Water for the environment

Southern Connected Basin Environmental Watering Committee

Annual Report 2020-21



Acknowledgement of the Traditional Owners of the Murray–Darling Basin

SCBEWC agencies would like to acknowledge and pay respect to the Traditional Owners of the Murray–Darling Basin and their Nations, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. SCBEWC agencies understand the need for recognition of Traditional Owner knowledge and cultural values in natural resource management in the Basin. SCBEWC agencies hope that by continuing to work closely with Traditional Owners and First Nations People we can help in the journey to heal the land, Country and Peoples of the Basin.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.



Photo above: Aerial view of Barmah Lake (Source: K Ward) Cover photo: Spotted marsh frog at Reedy Lagoon, Gunbower Island (Source: P Brown)



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Southern Connected Basin Environmental Watering Committee

Who we are

The Southern Connected Basin Environmental Watering Committee is the coordination forum that supports the delivery of water for the environment in the River Murray system and connected tributaries across multiple environmental water holders and jurisdictions.

Why

Water for the environment improves the health and water quality of rivers, wetlands and floodplains. Healthier landscapes can support an abundance of native wildlife including fish, birds and frogs.

Healthy rivers benefit all river users and are vital to our economy as well as underpinning community and cultural health and wellbeing.



Our impact

Recovering the health of significant sites in the southern Basin will take time, however we are documenting steady improvements in areas that are regularly watered.

Increasing collaboration has seen environmental water holders combine water deliveries to achieve larger and more effective watering events throughout the southern connected Basin.

2020-21 highlights included replenishing flows in the Lower Darling (Baaka) which successfully supported early steps for native fish population recovery in this reach following the mass fish deaths of 2018-19. In the River Murray, over 320 gigalitres of water for the environment was delivered through the multi-site Southern Spring Flow to connect thousands of kilometres of river, improve water quality and boost productivity to feed plants and animals.

Southern Connected Basin Environmental Watering Committee

2020-21 in review





Moderate conditions

3,279 GL water available*



2,323 GL delivered to multiple sites (use & re-use)[#]



coordinated

events between water holders

5

~ **30%** of flow the SA border

Watering overview

In our largest coordination effort yet, we collaborated to deliver the 2020 Southern Spring Flow – a river pulse designed by carefully timing releases of water for the environment in the Murray, Goulburn and Murrumbidgee rivers to deliver water to 5 wetlands of international significance, provide a system-wide productivity boost and improve connectivity down the river to the Coorong and Murray Mouth.

Community overview

Communities faced a challenging second year affected by the COVID-19 pandemic, although easing climatic conditions provided some respite from drought. Virtual regional engagement events have supported communities to continue to participate in planning for water for the environment. First Nations engagement continues to be a priority. Environmental water holders have worked to improve transparency about planning and use of water for the environment and the shared benefits of healthy Country.



Azure kingfisher (left) and long-necked turtle (right) in Millewa Forest (Source: C. Tzaros)

*Note – The water available includes held and planned environmental water that can be actively delivered to sites (2,787 GL) and carryover from 2019-20 (492 GL). This figure is reported for all environmental water holders. # The amount of water delivered to sites is sourced from Basin Plan Matter 9.3 annual reporting. 2020-21 SCBEWC Annual Report

Key messages

Improvements in river flows, but many floodplains remain stressed

2020-21 saw improved inflows to many river systems compared to the previous three years. This relieved some of the pressure on communities and the environment, and resulted in improved water allocations for consumptive users and the environment alike.

Although environmental flows helped boost river connectivity, flows were not high enough to reach large parts of the thirsty floodplains within current operational constraints. Environmental water holders plan to capitalise on increased water availability in 2021-22 to deliver water where possible to stressed highvalue wetlands and floodplains.

Strengthening our relationships with First Nations



Environmental water holders recognise First Nations ongoing connection with Country and water and respect their Lore. SCBEWC hopes to create a culturally safe environment for First Nations to engage with the planning and delivery of water for the environment, while continuing to build environmental water holder Cultural capability.

In 2020-21 Murray Lower Darling Rivers Indigenous Nations became a member of SCBEWC, and First Nations guidance was formally included in SCBEWC's annual water planning process through the inaugural First Nations Environmental Watering Forum held in Mildura in April 2021. The forum included representatives from twelve First Nations across the southern Basin coming together to input into system-scale planning.

Coordination results in better outcomes

Environmental water holders continue to work together and with river operators to improve the coordinated delivery of water for the environment. River Murray system scale coordination is allowing water for the environment to be delivered from multiple tributaries within regulated limits.

Monitoring is showing promising signs of recovery

for sites that received water for the environment. In 2020-21 there was successful breeding of over 450 waterbirds in Barmah Forest for the first time since 2016, breeding of the threatened Australasian bitterns in Millewa Forest, hundreds of golden and silver perch eggs in the Lower Murray and around a 13% increase in the extent of the important aquatic plant *Ruppia* in the Coorong.



Southern Connected Basin Environmental Watering Committee 2020-21

Collaborates

with a range of

Plans

with local

Membership

🛉 🛉 MDBA, CEWO, DAWE, NSW



River Murray system includes: the main course of the River Murray and all its effluents and anabranches downstream of Hume Dam to the including the Edward–Wakool River system, the Mitta Mitta River downstream of Dartmouth Dam and the Darling River and Great Darling Anabranch downstream of Menindee Lakes.

2020-21 in review

Climate Conditions

2020-21 brought welcome relief with relatively cooler and wetter conditions than the previous three years. However some regions missed out, with rainfall still below average for much of the mid and lower Murray especially in South Australia.

A weak La Niña event contributed to higher rainfall and increased streamflows for many areas, with central and northern NSW in particular recording average rainfall across the year. This contributed to good inflows to the Barwon-Darling River and boosted the storage volume in Menindee Lakes. Releases into the Lower Darling continued throughout 2020-21 providing the important connection between northern and southern Basins.

By the end of June 2021, total River Murray system storage increased to the highest level since 2017.







