

Parks and Wildlife Service, SunWater; WaterNSW; several Aboriginal organisations in the Lower Balonne; the Narran Lake Nature Reserve Aboriginal Joint Management Committee; and the Lower Balonne Working Group.

Map CB1 Condamine–Balonne Valley and surrounding systems, including an inset of the internationally significant Narran Lakes system.



Source: CSIRO (2007)

4.2 Environmental objectives

Based on long-term environmental objectives in the Basin Plan, state long-term watering plans, site management plans, and best available knowledge, the following objectives are relevant for environmental watering in the Condamine-Balonne Valley.

The objectives that are 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 (CEWO) commitment to adaptive management. The objectives are:

- Vegetation – Maintain and improve the condition, growth and survival of riparian, in-channel, floodplain and wetland vegetation.
- Waterbirds – Increase waterbird abundance and maintain species diversity by supporting naturally triggered breeding events, and maintaining suitable refuge, feeding and breeding habitat at targeted floodplain sites.
- Native fish – Improve habitat condition, and support different life stages (migration, spawning, recruitment and refuge), natural flow variability, and connectivity between river channels, wetlands, anabranches and floodplains.
- Other vertebrates and invertebrates – Support opportunities for the reproduction and recruitment of other native aquatic species, including frogs, platypus, native water rats, turtles, and freshwater mussels.
- Connectivity – Support longitudinal connectivity, including with the Barwon River, and lateral connectivity between the river, wetlands and floodplains.
- Processes/water quality/resilience – Support key ecosystem functions and promote productivity, maintain water quality in channels and pools, and maintain drought refuge habitat.

4.3 First Nations environmental watering objectives

The CEWO is committed to working with First Nations groups to better understand their objectives. The CEWO will use environmental flows to contribute to these objectives where possible and where this is consistent with the Commonwealth Environmental Water Holder's statutory responsibility of protecting and restoring environmental assets in the Basin (see [Chapter 2](#)).

As the next steps, CEWO will develop and implement a work program to work with First Nations groups in the northern Basin. This work program will be developed in collaboration with First Nations groups and will be integral in continuing to build relationships and our capacity with First Nations groups. It will also ensure First Nations groups actively participate in the planning and management of environmental flows.

4.4 Recent conditions and seasonal outlook

4.4.1 Recent conditions and environmental water use

Following flows in early 2020, most of the upper Condamine catchment experienced below or very much below average rainfall for the remainder of the calendar year. Rainfall in late October and November 2020 produced inflows into Beardmore Dam totalling 1,500 megalitres. This

water was released for environmental, stock and domestic use over six days from 11 to 16 November 2020 and the flow reached Hastings Weir on the Balonne-minor River.

Widespread rainfall across the Valley began in January 2021 with some areas receiving up to 200mm in March. This rainfall led to further environmental stock and domestic releases from Jack Taylor Weir with water harvesting announcements commencing on Sunday 21 March for 21 days. The flow event rule to support Narran Lakes was applied from 22 March, which reduced daily rates of take by 10 per cent for 10 days.

More than 330 gegalitres (GL) flowed passed the St George gauge from January to May 2021. This inflow was important, but relatively small: only one-third of the historical annual average and less than a quarter of the 1,442 GL that passed St George in early 2020. Commonwealth water for the environment contributed around 43 GL across the Queensland Lower Balonne rivers during March and April 2021. Over 36 GL of this water passed the New South Wales border, contributing to flows downstream in the Darling River. The Commonwealth portfolio also contributed around 3 GL from the Nebine Creek at the NSW border.

Flow rates and total flow volumes for various parts of the Lower Balonne network are shown (Table CB1). This water will help build on the environmental benefits achieved from last year’s flow event.

Table CB1 Maximum flow rate, duration and total flow volume at key flow gauges across the Lower Balonne distributaries from 1 February to 30 May 2021

Site	Description	Maximum Flow Rate (ML/d)	Flow Duration (Days)	Total Flow Volume (ML)
Wilby Wilby (Narran River)	Located mid-way between the Queensland/NSW border and the Narran Lake Nature Reserve	2,394	50	34,860
Narran Park (Narran River)	Located on the western boundary of the Narran Lake Nature Reserve	1,821	50	31,291
Brenda (Culgoa River)	Located near the Queensland/NSW border	3,714	97	88,272
Downstream of Collerina (Culgoa River)	Downstream of where Nebine and Birrie systems connect to the Culgoa River. The most downstream gauge	4,817	107	150,064
Bokhara (Bokhara River)	The most downstream gauge	468	73	13,122

Learn more about previous [Commonwealth environmental water use in the Condamine–Balonne Valley](#).

