Water for the Environment

Southern Connected Basin Environmental Watering Committee

Annual Report 2021-22



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 and accept 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: Family of Southern Boobook owls (Source: D Kleinert) Cover photo: Students heading into Ral Ral Creek, Calperum Station with fyke nets (Source: CEWO)



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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 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

Highlights for the year included the coordination of flow releases in the Goulburn and Murray rivers to water low-lying floodplain along the mid Murray, widespread waterbird breeding, and great connection between the northern and southern Basins via the Baaka (lower Darling).

In the southern Basin, more than 384 GL of water for the environment was delivered through the River Murray in and around natural flows, connecting thousands of kilometres of river to support waterbird breeding, fish habitat and improved water quality.

Environmental water holders work with First Nations, communities and river operators to plan and shape watering events. Increased collaboration is improving coordination and outcomes along the length of the River Murray and its tributaries as water is used and reused.

Southern Connected Basin Environmental Watering Committee

2021-22 in review





Wet conditions

over 3,000 GL water

available



~3,000 GL delivered to multiple sites (use & re-use)[#]



coordinated events between water holders



~ 11% of flow the SA border

Watering overview

2021-22 saw extended periods of unregulated flows throughout the River Murray and its tributaries.

Environmental water holders worked closely with river operators, land holders and community to coordinate a spring fresh from the Goulburn into an unregulated Murray to connect important floodplain sites in the mid-Murray, reaching areas that hadn't been connected since 2016.

Flows across the SA border were unregulated since mid-July, with a peak of 42,820 ML/d - the highest level in the lower Murray since 2016.

Community overview

Easing COVID-19 impacts in 2021-22 enabled communities to continue to open up. Face to face meetings, including those on Country, were possible again for the first time in two years.

Wetter than average conditions supported high allocations. However, some river communities experienced pressures caused by higher river levels restricting access and causing low level flooding.

Increased First Nations engagement and involvement in water for the environment continues to be a priority for water holders, which will better support healthy Country.



The amount of water delivered to sites is sourced from Basin Plan Matter 9.3 annual reporting.

Key messages

Why do we water when it's wet?

Delivering water for the environment during wet years helps to restore and enhance the health of rivers and their floodplains, as well as the plants and animals that rely on them.

When it's wet, water for then environment can be added to fill in gaps between natural inflow events and to extend the duration of natural flows. These interventions are critical for ensuring water levels are sustained for key environmental processes, such as waterbird breeding to finish.



We know from monitoring results that sites which receive both natural inundation and water for the environment are more resilient than those which receive natural flooding only.

Delivering water for the environment within operational constraints

Delivering water for the environment where and when it's needed can be challenging, particularly when it's wet. Operational flow limits (most of which are well below minor flood levels) can restrict the delivery of water for the environment, as natural inflows can often exceed these thresholds within certain river reaches.

Working within current operational constraints, water holders coordinate flows in the River Murray with its tributaries to build and extend flows in the mid to lower Murray. This allows water for the environment to boost flows to reach parts of the floodplain that may otherwise have remained dry.

The ability for water for the environment to support environmental and cultural outcomes will significantly improve with the implementation of programs to relax constraints and facilitate higher flows, such as <u>Reconnecting River Country</u> and Enhanced Environmental Water Delivery.

First Nations involvement

First Nations involvement in the planning and delivery of water for the environment is a key priority for Governments, communities, and Traditional Owners.

While some progress has been made, additional resourcing for Nations and their representative groups is needed in order to effectively increase the scale of involvement and influence for First Nations in water management.



Southern Connected Basin Environmental Watering Committee 2021-22



River Murray system includes: the main course of the River Murray and all its effluents and anabranches downstream of Hume Dam to the sea 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.

2021-22 in review

Climate Conditions

2021-22 brought rainfall across the majority of the Murray-Darling Basin. It was the second La Nina year in a row, with some regions getting wet for the first time since 2016.

This high rainfall contributed to unregulated conditions for much of the River Murray system during winter, spring and summer.