(Variable range of temperature and rainfall conditions across Basin: Bureau of Meteorology)

Water Availability

River Murray system inflows for 2020-21 were representative of a moderate inflow year, 29% of years on record were drier than 2020-21.

Year-to-year held environmental water allocation 2017-18 1,882 GL (dry year following wet)* 2018-19 1,259 GL (second dry year)* 2019-20 1,181 GL (third dry year)* 2020-21 2,091 GL (moderate year) ^ 2020-21 was preceded by a three-year sequence of very dry inflow conditions (lowest 2% on record) and allocations were lower than previous years, which was reflected in low opening allocations.

Late winter and early spring rainfall increased inflows into storages and resulted in a period of unregulated system flows, slowly improving state water allocations.

By summer, 2020-21 allocations had reached levels not seen for several years.

Inflows include Snowy Hydro inflows, inter-valley transfers, managed environmental inflows and inflows to Menindee Lakes *Held Environmental allocations, as per the Transition Period Water Take reporting by MDBA for 2017-18, 2018-19 and 2019-20. ^Preliminary environmental water allocation data from water holders. Excludes planned environmental water that can be delivered by environmental water holders for targeted environmental outcomes (i.e. the BMEWA and NSW PEW products).

Every year is different

Flows to the Lower Murray, as measured at the South Australian border (ML/day)*



South Australia's flow entitlement (not including water for the environment held in SA)

Three years of dry conditions between 2017-18 and 2019-20

resulted in lower river flows across the southern Basin with barely any periods of unregulated flow at the South Australian border. Water for the environment was used and carried over carefully to ensure that hard-won river health improvements from past years were not lost.

An important part of the delivery of water for the environment was maintaining connectivity along the length of the River Murray all the way to the Lower Lakes, Coorong and Murray Mouth. This helped keep the barrages between the Lower Lakes and Coorong open to provide fish with habitat and movement and mitigated dropping lake levels and the risk of acid sulphate soils from exposed sediments.

As dry conditions continued, planning for deliveries of water for the environment largely switched to providing much needed refuge habitat for animals and to help small pockets of high value ecological sites to survive the hot and dry conditions as best as possible.

In 2020-21 there was a modest improvement in conditions, with

unregulated flows at the start of the year. Environmental water holders planned and used their water to maintain the health and resilience of key sites in a droughtstressed landscape. A coordinated spring fresh between the Murray, Goulburn and Murrumbidgee rivers resulted in a pulse of water passing through the system in Oct to Dec 2020. This increased the productivity of the river, providing more food and habitat for plants, fish and birds.

*The graphs represent the estimated environmental flows delivered in addition to the monthly averaged SA entitlement. The diagram should not be interpreted to infer that environmental water "sits on top" of other flows.

Whose water is in the river?

At any given time, water flowing through the river is destined for various uses, including irrigation, industry, communities, and the environment. The exact mix of water in the river is determined by demand by different users, water availability and other factors such as water entitlement rules in each State.



Overall, water for the environment is a small percentage of the total water used in the Murray–Darling Basin.

Water entitlements held for the environment are subject to the same allocations, fees, rules and carryover arrangements as all other users for equivalent water products. Average use of water for the environment over the last five years (2015-16 to 2019-20) was **22.4%** of the total water used in the Basin



Environmental water holders use water year-round, but the main delivery period is in latewinter and spring to align with growing and breeding season of many of the Basin's native plants and animals.

In comparison, the main delivery season for irrigation demands is over the warmer summer and autumn months when livestock and crops require consistent access to water.

Working together to achieve better outcomes for the environment and communities

Collaboration is critical to the successful management of water for the environment. Local, State and Commonwealth government agencies, Traditional Owners, scientists and community groups all work together to deliver water for the environment to support the plants, animals and communities which depend on a healthy river.

The Southern Connected Basin Environmental Watering Committee (SCBEWC) is the coordination forum that enables the collaboration required to deliver water for the environment at the whole of southern Basin scale.

Government agencies work directly with community, site managers and scientists when planning the use of water for the environment. SCBEWC helps facilitate the sharing of on-ground site knowledge with the environmental water holders and river operators who operate and manage events at a broader southern connected Basin scale. SCBEWC brings together managers from across the southern Basin to coordinate water for the environment to improve river health.

Stories from the river: Upstream/downstream farmer exchange

It has often been said the Murray Darling Basin water reform can be boiled down to Goowla town hall versus Deniliquin town hall. Changing this culture is a challenge a handful of Basin landholders have decided to address. It started with two Deniliquin landholders and their wives making a self-funded wine tour holiday in March of 2020 to South Australia. They requested the Commonwealth Environmental Water Office arrange for them to meet local farmers and access to the barrages and south east drainage system. While driving over the barrages one of the Deniliquin visiting landholders famously said "is that it? Is that all that is going through the barrages? We drank more red wine than that last night!"

This tour was then reciprocated in December 2020. The Deniliquin landholders invited South Australian farmers upstream to show them the Choke and these "open

channels" that South Australian's seemed so critical of. Murray Irrigation Limited pitched in, hiring a bus and putting on lunch. South Australian's who attended were able to slowly pick apart the many myths they have heard over the years. Solid relationships were developed, and it will be interesting to see how Basin communities continue developing farmer exchanges to hear each others perspectives and see how things look in other people's patch.



Strengthening involvement of First Nations

There has been positive progress in engagement and involvement of First Nations in water for the environment management. However, it is acknowledged that these are early steps which will continue to evolve and strengthen over time.

Individual agencies work with First Nations on-ground to discuss plans and include local knowledge and priorities on Cultural objectives and outcomes associated with watering proposals. A network of Indigenous Facilitators operate across The Living Murray Icon Sites and Indigenous rangers are employed via jurisdictions.

From 2020 onwards, representatives from the <u>Murray Lower Darling Rivers Indigenous</u> <u>Nations</u> (MLDRIN) have participated as members of SCBEWC to support increased First Nation influence in water management and to complement the engagement that occurs with individual First Nations at the local/site scale

Traditional Owners from 12 individual First Nations in the Southern Connected Basin came together in April 2021 on Latji Latji Country in Mildura for the inaugural First Nations Environmental Water Forum

In 2020-21 MLDRIN worked in partnership with the CEWO and MDBA to establish a new mechanism for First Nations to directly input into system scale environmental water planning. As part of this, in April 2021 Traditional Owners from across the Southern Basin came together in Mildura with environmental water holders for a dedicated Southern Basin First Nations Environmental Watering Forum.