4.4.2 Seasonal outlook

According to the Bureau of Meteorology outlook on 3 June 2021, above median rainfall is forecast to occur across the Condamine–Balonne system through winter into spring (BoM 2021a,b). Follow up rain over the coming summer is needed to ensure continued recovery from the drought. Despite river flows ceasing again in early-winter, wetter conditions can return suddenly in this region. Maximum temperatures are also forecast to remain below average over the coming months (BoM 2021c,d).

4.4.3 Water availability

The Condamine-Balonne’s two main public storages have a combined storage volume of 188 gigalitres, while the average annual stream flow at St George is 1,305 gigalitres. Thus, entitlements reliant on regulated releases from these storages are relatively small compared to the entitlements used to access unregulated or natural flow events. Consistent with this, Commonwealth environmental water holdings in the Condamine–Balonne system are almost exclusively made up of unregulated entitlements and can only be sourced as a share of an unregulated flow event determined by entitlement conditions.

Availability of water for the environment in the Condamine–Balonne depends on the nature of flow events that occur. Unregulated entitlements provide opportunistic access to unregulated river flows and overland flows when water resource plan rules are triggered, and a period of access is announced. Each entitlement will contribute to restoring flows reflecting its particular flow access windows, take rates and location. Daily, instantaneous, annual or multi-year limits cap overall diversions in any given year or flow event, and likewise the flow contributions that can be attributed to unregulated Commonwealth entitlements.

4.4.4 Environmental demands

The environmental water demands for assets in the Condamine-Balonne Valley in 2021–22 are shown in Table CB2. The capacity to contribute to these environmental demands is contingent on the Commonwealth licences being triggered by natural flow events.




Table CB2 Environmental demands in 2021–22 in the Condamine–Balonne Valley

Environmental assets	Target values	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)	2021–22
	Physical and process assets	Flow/volume	Required frequency (maximum dry interval)		Environmental demands for water (all sources)
Lower Balonne River channels (Culgoa River, Narran River and inner distributary channels) and Barwon–Darling	Drought refuge (waterholes)	Flow reaches end of all channels within a three-month period, indicated by: <ul style="list-style-type: none"> 30 ML/day Birrie River at Talawanta for 1 day 30 ML/day Bokhara River at Bokhara for 1 day 30 ML/day Culgoa River at Weilmoringle for 1 day 30 ML/d Narran River at Narran Park for 1 day 	Annually (no longer than 12 months between last flow)	Since 2011–12 flow requirements for the maintenance of drought refuges in the four rivers have been met in most years, including 2020–21. Water is required annually to replenish refugial waterholes (contributing to persistence, connectivity and quality). Therefore the demand is high. The demand should be met by planned environmental water (environmental, stock and domestic flows). After a water harvesting event has been announced, water left in the river as a result of the Commonwealth owning licences will be distributed across channels in the lower Balonne	High
	Culgoa River for longitudinal connectivity	Small in channel fresh 1,000 ML/day at Brenda for 7 days	8 in 10 years	Small freshes have occurred 7 in 10 years, including this year. However, the average required frequency has not been met so the requirement for this demand is high.	High
	Narran River for fish migration	Large in-channel fresh 1,700 ML/day at Wilby (August–May) for 14 days	4–6 in 10 years	Large in-channel freshes have been met in 3 of the past 10 years and only once (in 2020) since 2013. The average required frequency has not been met so the requirement for this demand is critical.	Critical
	Culgoa River for fish migration	Large in-channel fresh 3,500 ML/day at Brenda (August–May) for 14 days	4–6 in 10 years	The last large in-channel fresh that met the demand occurred 9 years ago. A large fresh is required in 2021–22 to provide opportunities for the dispersal and recruitment of native fish species.	Critical
Lower Balonne floodplain	Connectivity with the riparian zone	9,200 ML/day Culgoa River at Brenda for 12 days	Every 2 to 3 years	The last flow of this magnitude occurred 9 years ago, which exceeds the critical interval (3 years) to maintain condition of river red gum, ephemeral wetlands and lignum communities. Inundation is required in 2021–22 to maintain ecosystem health and function.	Critical
	Connectivity with the inner floodplain	15,000 ML/day Culgoa River at Brenda for 10 days	Every 3.5 to 4 years	The last flow of this magnitude occurred 9 years ago. Inundation is required in 2021–22 to maintain ecosystem health and function.	Critical
	Connectivity with the mid floodplain	24,500 ML/day Culgoa River at Brenda for 7 days	Every 6 to 8 years	The last flow that met the demand occurred 9 years ago. Inundation is required within the next year to maintain ecosystem health and function.	Critical
	Connectivity with outer floodplain	38,000 ML/day Culgoa River at Brenda for 6 days	Every 10 to 20 years	The last flow that met the demand occurred 9 years ago. Inundation is required within the next year to maintain ecosystem health and function.	Critical
Narran Lakes	Waterbird breeding habitat in northern lakes (Ramsar site)	25 GL at Wilby Wilby (Narran River) over 60 days	Every 1 to 1.3 years	This demand has been met 4 out of the past 10 years, which is much less than the overall required frequency range, despite being met the last two years. This demand is considered a priority for event-based mechanisms.	High
	Waterbird breeding and foraging habitat northern lakes zone	50 GL at Wilby Wilby over 90 days	Every 1.3 to 1.7 years	This demand has been met 3 out of the past 10 years, which is much less than the required frequency range, and most recently in 2020. This demand is considered a priority for event-based mechanisms.	Critical
	Trigger and maintain large scale colonial waterbird breeding	154 GL at Wilby Wilby over 90 days	Twice in every 8 to 10 years	This demand was last met 9 years ago. An acute and chronic shortage of waterbird breeding across the Basin and the likelihood of this demand not being met in the long term, increases its urgency. This demand is considered a priority for event-based mechanisms.	Critical