Unregulated flows passed the South Australian border from mid-July due to large volumes of natural inflow entering the Murray from the Murrumbidgee and Baaka (Lower Darling).

Connection between the northern and southern Basin was provided by high flows down the Baaka and the Great Darling anabranch.

Temperatures were average to slightly above across most of the Basin.

Water Availability





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Top: Year-to-year variability in River Murray inflows Middle / Bottom: Variable range of temperature and rainfall conditions across Basin: Bureau of Meteorology

River Murray system inflows for 2021-22 were representative of a **wet** inflow year, only 14% years on record were wetter than 2021-22.

Regular rainfall increased inflows into storages and resulted in high water allocations and long periods of unregulated system flows.

Inflows include Snowy Hydro inflows, inter-valley transfers, managed environmental inflows and inflows to Menindee Lakes *Held Environmental allocations, as per the water take reporting by MDBA for <u>2017-18</u>, <u>2018-19</u>, <u>2019-20</u> and <u>2020-21</u>. ^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).

Why water when it's wet?

If the river already has water in it, why do we need water for the environment when it rains?

Delivering water for the environment during wet years helps restore and enhance the health of rivers and wetlands, and the plants and animals that rely on them.

River regulation has significantly reduced the frequency and duration of natural flood events. This means that even when high unregulated events occur, they may not last long enough for native animals and plants to respond and for key lifestyle processes to finish e.g. breeding events.

Water for the environment can be strategically added to fill gaps between natural inflow events, or to extend the duration or in some cases magnitude of larger natural flow events. These interventions are critical to ensuring flows are sustained at the right levels for long enough for key ecological process to be completed.



Waterbird breeding events are often triggered by natural flows, but these breeding events may fail if water levels drop before chicks fledge. Similarly, Murray cod build their nests on submerged snags, and rapidly dropping water levels can result in nest abandonment or stranding of eggs. Extending the duration of higher flows through delivery of water for the environment can support the completion of these breeding cycles to help build population numbers.



Watering over consecutive years helps improve ecological condition and build resilience to help the environment through the dry periods.

Monitoring results have shown that sites that receive water for the environment and natural flooding are more resilient than those sites that receive natural flooding only

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Unregulated flows

During wetter years, environmental water holders, like other consumptive users can sometimes get access to a range of different water products that are not available during drier conditions.

Many of these products are associated with unregulated flows. <u>Unregulated flows</u> in the River Murray system are any river flows that i) are in excess of the amount of water needed to meet all system demands, and ii) cannot be captured in Lake Victoria (the last storage before the South Australian border).

Unregulated flows are vital to achieving environmental outcomes across the Murray-Darling Basin. Many of the environmental outcomes anticipated under the Basin Plan require unregulated flows in conjunction with water for the environment deliveries.

Supplementary water Supplementary entitlements exist in NSW. During unregulated flows, a period of Supplementary Access is announced, and

entitlement holders can extract water during this period which is metered. Some supplementary licences were purchased for the environment as part of water recovery processes in the Murrumbidgee, Lower Darling and Murray valleys. This stops some of the unregulated flow getting extracted or captured, supporting river channel outcomes.

River Murray Unregulated Flow (RMUF)

RMUF is declared by River Operators when there is water left in the river that cannot be captured by dams and after NSW and Victoria have exercised any rights to access other unregulated entitlements.

SCBEWC provides advice to MDBARiver Operators about prioritisation & use of RMUF for the environment in the Murray system. Prior rights / Unregulated entitlements These entitlements capture the operations river operators would historically do when undertaking operations during unregulated flows without the need for approval e.g. opening regulators to allow higher flows to travel through the forest floodplain. These 'prior rights' apply to specific wetlands and sites in NSW, and in Victoria were converted into unregulated entitlements that can be delivered during periods of unregulated flow.



River operations

lurrumbidgee Riv

River operators pre-release from storages to create airspace and help to mitigate flooding impacts where possible during wet periods. These pre-releases can be drivers of unregulated flows downstream in wetter years.