The Forum gave First Nations people an opportunity to share ideas and information about their Country's watering needs and produce a powerful statement on environmental water use for 2021-22. With the consent of participants, the statement was directly reproduced across many environmental water planning documents for 2021-22 (see for example the <u>CEWO's 2021-22 water management plan</u>).



Context and Planning

Planning for delivery of water for the environment

Planning for the use of water for the environment occurs at multiple scales, from detailed site plans to coordinated southern Basin delivery plans. Significant effort is invested to ensure the best environmental outcomes, and shared benefits for Basin communities, can be achieved through the delivery of water for the environment.

Environmental water managers work closely with site managers, Traditional Owners, community members and river operators to ensure activities are coordinated, mutually beneficial and informed by the best available information.

Each year, SCBEWC agencies plan for a range of conditions from very dry to wet to ensure they are prepared for all climate conditions and are aware of emerging risks, trade-offs, and key watch-points. Detailed planning allows environmental water holders to respond to changing conditions, capitalise on opportunities and mitigate risks.

The plans are informed by Basin scale and regional annual environmental watering priorities, watering proposals developed by the states and site managers, the long-term watering plans of jurisdictions, and the potential activities and needs of river operators.

There is consensus decision making on use of the jointly held portfolios (The Living Murray, River Murray Increased Flows and River Murray Unregulated Flows).

SCBEWC provides information from the annual planning to river operators to assist with their planning which is factored into their <u>Annual Operations Outlook</u>.



For key sites and reaches throughout the southern Basin, Operational Advisory Groups facilitate conversations between water managers, site managers, river operators, and scientists. When a watering event is underway, regular meetings (often weekly) are established so that flow rates, emerging risks, early monitoring results and on-ground observations are shared in real-time to aid decision making.

2020-21 Watering highlights

With climate conditions easing in 2020-21 after three hot and dry years, moderate water allocations allowed environmental water holders to water some of the key sites in the Southern Basin. Additionally, careful coordination resulted in the Southern Spring Flow connecting the River Murray with both the Goulburn and Murrumbidgee Rivers to provide a flow peak of 18,000 ML/d to South Australia.

To illustrate some of the watering highlights from 2020-21, seven case studies from around the River Murray system are provided as well as some highlights from the northern Basin.



A. Waterbirds are breeding again in Barmah-Millewa Forest

Barmah-Millewa Forest is a centuries-old river red gum forest in a naturally wet part of the landscape that thrives on frequent watering in winter and spring. Water for the environment deliveries in spring 2020 provided ideal conditions for waterbirds to breed with more than 450 ibis and spoonbill nests observed at Boals Deadwood in the Barmah Forest in Victoria. This was significant as royal spoonbills are listed as a vulnerable species in Victoria.



Water for the environment continued to be supplied to the wetland over summer to support the colony and ensure the first successful colonial nesting waterbird breeding event in four years for the forest. Although there was some nesting in 2018, these were unsuccessful due to pig predation. Much of the water for the environment used at Barmah-Millewa Forest flows back to the river as return flows, and was re-used for other environmental sites downstream.



A 'Bidgee boom!

Water for the environment delivered to Yanga National Park, in the lower Murrumbidgee catchment resulted in a significant breeding event of the cryptic little bittern and endangered Australasian bittern. With only around 2000 Australasian bitterns globally, this breeding event is a great result!



\mathcal{B} . Reconnecting our rivers and helping fish move more freely

Thousands of native fish will be able to freely move between the Murray River and the rich habitat of Gunbower Creek with the construction of fishways at Koondrook Weir and Cohuna Weir, due to be completed in spring 2021.

The fishways will provide passage for native fish, such as the iconic and vulnerable Murray cod, trout cod and threatened golden perch, from the river into the creek which has been absent in all but very large floods for more than a century.



SCBEWC coordinates flows throughout the River Murray System, including environmental watering at Gunbower Creek and Gunbower Forest. This helps support native fish populations by providing more food in the river and giving cues for fish to move and breed.

Research has shown that native fish accumulate at Koondrook Weir, and once completed, these fishways will dramatically improve connectivity between Gunbower Creek and the Murray River, improving outcomes of environmental watering and helping to boost native fish populations.

The fishway is part of *the Native Fish Recovery Plan – Gunbower and Lower Loddon*, which involves the large-scale, long-term and holistic rehabilitation of the network of creeks,



lagoons, wetlands and floodplains in northern central Victoria.

Environmental flows targeting Murray cod spawning and recruitment were delivered for the seventh consecutive year to Gunbower Creek in 2020-21. Flows in the creek include a steady spring flow to keep Murray cod on their nests, some areas of permanent fast flowing water, and higher winter flows to provide habitat for juvenile cod. Juvenile cod recruitment has occurred annually since the flows have been delivered.

Gunbower Forest watering not only maintained the health of this iconic red gum forest in dry conditions, it also provided important native fish populations with a boost, as vital food and nutrients flowed off the floodplain and back into our creeks and rivers in spring.

C. Recovering native fish in the Lower Baaka River

After three extremely dry years, rainfall in the northern Basin provided welcome inflows to the Menindee Lakes. This enabled the delivery of 32 gigalitres of water for the environment into the Lower Darling-Baaka to kickstart the recovery of native fish populations which had been heavily impacted by the low-flow conditions and mass fish deaths in summer 2018-19.

The delivery of water for the environment was timed with Murray cod breeding season in spring, supporting nesting and spawning for these iconic fish. Releases then continued into mid-Summer to increase productivity and access to habitat for the baby fish, improving their chances of survival.