Water all floodplain and wetland habitat in Narran Lakes complex, initiate waterbird breeding, provide long-term refuge	250 GL over 180 days at Wilby Wilby	Every 10 to 12 years	This demand was met 9 years ago. Following the 2010–11 and 2011–12 floods, the critical interval for inundation will be from 2022 (if not received before then).	Low
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Key

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

-  High to critical demand for water (needed in that particular year or urgent in that particular year to manage risk of irretrievable loss or damage)
-  Moderate demand for water (water needed in that particular year, the next year, or both)
-  Low demand for water (water generally not needed in that particular year)

4.5 Water delivery in 2021–22

Unregulated entitlements provide opportunistic access to river flows and overland flows when water levels exceed trigger values at certain locations, as specified in the entitlement conditions. Each triggered Commonwealth environmental water entitlement leaves water in the river which could otherwise be extracted. This makes a contribution to restoring natural flows, reflecting its particular flow access windows, take rates and location. The location and size of the event will influence which environmental demands Commonwealth environmental water contributes to (Table CB2).

The Commonwealths water harvesting allocations will contribute to all flows during water harvesting periods, and thus are able to contribute to all environmental demands listed in Table CB2. The characteristics of the overland flow licences are such that in wetter years there will be a higher yield of water against these overland flow licences than in drier years. These licences will generally contribute to meeting fish migration, Lower Balonne floodplain and Narran Lakes demands during wetter years.

The CEWO will consider implementing an event-based mechanism in 2021–22 to contribute to meeting the waterbird breeding and foraging habitat demands that are listed as high and critical in Table CB2. If a medium sized flow event occurs, the CEWO may offer to reimburse water licence holders in the Lower Balonne river system (via an ad-hoc grant) to not pump water from the river. The trigger flow volume will be between 250 to 500 gigalitres at St. George. If colonial nesting waterbird occurs in the Narran Lakes Nature Reserve in 2021–22, a release from storage option may be considered to mitigate the risk of nest abandonment.

4.6 Monitoring and lessons learned

4.6.1 Monitoring

In the Condamine–Balonne Valley, monitoring is undertaken by Queensland and NSW agencies, including Queensland DRDMW and DES (flow, hydrology, water quality, native fish) and NSW DPIE (vegetation, waterbirds and other animals), NSW DPI – Fisheries (native fish), and WaterNSW (hydrology and flow delivery data). The CEWO is also funding several short-term intervention monitoring projects to evaluate the environmental responses of native fish, waterbirds and vegetation in the Condamine–Balonne.

Learn more about [monitoring activities funded by the CEWO in the Condamine-Balonne Valley](#).

4.6.2 Lessons learned

Outcomes from monitoring and lessons learned in previous years are a critical component for the effective and efficient use of Commonwealth water for the environment. These learnings are incorporated into the way environmental water is managed.