For the River Murray, which is operated by Murray-Darling Basin Authority on behalf of the Victorian, NSW and South Australian governments, flood operations are undertaken according to an agreed set of objectives and outcomes.

Working together to achieve better outcomes

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 plan how water for the environment is delivered 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 across multiple jurisdictions in the southern Basin.

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.

Strengthening First Nations involvement

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 (MLDRIN)</u> 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.

It is acknowledged that these are early steps which need to evolve over time.

Rivers, the Veins of our Country

Each year the MDBA works with First Nations, state and commonwealth agencies to create a collection of <u>short stories</u> of how First Nations people are working across the Basin to achieve shared cultural and environmental benefits through the delivery of water for the environment.

The short stories demonstrate the deep connection First Nations individuals and communities have to water and Country.



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 <u>coordinated southern Basin delivery plans</u>.

Detailed planning allows environmental water holders to respond to changing conditions, capitalise on opportunities and mitigate risks.



Environmental water managers work closely with site managers, Traditional Owners, community members and river operators to ensure activities are coordinated 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.

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.

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.



2021-22 Watering highlights

Building on ongoing wetter conditions, 2021-22 saw a record delivery of water for the environment between periods of high natural flows, with approximately 3000 GL delivered across the Murray-Darling Basin.

Higher flows meant that many wetlands and floodplains received their first drink since natural flooding in 2016. This supported the recovery of wetland vegetation and facilitated waterbird and native fish movement and breeding throughout the Basin. However, there were still significant parts of the floodplain that remain dry. For example the lower Murray requires higher flows for water to connect the river with its floodplain.

The following 7 case studies showcase some of the watering highlights from 2021-22, with their corresponding locations displayed on the map below.



A. Higher flows through Barmah-Millewa Forest

Water for the environment was delivered to Barmah-Millewa Forest in between periods of higher natural flows. The higher natural flows wetted approximately 45% of Barmah-Millewa's floodplain, giving vegetation higher up on the floodplain a much-needed drink. Moira grass flourished, providing important nesting and foraging habitat for waterbirds. Moira grass is a threatened plant species that is important to the ecological character of Barmah Forest and its status as a Ramsar wetland of International Importance.

Monitoring observed around 70 intermediate egret and 30 eastern great egret nests, alongside ~1600 rufous nightheron nests. Barmah Forest is one of the last remaining areas in Victoria where these egret species breed.

Endangered Australasian bitterns were also observed breeding, with Barmah-Millewa Forest providing critical habitat for around 30% of the known population.



Native fish rescues

Forest regulators were opened in winter and spring to provide water to the creeks and small channels throughout the forest, providing important habitat for native fish like Murray cod. In summer regulators were shut again, which can cause some native fish to become stranded and cut off from the main river channel.

In addition to physically moving fish, NSW NPWS and the Arthur Rylah Institute have been trialling <u>new strategies</u> to encourage fish to leave the forest and re-join the river before regulators are closed.





B. 2021 Southern Spring Flow – coordinating flows between the River Murray and its tributaries

The **Southern Spring Flow** was delivered for the third consecutive year in 2021. Water for the environment was delivered between periods of high flows from Hume Dam between August 2021 and February 2022 to support wetlands and lower parts of the floodplain along the River Murray between Yarrawonga and the Lower Lakes, Coorong and Murray Mouth.

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

397 GL (gigalitres) of environmental water was released from Hume Dam – which is equivalent to 80% of the volume of Sydney Harbour!

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



Flows downstream of Yarrawonga Weir

The above hydrograph shows the flows downstream of Yarrawonga Weir during the 2021-22 water year. The green shading illustrates where water for the environment was delivered between the larger unregulated peaks to support wetlands, native fish and waterbirds.

Building flows in the mid-Murray

Cross-border cooperation helped the River Murray to connect with its floodplain for over 600 kilometres between Torrumbarry (near Echuca) and Euston in October 2021.