Juvenile golden perch (or 'dhagaay' in Gamillaraay/ Kamilaroi language and 'gagalin' or 'bidyin' in Wiradjuri language) that spawned in the northern Basin above Wilcannia drifted down into Menindee Lakes. These fish grow quickly in the highlyproductive habitat of the lakes before water for the environment deliveries help pass them downstream to join the adult population in the Lower Baaka and Murray.

'Bidgee Fish are Biting at Balranald!

Native fish populations in the Murrumbidgee River were badly effected by hypoxic blackwater in 2016, and a small fish kill in 2019. With the hot and dry conditions easing in 2020-21, a native fish pulse of 30 gigalitres of water for the environment was delivered to the Murrumbidgee River in spring. The flow resulted in Balranald Weir being temporarily removed and provided good connectivity with the River Murray, allowing native fish including golden perch and Murray cod to move back into the system and re-establish. This improved both the ecology and recreational opportunities for anglers, who were loving being able to catch some fish again.

Additionally, return flows from the Murrumbidgee fish pulse were re-used for ecological benefits at sites downstream.





Darling River (Source: NSW DPI Fisheries)

Around 30% of Murray cod sampled during Autumn 2021 fish surveys in the lower Darling were juvenile fish. This is a good indication that the population is on the road to recovery.

O. The 2020 Southern Spring Flow – our biggest coordinated flow event so far

The <u>Southern Spring Flow</u> delivered water for the environment from Hume Dam between September and December 2020 to support wetlands and lower parts of the floodplain, including at 5 Ramsar listed wetlands of international significance, along the River Murray between Yarrawonga and the Coorong.

The flow pulse connected over 2000 km of river to help native fish breed and move, and increased productivity by flushing food and nutrients from the floodplain into the river.



This was our largest coordinated water for the environment event ever. Months of careful planning by SCBEWC member agencies made the Southern Spring Flow possible. The flows were delivered by river operators in close collaboration with local site managers.

The release of 323 gigalitres of environmental water from Hume Dam built upon other operational flows in the river to inundate around 25% of Barmah-Millewa Forest before returning to the River Murray. These flows then combined with environmental flows from the Goulburn, Murrumbidgee and Lower Baaka/Darling rivers to create a well timed flow pulse down the length of the River Murray to the Lower Lakes and Coorong.

Return flows were used at multiple environmental sites as the water flowed down the river including spring pulses in the Edward-Wakool system in NSW, Gunbower Forest in Victoria and Chowilla, Pike and Katarapko floodplains in South Australia.



Environmental flows achieving system scale connectivity, colours signify environmental watering events in the tributaries adding to the Southern Spring Flow in the Murray (Source: CEWO)

Building the flow into the Lower Murray

The Lower Murray has a lot more slower-flowing water due to the influence of a series of weirpools. High spring flows are critical for this reach as they generate faster flowing water habitat in the weirpools which enables native fish breeding and juvenile survival success. The timing of flows is also important. The Southern Spring Flow was closely planned to ensure the flow peak arrived in the Lower Murray after mid-October when water temperatures are best suited to golden and silver perch breeding.

Release of environmental flows in the Murray, Goulburn and Murrumbidgee rivers built a pulse along the length of the river that peaked at the South Australian border in late November at 17,806 ML/d with 18 days above 15,000 ML/d.

A spring pulse of this size has never been achieved with water for the environment under regulated river conditions before. This was only made possible by the efforts that went into coordinating flows. The spring pulse is a natural feature of the flow regime which would occur in most years under natural conditions.

Before the construction of dams and weirs, large flows down the length of the River Murray were a regular occurrence in winter-spring. Under natural conditions there would have been a pulse into South Australia of at least 20,000 ML/d in 19 of the past 20 years (2006/07 being the only year without an estimated flow of this scale). Based on the inflows in 2020, the Murray would have naturally reached 38,000 ML/d at the South Australian border.

What did the Southern Spring Flow achieve?

A team of scientists, led by CSIRO, monitored water quality and river foodwebs at eight sites along the Murray between Tocumwal in NSW and Renmark in South Australia.

Monitoring showed the inundation of Barmah-Millewa Forest mobilised considerable amounts of carbon and nutrients into the main river. This injection of 'fish food' supported river productivity and increased food available for plants and animals. The monitoring also showed a small increase in productivity in the Lower Murray which equated with the smaller scale of floodplain connectivity in this part of the river system.

Hundreds of golden and silver perch fish eggs were detected in South Australia during the flow peak. Silver perch larvae were detected, however no juvenile or young-of-year fish have been sampled yet. This may not represent a lack of recruitment as juveniles are difficult to sample at low numbers.

The flow also supported a range of outcomes including waterbird breeding in Barmah-Millewa Forest, flowering of the important aquatic plant *Ruppia* within the Coorong and improved wetland conditions along the length of the system.



E. Cycles of wet and dry in the Hattah Lakes System

Water for the environment has been delivered to Hattah Lakes for the first time since 2017. Drying is part of the natural cycle of these floodplain lakes and it allows herbs and grasses to establish and grow throughout the lakebeds. This provides food and habitat for large animals such as emu and kangaroo.

27 gigalitres of water for the environment was delivered in 2020-21, filling 13 out of 18 lakes and inundating over 1,300 hectares of the site. This allowed aquatic vegetation to establish, and brings native fish like golden perch and carp gudgeon back to the system. Both of these provide an important food resource for waterbirds.

The Hattah Lakes area holds significant value to the Latji Latji and Jari Jari people, with over 1000 cultural archaeological sites. Hattah has been considered a 'paradise of plants' to the Traditional Owners.



Emus utilising the herb layer in a dry Lake Konardin (Source: Mallee CMA)





A before (top) and after (below) of the Autumn filling of Hattah (Source: MDBA)



Social and economic benefits: The Hattah Lakes are abuzz

Beekeeper and pollination experts have been operating at Hattah Lakes since the late 1950s. After producing honey at Hattah, bees are moved to pollinate almond orchards around Robinvale; stone-fruit around Swan Hill; then cherry, apple and pear orchards across Victoria. This helps ensure food security for our communities, and leads to significant economic benefit each year.