Key findings from fish, aquatic habitat and flow monitoring in the Condamine–Balonne Valley are summarised in Table CB3.

Table CB3 Key lessons learned from monitoring in the Condamine–Balonne Valley

Theme	Lessons learned
Native fish and aquatic invertebrates	<ul style="list-style-type: none"> Only 10% of the river channel network in the Condamine–Balonne retained water at the peak of the 2018–20 drought. Native fish moved from the few remaining refuges into previously dry waterholes during the autumn 2020 flow. The project findings are helping to identify river segments where drought poses the greatest risks to fish population viability and the barriers that pose the greatest threat to post-drought recovery. The project will help assess and prioritise the management of risks to fish population viability from drought and fragmentation by barriers in any non-perennial river setting (Marshall & Lobegeiger 2020; Marshall & Lobegeiger 2021).
Aquatic habitat	<ul style="list-style-type: none"> The CEWO has funded a short-term intervention monitoring (STIM) project on vegetation condition at Narran Lakes from early 2020 to December 2021. Preliminary results suggest that vegetation of all community types suffered as a result of drought in recent years. River red gums were the most affected tree species. The vegetation in some areas of the Nature Reserve is showing signs of recovery following inundation in autumn 2020, but in other areas, the vegetation is yet to show signs of recovery. Monitoring has shown that follow-up watering was required to consolidate condition and resilience benefits from the 2020 watering (UNE 2020).
Connectivity	<ul style="list-style-type: none"> The Condamine–Balonne, including the Nebine Creek, provide important tributary inflows to the Barwon–Darling during unregulated flow events (WaterNSW 2021). Cross-border accounting arrangements being developed by Queensland and NSW with input from the Commonwealth will help track environmental water from the Queensland Condamine–Balonne into the NSW downstream to the Barwon–Darling. Active management arrangements in NSW will also provide better protection of the Commonwealth’s environmental water in the Barwon–Darling from water flowing from the Condamine–Balonne and other unregulated Barwon–Darling tributaries.
Waterbirds	<ul style="list-style-type: none"> Regular waterbird surveys undertaken by state agencies since flows in 2020 detected thirty species, including freckled duck, plumed duck, pelicans and darters. Straw-necked ibis were also detected but no breeding was evident. During the March–April 2021 flow event to the Nature Reserve 33 species of waterbird were observed.

References

BOM 2021a, [Rainfall—The chance of above median for June to August 2021](#), Bureau of Meteorology, Canberra, accessed 11 May 2021.

—2021b, [Rainfall—The chance of above median for July to September 2021](#), Bureau of Meteorology, Canberra, accessed 11 May 2021.

—2021c, [Temperature—the chance of above median maximum temperature for June to August](#), Bureau of Meteorology, Canberra, accessed 11 May 2021.

—2021d, [Temperature—the chance of above median maximum temperature for July to September](#), Bureau of Meteorology, Canberra, accessed 11 May 2021.

Butcher R., Hale J., Capon S., and Thoms M. 2011, *Ecological Character Description for Narran Lake Nature Reserve*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

CSIRO 2007. *Water availability in the Condamine-Balonne. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project*. Commonwealth Science and Industrial Research Organisation, Australia.

DSITI and DNRM 2017, *Improving the understanding of water availability and use by vegetation of the Lower-Balonne Floodplain*, Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines, The State of Queensland.

Marshall, J & Lobbeiger, J 2020, *Fish population resilience following severe drought in the Northern Murray-Darling Basin: progress report 1 incorporating highlights and conceptual models from water drought mapping and flow connectivity analysis*. Queensland Department of Environment and Science, Brisbane.

—2021, *Investigations into fish population resilience following severe drought in the northern Murray-Darling Basin: progress report 2 incorporating highlights from first field sampling*. Queensland Department of Environment and Science, Brisbane.

MDBA 2021, [Condamine Balonne catchment overview](#), Murray Darlin Basin Authority, accessed 7 June 2021.

NSW DPIE 2020, [Intersecting Streams Long-Term Water Plan Part A and B: Draft for exhibition](#).

NSW Department of Planning, Industry and Environment Parramatta, accessed 25 May 2021.

WaterNSW 2021, [Operations update Northern NSW rainfall event 24 May 2021](#), WaterNSW, Sydney, accessed 2 June 2021.

UNE 2020, *Naran Lakes vegetation short term intervention monitoring project update*, University of New England.