A number high rainfall events in the Upper Murray above Hume dam commenced in late winter to early spring 2021. These wetter conditions saw river operators start releases from Hume Dam to create airspace in the storage to help manage flooding risk. These releases in the upper Murray were at flow rates higher than the normal operational constraints that water for the environment can be delivered at.

These higher unregulated Murray flows created an opportunity to build flows to support mid-Murray ecosystems while staying within mid-Murray constraint levels. Environmental Water Holders worked together with land and water managers, river operators and local landholders to take advantage of this fantastic opportunity.

An environmental water pulse from the Goulburn Valley was coordinated with high Murray flows building a peak of approximately **24,000 ML/d** downstream Torrumbarry. Numerous billabongs, creeks and flood-runners on both the Victorian and New South Wales side of the Murray had their first drink since 2016 including Poon-Boon Lakes.

Though many of these important waterways sprang back to life, they need more water, and more often. Governments are continuing to work with communities to see how these valuable ecosystems can continue to be supported into the future without impacting communities or contributing to flooding.



C. High flows in the Murrumbidgee support pelican breeding

Large colonies of pelicans were observed in the Murrumbidgee and Lachlan valleys (12,000 and 30,000). The wet conditions triggered large breeding colonies and provided abundant food sources to support the booming population. Pelicans were recorded at Kieeta Lake in the Murrumbidgee system for just the second time, with the only other time being during the 2016 floods.



Nari Nari Tribal Council conducted feral pest management to ensure fledgling waterbird survival at breeding sites, and worked closely with environmental water holders, scientists, and water managers to deliver water for the environment to keep water levels stable and ensure the breeding cycle was completed successfully. More info: <u>The Pelican Brief</u>

Endangered frog spotted!

Painted burrowing frogs were recorded in the Murrumbidgee catchment for the first time in 2021. This endangered frog is usually only found in South Australia and western Victoria, and this sighting shows a significant expansion of its range. Follow-up delivery of water for the environment will be critical to helping these frogs establish a stable population. Additionally, hundreds of threatened southern bell frogs were heard during monitoring in the wetlands along the mid and lower Murrumbidgee River.



O. Northern Basin waterbirds are back!

Large scale colonial waterbird breeding occurred in the Macquarie Marshes, Gwydir wetlands and Dharriwaa (Narran Lakes).

This is the first time in 24 years that colonial waterbird breeding has been observed at all three sites simultaneously.

Colonies of Australian white ibis, royal spoonbills, straw-necked ibis, glossy ibis, egrets, herons and cormorants were amongst the birds recorded breeding at these wetlands.



An estimated **150,000 pairs** of waterbirds were observed during monitoring at the Macquarie Marshes alone!

These breeding events were triggered by large-scale flooding across the northern Basin. The delivery of water for the environment ensured that waterbird feeding and breeding habitat was supported for the duration of the breeding period, and that the wetlands were able to support these events..

Watching out for the new parents

The Commonwealth Environmental Water Office (CEWO) has had a team of scientists monitoring bird breeding events to assess how water for the environment is making a difference as part of the <u>Flow-MER Program</u>. Waterbird satellite tracking conducted by CSIRO has shown waterbirds moving across the entirety of the Murray-Darling Basin and beyond.



Waterbird monitoring undertaken by the University of New South Wales and the NSW Department of Planning and Environment in 2021-22 showed that colonial waterbird species were starting to bounce back after years of drought.

The monitoring highlighted the importance of keeping nesting sites wet for the total duration of the breeding season. This is critical for the recovery and conservation of many waterbirds, as rapidly falling water levels will cause adults to desert their nests abandoning their chicks.

Highlights

E. Baaka and Anabranch raise their glasses to the North

Summer, autumn and winter 2022 saw high inflows from the northern Basin via the Baawan-Baaka into the Menindee Lakes. To manage lake levels and flood risks, river operators released large volumes down both the lower Darling-Baaka River and the Great Darling Anabranch.