F. Pike and Katarapko floodplains receive first delivery of water

Two SA River Murray floodplains received a welcome drink of water for the environment with the first operation of new infrastructure on the Pike and Katarapko floodplains in 2020.

Located on the land of the First Peoples of the River Murray and Mallee Region, the floodplains are important natural areas of significant Cultural and ecological value. The Pike floodplain regulators were operated modestly for the first time in spring 2020 filling flood runners and wetlands across over 495 hectares of the thirsty floodplain landscape.



A simultaneous raising of the weir pool at Lock 5 inundated an additional 1030 hectares of the Pike Floodplain. At Katarapko the regulators were operated to raise creek levels by 2.8 m, inundating 740 hectares of the Katarapko Floodplain.

The floodplain trees and understorey vegetation responded rapidly to the watering with areas of black box, river red gum, river cooba and lignum flourishing with the water. The chorus of frogs calling was deafening with five species recorded at Katarapko and six species at Pike, including the threatened southern bell frog.

34 water bird species were observed at Katarapko and 27 species were recorded at Pike making the most of the wetlands and mudflat environments across the watering events, including four state listed species.

Chowilla Floodplain wetland pumping

In 2020 conditions continued to be too dry for large scale watering using the regulator but amazing outcomes were achieved at a number of wetlands which received pumped water for the environment. Waterbirds in their hundreds and even thousands were recorded at the sites along with hundreds of frogs including Southern Bell Frog which was recorded in large numbers at all monitoring sites.



\mathcal{G} . LLCMM celebrate 10 years of connectivity

In October 2020, First Nations, community representatives, scientists, and government gathered at Goolwa to share insights and celebrate a decade of connection and healing for the Lower Lakes, Coorong and Murray Mouth Icon Site.

The Millennium Drought, between 1996 and 2010, was one of the worst



connection and healing. (Source: E. Pink)

droughts in recent history. Low rainfall, upstream water use and river regulation resulted in low inflows and water levels below Lock 1 reduced to unprecedented levels. Freshwater flows to the Coorong ceased completely, and resulted in dry wetlands, increased salinity and acid sulfate soils, and ecological collapse in both Lower Lakes and Coorong. These impacts were felt by First Nations and local communities, with livelihoods, health, the local economy and people's resilience suffering.

Ngarrindjeri community members stressed the importance of the freshwater flows to the Meeting of the Waters site at the Murray Mouth; 'keeping our lands and waters healthy means that Ngarrindjeri people are healthy'

September 14th 2010 marked the day that barrages started to flow again at the end of the Millennium Drought. Since then, continuous freshwater flow from the barrages at Lake

Alexandrina to the Coorong has been maintained, thanks to the delivery of water for the environment.

Water for the environment has been delivered to the end of the system over the last ten years with the majority of flows being utilised across multiple upstream wetlands and floodplains before being returned to the river, and ultimately, delivered to the Lower Lakes and Coorong.

There have been some rapid improvements in response to flow, such that diadromous fish are now migrating between fresh and salt water in increasing numbers, and native fish populations continue to increase in the Lower Lakes.



But recovery across the site will take time, particularly in the Coorong, which is still showing the impacts of the drought and lack of freshwater flows.

You can check out a video of the October 2020 celebrations and the reflections on the last decade from local community members, Ngarrindjeri, scientists and government here.

Highlights

H. The Baawan-Baaka flows again

Cycles of 'boom' and 'bust' dominate the Barwon-Darling River (Baawan-Baaka), with extended dry periods often broken by flooding rains. After years of drought, the Barwon-Darling River once again started flowing all the way from Queensland to the River Murray, providing crucial connection between the northern and southern halves of the Murray-Darling Basin.

The flows of December 2020, January 2021 and flooding in March-April 2021 finally



broke the driest four years on record, filling the river channel and spilling onto nearby floodplains. This came off the back of a predominately dry decade since 2012 for the north.

The hot and dry conditions of the past few years have affected communities deeply. While the flows to date are a relatively short welcome 'boom', it is expected to take multiple years to recover and rejuvenate the landscape and communities after the long dry.

More than 68 gigalitres of water for the environment contributed to the connecting flows within the northern Murray-Darling Basin 2020-21.

Communities welcome flows

In the words of Kelly Smith, who lives alongside the Barwon River at Collarenebri: "The last couple of years have been probably some of the hardest ones in my lifetime living on the Barwon... but now with that flow and a change in our season with great rainfalls, our river system has become the healthiest I have witnessed in a lot of years. There is an abundance of food sources and very, very healthy fish." 2020-21 saw the start of the recovery in the northern Basin, both for the ecosystems and communities

Monitoring undertaken by NSW DPI Fisheries suggests that flows in the Barwon-Darling during 2020 supported spawning, growth, and movement of golden perch (or 'dhagaay' in Gamillaraay/ Kamilaroi language and 'gagalin' or 'bidyin' in Wiradjuri language) between Menindee Lakes, the main stem of the Barwon-Darling rivers and their tributaries. Following this year's flows, we expect to see more golden perch moving around the Barwon-Darling.



How the Barwon River at Collarenebri Weir has changed over the past 10 months. (Source: J. Wilson, CEWO)

Learning and adapting

Scientific monitoring across sites is showing that the delivery of water for the environment and the operation of environmental works during dry years are making a difference to the health of rivers and wetlands. Monitoring undertaken as part of the Living Murray program shows that sites which have received water for the environment over consecutive years have maintained or improved their condition, helping to build resilience for dry times. Conversely, areas that can't be watered continue to show decline.



Snapshot of the condition of six icon sites in the southern connected Basin as of 2019-20

In 2020-21, state partner agencies delivered around 100 monitoring projects as part of The Living Murray Program. The projects include condition monitoring to assess site health, and intervention monitoring to inform the real-time management of water use and to measure ecological responses to watering. The projects also monitor emerging risks such as the potential for poor water quality.

This monitoring is used by environmental water managers to report on and evaluate outcomes of watering actions and to improve the delivery of water for the environment in subsequent years. Monitoring reports are shared for each location on the <u>MDBA website</u>.