Water for the environment was delivered to encourage Murray cod spawning, and also to fill 'gaps' between operational releases to the Baaka and Anabranch. This has:

- Connected the river with wetlands and billabongs, providing significant benefits for vegetation, waterbirds, aquatic bugs, frogs and terrestrial fauna that live on the floodplain
- Provided a boost in river productivity, and hence plenty of food for juvenile fish.

Menindee Lake airspace releases have provided the largest overbank flows in the region for over 10 years



Great Darling Anabranch (Source: C. Locke)



Baaka in flood; mussel and golden perch monitoring. Credit: P. Childs, DPI Fisheries and Charles Sturt University

The Great Darling Anabranch is enjoying the first flows in almost five years, connecting all the way to the Murray River. This much needed drink has increased productivity and supported both aquatic and terrestrial plants as well as native fauna both in and out of the water.

"So awesome to see the river come to life! We haven't even had the water here for a week and the fish are loving it! Really exciting to see the juveniles follow the food down the river" (Angus Whyte, Wyndham

(Angus Whyte, Wyndham) Station) Monitoring has shown:

- Murray cod and a suite of smaller native fish have bred
- Multiple age cohorts of golden perch are now present in the Menindee Lakes and lower Darling-Baaka.
- Young golden perch that spawned across the northern Basin have dispersed as far south as the Lower Darling-Baaka, and beyond to the Murray River.
- Scientists and Barkindji River Rangers have shown the importance of flows for rebuilding the freshwater mussel population.

F. Coordinated floodplain operations begin in South Australia

From August to late November 2021, the major floodplain regulator works at Chowilla, Pike and Katarapko were operated concurrently for the first time. The coordinated operations, coincided with high unregulated flows in the lower Murray and weir pool raisings at Locks 4, 5 and 6, gave 7,629 hectares of SA floodplain a much-needed drink.

Wetter conditions and the delivery of water for the environment saw increased flows in the lower Murray River for much of 2021-22.

Higher flows increased the velocity of the water and improved the habitat available for native fish, supporting their spawning and recruitment.

In 2021-22 golden and silver perch spawned in the lower Murray for the second year in a row after long absences of younger fish for many years.



oung of year silver perch caught electrofishing in the lower Murray (Source: SARDI)



Floodplain watering improves habitat and food availability for a wide range of species and brings habitats back to life. Following the watering action trees and understorey vegetation like river red gums, black box and lignum are showing improvement in condition and providing important habitat for a range of species. Eight frog species including the threatened southern bell frog were recorded at Chowilla.



Many thousands of birds responded to the floodplain waterings, with species such as Australian shell-duck, pied cormorants, grey teal, white-headed stilt, and avocets present in good numbers. Migratory species such as red-necked stints and sharp-tailed sandpipers were also spotted.

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G. Ngarrindjeri support monitoring in Lower Murray wetlands

Yarning circles

The Ngarrindjeri Aboriginal Corporation (NAC) and the Department for Environment and Water (DEW) held a series of Yarning Circle workshops across the Lower Lakes, Coorong and Murray Mouth (LLCMM) region in 2020-21.

The Yarning Circles identified that the care and protection of **Ngartjis** (totemic species) is very important to Ngarrindjeri, along with maintaining a connection to **Ruwe** (Country) through hands-on cultural activities.

In 2021-22, in order to implement recommendations from the Yarning Circles project, NAC staff and Ngarrindjeri community members took part in a number of ecological monitoring programs.



The NAC and The University of Adelaide codeveloped a yabby monitoring project in the Lower Murray wetlands in January 2022.

Ngarrindjeri helped to define the wetland locations and also participated in the monitoring through setting and baiting traps and retrieving and sorting through the catch of yabbies. The yabbies were sexed, weighed, measured and photographed before being returned back to the wetlands.

A joint program between the NAC, DEW, and the South Australian Research and Development Institute (SARDI) Aquatic Sciences monitored fish passage at Salt Creek and Morella Basin.

Ngarrindjeri community members assisted in the field monitoring, by sorting and identifying fish and undertaking water quality monitoring.