Productivity monitoring The Pollack (Source: MDBA)



Turtle tracking at Barmah Forest (Source: ARI)



TLM MONITORING

Site condition through time

		Barmah- <mark>Millewa</mark> Forest	Gunbower Forest	Koondrook- Perricoota Forest	Hattah Lakes	Lindsay-Mulcra- Wallpolla Islands	Chowilla 📝	Lower Lakes Coorong Murray Mouth
	2019/20	в	в 🛃	D 🔀	A 🗾	В	С	С
	2018/19	в	A 🖊	D	В	В	B 🛃	С
	2017/18	A	В	D	A 🗾	В	В	С
≋	2016/17	А	В	С	A 🛃	В	B 🎽	В
	2015/16	В	B 🛃	D	A 🗾	В	c 🛃	С
	2014/15	В	B 🛃	D 🔀	A 🛃	1	C 🛃	В
	2013/14	С	в 🛃	D	B 🛃	C 🗾	С	В
	2012/13	С	В	D	С	С	С	В
	2011/12	С	С	D	В	В	С	В
≋	2010/11	в	В	D	С	С	В	D
	2009/10	С	С	D	D	D	С	D
	2008/09	D	С	D	D	D	С	D
	2007/08	D	D	D	D	D	-	D

🕿 🛛 Flood year

 Environmental works used to deliver water to sites A: Excellent – Most (75-100%) of ecological objectives have been met B: Good – More than half (50-74%) of ecological objectives have been met C: Fair – Fewer than half (25-49%) of ecological objectives have been met D: Needs attention – Few (0-24%) of ecological objectives have been met

Barmah-Millewa uses regulators to deliver water into the forest, and LLCCMM uses barrage gates to deliver water to the Coorong. Both are used in most years, except extreme drought years





Learning and Adapting

River Murray Channel Monitoring Plan

During 2020-21, environmental water managers from Basin state and Commonwealth

agencies collaborated to develop a five-year monitoring plan for the River Murray Channel.

The Plan focuses on monitoring River Murray system scale responses to coordinated water for the environment delivery in the Southern Connected Murray-Darling Basin. It builds on existing monitoring programs to fill gaps and to evaluate ecological responses to flow at a system scale, to inform and improve the way water for the environment is managed.



Implementation of the Plan is expected to significantly improve monitoring coverage in the River Murray, focusing on productivity and fish indicators that will directly inform improved management and coordination of flows. A key element of the Plan is an annual review of implementation, which will inform any refinements over the five year period.

The Plan was developed by the monitoring sub-group of the Southern Connected Basin Environmental Watering Committee, with support and guidance from a team of scientific experts.



The Plan is available at: River Murray Channel Monitoring Plan 2021-22 to 2025-26

Learning and Adapting

Using water efficiently return flows in 2020-21

Water delivered to floodplain or wetlands is typically not completely lost from the river. Often, some of the water flows back from the floodplain or out of the wetland to re-join the river – described as <u>return flows</u>. The return flows are measured (with any losses accounted for) then made available for downstream environmental sites.

This provides an efficient means to re-use water at multiple environmental sites from the top to the bottom of the river system, increasing connectivity and food in the river as carbon and nutrient-rich water from the floodplains returns to the river.



Concept of environmental water return flows (Source: MDBA)

Return flows were used to support watering events in the Edward-Wakool rivers, Gunbower Forest, Hattah Lakes, Lake Wallawalla, Chowilla, Pike and Katarapko floodplains and flows to the end of system at the Lower Lakes and Coorong.



Other environmental sites that received water in the Southern Connected Basin: Vic wetlands 9.9 GL (no return flows); NSW wetlands and creeks 31.8 GL (no return flows); SA wetlands and River Murray Channel use from upstream e-water 68.8 GL (no return flows). Delivery of water for the environment through the river system supported the River Murray Channel from Hume Dam to the Coorong.

Opportunities to improve

The successful implementation of the Basin Plan requires water for the environment to be fully integrated into the everyday management of water in the River Murray system. There are several key policy issues and operational challenges that state and Commonwealth governments are working through as part of implementing the Basin Plan. An update on the status of these key issues can be found in the MDBA's <u>Basin Plan Report Card</u>.

These challenges impact the delivery of water for the environment and limit the outcomes that can be achieved, hindering the full realisation of water reform and this significant public asset.

Challenges include:

- <u>Constraints relaxation</u> to allow water for the environment to reach higher levels on the floodplain and some of the Basin's key environmental assets
- Adapting and improving <u>pre-requisite policy measures</u> to better protect environmental flows from re-regulation and extraction
- Implementation of the <u>Sustainable Diversion Limit Adjustment projects</u> to allow Basin Plan environmental outcomes to be achieved with less water
- Completion and accreditation of all <u>Water Resource Plans</u> that set out the rules for the use of all water, including water for the environment

Despite weather conditions easing, and an increase in inflows and allocations, several pressures still limited the ability for water holders to meet environmental water needs as outlined below:



Location of key pressures that impacted the delivery of water for the environment in the southern connected Basin in 2020-21

Appendix – Basin environmental watering priorities and Regional watering priorities

The <u>Basin Environmental watering priorities</u> provide a whole-of-Basin perspective and help guide environmental water managers on where to focus water delivery. The key themes are river flows and connectivity, native vegetation, waterbirds and native fish. They are set out as rolling multi-year priorities to provide a medium term (3 – 5 year) step towards achieving the longer-term objectives of the Basin-wide Environmental Watering Strategy and the Basin Plan.

Under the dry to moderate conditions, the 2020-21 annual priorities aimed to **maintain or improve the condition of species and habitat where water is available.**

SCBEWC agencies supported the Basin annual priorities by: increased baseflows in the Lower Baaka in spring for Murray cod spawning; delivering a River Murray Channel multi-site event as the Southern Spring Flow; providing flows to the Coorong to support suitable habitat and water quality for migratory wading birds; and connecting southern rivers to support native fish recovery.



Regional watering priorities

Regional priorities guide the planning and delivery of water for the environment at a river reach and catchment scale.

Regional priorities are developed by states each year in partnership with site managers, local communities, Traditional Owners and other stakeholder groups. They consider the objectives of the long-term watering plans, climate conditions, outlooks for the coming year and previous watering regimes.

The Commonwealth Environmental Water Holder undertakes a similar approach to develop annual portfolio management plans. Regional watering priorities are then used as an input to inform the setting of Basin-scale annual priorities.

Appendix - Who holds and manages water for the environment

At 30 June 2020 the total volume of water for the environment held in the Murray-Darling Basin is 3,122 GL/year*. Of this, 2,418 GL/year is held for use in the southern connected Basin (77 percent).

Importantly, these volumes are in Long-term Diversion Limit Equivalent volume terms, not what is actually allocated each year. The allocation in 2020-21 against held entitlements was less at 2,091 GL, reflecting the moderate year with below average inflows.

2,418 GL/year in the Southern Connected Basin:

HEW entitlements in the Southern Connected Basin by manager as at 30 June 2020 in GL/y (LTDLE) and as a percentage of total SMInister for Environment and Water, 43 GL/y, 28 Jointly managed GL/Y, 28 GL/Y, 28 (499 GL/TLM & 70 GL/V, MIF), 59 GL/Y, 28 (499 GL/TLM & 70 GL/V, 59 GL/Y, 28 (490 GL/Y, 48 (499 GL/TLM & 70 GL/V, 59 (490 GL/Y, 28 (490 GL/Y, 28) (490 GL/Y, 28 (490 GL/Y, 28) (490 GL/Y, 28)

Total long-term average volume of water for the environment held by each water holder in the southern connected basin as at June 30, 2020. Jointly held water volumes include 489 GL TLM and 70 GL RMIF.

* 3,122 GL/year of total water for the environment in the Basin includes 70 GL RMIF.

Water holders include:

CEWH: Commonwealth Environmental Water Holder VEWH: Victorian Environmental Water Holder NSW DPIE: New South Wales Department of Planning, Industry and Environment SA: South Australia Minister for Environment and Water Jointly held: The Living Murray (TLM): Commonwealth, VIC, NSW, SA (489 GL) Jointly held: River Murray Increased Flows, Snowy Scheme (RMIF) : VIC, NSW (70 GL)

Appendix – Measuring water used

Water held for the environment uses the same entitlement framework as consumptive users, including the same <u>state allocation systems</u> that apply to all other water users.

All environmental water delivered in the River Murray system from environmental entitlements is measured. Where this water is released from a storage, it is measured at the dam wall. Where the water is delivered to a wetland via a pipe or regulator, it is measured using an Australian Standard meter or gauge. Where this water is delivered onto floodplains via overbank flows or multiple flow points, this water is measured using calibrated computer models that conservatively estimate how much water leaves the river channel and how much returns.

Water used in wetlands and floodplain forests is debited against water entitlements held specifically for the environment. States have arrangements in place to ensure environmental water holders are responsible for any losses during overbank watering and these are factored into their orders. This means the environmental water holders can water wetlands and floodplain forests without impacting on the water availability of other water users.

Where the delivery of water for the environment results in an increase in the river conveyance loss for the River Murray system, this increase in loss is charged to environmental water holders to prevent any impact on other water users and entitlement holders.





Above: Water returning from Gunbower Forest to the River Murray is measured (Source: MDBA)

Left: Water is measured at Punt Paddock in Barmah Forest (Source: K. Ward)

Appendix – Water delivery by location

Table of 2020-21 environmental water use (GL) in the southern Basin. Figures drawn from Basin Plan Annual Reporting, Matter 9.3.

Site or watering event description	Primary ecological purpose	Joint (TLM & RMIF)	CEWH	VEWH	NSW	SA	Other	Total
Ovens River	Ovens River Longitudinal connectivity		0.123	0.036	0	0	0	0.159
Barmah-Millewa	Fish; Vegetation; waterbirds	59.6	277.8	26.4	5.7	0	0	369.5
Niemur; Yallakool-Wakool	Fish	0	14.2	0	0	0	0	14.2
Lower Darling	Fish	20.5	11.8	0	0	0	0	32.3
Broken System	Water quality; Fish	1.7	32.8	0.4	0	0	0	34.9
Goulburn System	Vegetation; Longitudinal connectivity; Fish	46.2	152.8	41.4	0	0	0	240.4
Campaspe System	Fish	0.194	4.9	20	0	0	0	25.1
Gunbower Creek	Fish; Longitudinal connectivity; Water quality	0	8.9	1.4	0	0	0	10.3
Gunbower Forest	Vegetation; Waterbirds; Fish	2.6	0	0	0	0	0	2.6
Koondrook-Perricoota Forest		0	0	0	0	0	0	0
Koondrook-Perricoota Forest: Pollack	Vegetation; Waterbirds	0	2.5	0	0	0	0	2.5
Loddon System	Fish; Vegetation; Ecosystem processes		1.9	17.7	0	0	0	19.6
Murrumbidgee System Vegetation; Fish; Waterbirds; Riparian		60	300.7	0	137.4	0	0.5	498.6
Hattah Lakes	Vegetation	12.3	0	15	0	0	0	27.3
Lindsay-Mulcra- Wallpolla	Vegetation; Fish; Waterbirds; Longitudinal connectivity	5.5	0	4.2	0	0	0	9.7
NSW/Vic Weirpool Manipulations		0	0	0	0	0	0	0
Other NSW Murray Wetlands and Creeks	Lateral connectivity; Fish; Waterbirds	0	6.3	0	25.5	0	0	31.8
Other Victorian Murray Wetlands	Vegetation; Fish	0	0	9.9	0	0	0	9.9
South Australian Murray Wetlands. Incl. Pike and Katarapko	Vegetation; Lateral connectivity; Fish	0	17.8	0	0	33.4	1.3	52.5
Chowilla Floodplain	Vegetation, waterbirds	6.7	0	0	0	0	0	6.7
Lower Lakes, Coorong and Murray Mouth End of system flows; Waterbirds; Longitudinal connectivity: Fish		170.5	668.7	54.4	0	12.1	13	918.7
SA River Murray use Longitudinal connectivity; from upstream e-water ecosystem processes		2.4	12.5	1.3	0	0	0	16.2
Total		388	1514	192	169	46	15	2323