A total of seven species of fish were trapped using the fishways including congolli, yelloweye mullet, smallmouth hardyhead, blue spot goby, blackbream, southern shortfin eel and flat-headed gudgeon.



Ngarrindjeri people are water people and their connection to water is a part of their identity – they are one with the sea (*Yarluwar*) and *Ruwe* (Country). Being involved in fish and yabby monitoring and protecting their *Ngartjis* is vitally important culturally and spiritually for both current and future generations.

Learning and Adapting

Monitoring and adapting – Water Quality

Environmental water holders and water managers regularly monitor water quality to help keep our rivers healthy for the people, plants and animals.

In certain situations water for the environment can be strategically released with the aim of maintaining water quality above key target thresholds, for example during hypoxic blackwater events.

During flood conditions, increased water on the floodplain flushes large volumes of organic matter into our rivers. This matter is then broken down by bacteria, a process that is important to boost productivity in our rivers and provide additional food for native fish and animals.

However, to break down the organic carbon the bacteria uses oxygen that rapidly speeds up as water temperatures increase. This can cause dissolved oxygen levels to plummet, becoming lethal to fish, and is commonly known as hypoxic blackwater.

!? What is blackwater ?!

Blackwater is water that picks up carbon in the form of plant and other organic matter from a floodplain. This then dissolves turning the water a dark brown or black colour, like the colour that leaks from a tea bag.

Not all blackwater is bad – this carbon rich water can boost waterway productivity providing food for aquatic organisms and fish.



During spring of 2021 dissolved oxygen levels in the lower Murrumbidgee were dropping rapidly as nutrient rich water from the floodplain was returning to the channel.

To help mitigate this hypoxic blackwater event, water for the environment was strategically released from upstream storages to provide freshening flows. This is where oxygenated water from the storages is mixed with the incoming low oxygenated water from the floodplain with the aim of keep water quality above critical thresholds and prevent large fish kills.

Whilst opportunities like the above do occasionally arise, during major flood events hypoxic blackwater can become very widespread and there are very few options to mitigate its impact on native fish communities. Environmental water holders work with scientists, communities and river operators to provide support where they can.

Monitoring and adapting

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 remain in poor condition or continue to show decline.

In 2021-22, state partner agencies delivered over 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.

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>.





TLM MONITORING

Site condition through time

		Parmah Millowa	Cuphower		Koondrool	k			LindsayMulcra			Lower Lakes,
		Forest	Forest	۶	Perricoota Forest	، <u>۲</u>	Hattah Lak	es	Walipolia Islands 🏸	Chowilla	۶	Coorong, Murray Mouth
- Č	2020/21	В	В	۶	D		В	۶	с 🗡	C		C
÷.	2019/20	В	В	۶	D	۶	Α		В	С		С
÷	2018/19	В	Α	۶	D		В		В	В	۶	С
÷.	2017/18	Α	В		D		Α	۶	В	В		С
*	2016/17	Α	В		С		Α	۶	В	В	۶	В
, Č	2015/16	В	В	۶	D		Α	۶	В	с	۶	С
Ö	2014/15	В	В	۶	D	۶	Α	۶	- 🍾	с	۶	В
<u> </u>	2013/14	С	В	۶	D		В	۶	с 🗡	с		В
<u> </u>	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
-Ö:-	2007/08	D	D		D		D		D	-		D

Sites with environmental works/years where works used

A - Excellent	B - Good	C – Fair	D - Needs attention
Most (75-100%) of ecological	More than half (50-74%) of	Fewer than half (25-49%) of	Few (0-24%) of ecological
objectives have been met.	ecological objectives have been met.	ecological objectives have been met.	objectives have been met.

NOTE: Objectives vary between sites and therefore this table should be interpreted as how individuals sites are faring over time as apposed to a comparison between sites.

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

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 low-lying floodplain areas 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

Some of the **opportunities to improve** SCBEWC identified in managing water for the environment in 2021-22 include:



Location of key challenges that impacted the delivery of water for the environment in the southern connected Basin in 2021-22

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.

SCBEWC agencies supported the Basin annual priorities by: building on unregulated events and extending periods of inundation on floodplains and wetlands; increased baseflows in the Lower Baaka in spring for Murray cod spawning; delivering a River Murray Multi-Site, providing flows to the Coorong to support suitable habitat and water quality for migratory wading birds.



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 2022 the total volume of water for the environment held in the Murray-Darling Basin is 3,123 GL/year*. Of this, 2,420 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.

2,420 GL/year in the Southern Connected Basin:

HEW entitlements in the Southern Connected Basin by manager as at 30 June 2022 in GL/y (LTDLE) and as a percentage of total



■ CEWH ■ Jointly held (TLM & RMIF) ■ VEWH ■ NSW ■ SA Minister for River Murray

Total long-term average volume of water for the environment held by each water holder in the southern connected basin as at June 30, 2022. Jointly held water volumes include 489 GL TLM and 70 GL RMIF. * 3,123 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)

Appendices and Data

Using water efficiently return flows in 2021-22

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, Pike and Katarapko floodplains and flows to the end of system at the Lower Lakes and Coorong.



*Return flows from the Lower Darling were not calculated but did add to the unregulated flows in the River Murray. Other environmental sites that received water in the Southern Connected Basin: Vic wetlands 10 GL (no return flows); NSW wetlands and creeks 31 GL (no return flows); SA wetlands and River Murray Channel use from upstream e-water 275 GL (95 GL return flows). Delivery of water for the environment through the river system supported the River Murray Channel from Hume Dam to the Coorong.

Appendix – Water delivery by location

Table of 2021-22 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	Longitudinal connectivity	0	0	0	0	0	0	0
Barmah-Millewa	Fish; Vegetation; waterbirds	79	0	70	0	0	0	149
Niemur; Yallakool-Wakool	Fish	0	80	0	10	0	0	90
Lower Darling	Fish	45	48	0	0	0	0	93
Darling Anabranch	Fish	0	0	0	5	0	0	5
Broken System	Water quality; Fish, Waterbird	0	71	2	0	0	0	73
Goulburn System	Vegetation; Longitudinal connectivity; Fish; Waterbirds	47	323	27	0	0	0	397
Campaspe System	Fish	0	9	26	0	0	0	34
Gunbower Creek	Fish; Vegetation	0	2	8	0	0	0	10
Gunbower Forest	Vegetation; Waterbirds; Fish	16	0	4	0	0	0	20
Koondrook-Perricoota Forest: Pollack	Vegetation; Waterbirds	0	4	0	0	0	0	4
Loddon System	Fish; Vegetation	0	3	21	0	0	0	24
Murrumbidgee System	Vegetation; Fish; Waterbirds; Water quality, Connectivity	60	588	0	27	0	0	675
Hattah Lakes	Vegetation	16	0	30	0	0	0	46
Lindsay-Mulcra- Wallpolla	Vegetation; Fish;; Lateral connectivity	11	0	0	0	0	0	11
NSW/Vic Weirpool Manipulations	Lateral connectivity	0	8	0	0	0	0	8
Other NSW Murray Wetlands and Creeks	Ecosystem processes; Fish; Waterbirds	0	26	0	6	0	0	31
Other Victorian Murray Wetlands	Vegetation; Fish	0	0	10	0	0	0	10
South Australian Murray Wetlands. Incl. Pike and Katarapko	Vegetation; Lateral connectivity	0	12	0	0	25	0	37
Chowilla Floodplain	Vegetation, waterbirds	0	0	0	0	0	0	0
Lower Lakes, Coorong and Murray Mouth	End of system flows; Waterbirds; Longitudinal connectivity; Fish	204	816	0	0	20	0	1040
SA River Murray use from upstream e-water	Longitudinal connectivity; ecosystem processes	18	220	0	0	0	0	238
Total		496	2210	198	48	45	0	2995

Appendix – Jointly held water portfolio overview The Living Murray (804.8 GL was available for use)