Appendix – Jointly held water portfolio overview Τ

he	Living	Murray	(353.4	GL was	available for	use)
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Location	Entitlement volume (GL)	Net carryover (GL)	Allocation (%)	Allocation (GL)	Available (carryover + allocation) (GL)
NSW Murray High Security	5.1	0.0	97%	5.0	5.0
NSW Murray General Security	83.0	5.9	50%	41.5	47.4
NSW Murrumbidgee General Security	85.0	9.4	100%	75.6	85.0
NSW Lower Darling High Security	0.5	0.0	100%	0.5	0.5
NSW Lower Darling General Security	47.8	23.9	100%	23.9	47.8
Vic Murray High Reliability	21.9	18.3	100%	21.9	40.2
Vic Murray Low Reliability	101.8	0.0	0%	0.0	0.0
Victoria Goulburn High Reliability	45.2	24.4	100	45.2	69.6
Victoria Goulburn Low Reliability	157.0	12.3	0%	0.0	12.3
Victoria Campaspe High Reliability	0.1	0.1	80%	0.1	0.2
Victoria Campaspe Low Reliability	5.0	0.0	0%	0.0	0.0
South Australia Murray Valley	45.0	0.0	100%	45.0	45.0
SUB-TOTAL	597.5	94.4	n/a	258.7	353.0
Supplementary & unregulated licences	397.3	0.0	n/a	0.4	0.4
GRAND TOTAL	994.8	94.4	n/a	259.1	353.4

Carryover is the net available after start of year adjustments (such as for evaporation) Allocation is the net available after deductions such as for spillable water account and volumes above max allocation Supplementary and unregulated licence allocation based on volume delivered.

River Murray Increased Flows (59.2 GL was available for use)

RMIF carryover in River Murray Storages at beginning of 2020-21 (GL)*		RMIF made available in River Murray Storages during 2020-21 (GL)^	RMIF used in 2020-21 (GL)	RMIF in River Murray Storages at the end of 2020-21 (GL)	RMIF in Snowy storages (as at 1 May 2021) (GL) [#]	
NSW Murray	1.36	25.0	1.36	25.0	194.5	
Victorian Murray	7.86	25.0	7.86	25.0	194.5	
TOTAL	9.22	50.0	9.22	50	389	

*RMIF carryover associated with release of additional water by Snowy Hydro in 2017-18.

^RMIF made available in River Murray Storages during 2020-21 associated with release of additional water by Snowy Hydro during the Snowy Water Year between 1 May 2020 and 30 April 2021 (and classified as RMIF available in Hume from June 2021). #RMIF in Snowy made up of 319 GL from the start of 2020-21 plus 70 GL of new RMIF allocation transferred into the RMIF account.

Appendix – Healthy rivers benefit communities

Water for the environment

Water for the environment maintains and improves the health of rivers by providing water to protect plants, animals and iconic landscapes that rely on rivers.

Healthy rivers support communities and agriculture to thrive.

Many of the rivers and wetlands in the Murray–Darling Basin have been modified to provide water for towns, industries and to grow food. In some rivers, up to half of the water that would have naturally flowed down them each year is removed for human use.

As a result many rivers are not able to function as they would naturally. This means it is necessary to actively manage how water flows through rivers.

All water in the river can provide an environmental benefit, but water for the environment is the water that is held and actively managed to target environmental outcomes that aim to keep the rivers of the Basin healthy for people, plants and animals.

Water for the environment is set aside in storages and released into rivers and wetlands to support them and the plants and animals that live, feed and breed in them.

Benefits of water for the environment

Water for the environment improves the health of rivers by providing water to support important ecosystems that improve water quality, like wetlands and floodplains.

Water for the environment also provides benefits to communities by:

- increasing opportunities for recreational activities such as fishing, boating and birdwatching
- improving water quality which has economic benefits for farmers and industries, like manufacturing
- protecting Australia's iconic landscapes for this and future generations to enjoy.

Key facts

Water for the environment aims to provide enough water to keep rivers healthy. Healthy rivers benefit everyone.



Water is used for towns, industry and agriculture.



Water for the environment is set aside to protect the plants, animals and iconic landscapes of the Basin.



More than 60 native fish species rely on rivers in the Basin to feed, grow and breed.



The Basin is home to **120** waterbird species that depend on rivers to feed, nest and/or breed.



30,000 wetlands in the Basin filter water which improves water quality.



Environmental flows keep our rivers healthy and sustain plants, animals and fish which is also important to First Nations.



Water for the environment supports tourism and recreational activities.



Good-quality water powers \$24 billion of primary production across the Murray– Darling Basin every year.

Appendix - Acronyms used within this report

Commonwealth Environmental Water Holder
Commonwealth Environmental Water Office
Catchment Management Authority
Commonwealth Scientific and Industrial Research Organisation
Department of Agriculture, Water and the Environment
Goulburn Broken Catchment Management Authority
Gigalitre (GL) = 1 billion litres
Partner governments including the Commonwealth, NSW, VIC, and SA
Lower Lakes, Coorong and Murray Mouth
Murray-Darling Basin Authority
Megalitre (ML) = 1 million litres; ML/d = megalitres per day
Murray Lower Darling Rivers Indigenous Nations
New South Wales
New South Wales Department of Planning, Industry and Environment
River Murray Increased Flow
River Murray Unregulated Flows
South Australia
South Australian Department of Environment and Water
South Australian Research and Development Institute
Southern connected Basin
Southern Connected Basin Environmental Watering Committee
The Living Murray
Victorian Environmental Water Holder



Thank you

The effective management of water for the environment relies on the contributions and efforts of many land and water organisations and communities across the southern Basin.



Australian Government

Commonwealth Environmental Water Office









TORIA



Government of South Australia

Department for Environment and Water









Environment, Land, Water

and Planning







Australian Government

Department of Agriculture,

Water and the Environment