Location	Entitlement volume (GL)	Net carryover (GL)	Allocation (%)	Allocation (GL)	Available (carryover + allocation) (GL)
NSW Murray High Security	5.1	0.0	100%	5.1	5.1
NSW Murray General Security	83.0	41.5	110%	91.3	91.3
NSW Murrumbidgee General Security	85.0	25.3	100%	85.0	85.0
NSW Lower Darling High Security	0.5	0.0	100%	0.5	0.5
NSW Lower Darling General Security	47.8	1.5	100%	47.8	47.8
Vic Murray High Reliability	21.9	17.9	100%	21.9	26.3
Vic Murray Low Reliability	98.8	0.0	100%	98.8	42.0*
Victoria Goulburn High Reliability	45.2	19.1	100%	45.2	64.3
Victoria Goulburn Low Reliability	157.0	0.0	0%	0.0	0.0
Victoria Campaspe High Reliability	0.1	0.0	100%	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	594.4	105.3	n/a	440.7	407.5
Supplementary & unregulated licences	397.3	0.0	n/a	397.3	397.3
GRAND TOTAL	991.7	105.3	n/a	838.0	804.8

Carryover is the net available after start of year adjustments (such as for evaporation).

Available 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.

* Volume available is less that total entitlement due to Victorian valley cap rules.

River Murray Increased Flows (50 GL was available + further 112 GL available from May)

Location	RMIF carryover in River Murray Storages at beginning of 2021-22 (GL)*	RMIF made available in River Murray Storages during 2021-22 (GL)^	RMIF used in 2021-22(GL)	RMIF in River Murray Storages at the end of 2021-22 (GL)	RMIF in Snowy storages (as at 1 May 2022) (GL)#	
NSW Murray	25.0	56.0	25.0	56.0	148.5	
Victorian Murray	25.0	56.0	25.0	56.0	148.5	
TOTAL	50.0	112.0	50.0	112.0	297.0	

*RMIF carryover associated with release of additional water by Snowy Hydro in 2020-21.

^RMIF made available in River Murray Storages during 2021-22 associated with release of additional water by Snowy Hydro during the Snowy Water Year between 1 May 2021 and 30 April 2022 (and classified as RMIF available in Hume from May 2022).

Appendix – Estimated unregulated flow delivery 2021-22

While sites were eligible to receive RMUF in 2021-22, many sites can access unregulated flows using other mechanisms unique to each state. Unregulated flows, including RMUF were delivered to sites in NSW and South Australia. In Victoria, numerous Victorian sites received water during unregulated conditions using TLM and VEWH unregulated flow entitlements.

The sites listed in these tables are where water is understood to have been *actively* managed (e.g. via regulators/pumping). These are not a complete list of everywhere that got inundated due to higher natural flows.

State	Site	Vol (ML)
NSW	Poon Boon Lakes	9,600
NSW	Wingillie Lagoon	403
NSW	Thegoa Lagoon	1,336
NSW	Gol Gol Lake	2,100
Vic	Gunbower Forest - Reedy Lagoon	1,406
Vic	Gunbower Forest - Little Reedy Lagoon Wetland Complex	6,959
Vic	Gunbower Forest - Black Swamp	529
Vic	Gunbower Forest - Yarran Creek	444
Vic	Gunbower Forest - Little Gunbower Lagoon	465
Vic	Hattah Lakes	46,139
Vic	Lake Wallawalla	9,448
Vic	Gunbower creek	8,079
Vic	Guttrum state forest	654
Vic	Johnson swamp	984
Vic	Lake Elizabeth	671
Vic	Lake Murphy	2,631
Vic	Muringa wetlands	15
Vic	Richardson Lagoon	1,263
Vic	Round Lake (Kunat Kunat)	360
Vic	Wirra-lo wetlands	62
Vic	Pyramid creek	275
SA	Chowilla/Lock 6	44,989
SA	Pike/Lock 5	6,006
SA	Katarapko/Lock 4	2,323
SA	Lock 2	1,264
SA	Berri Evaporation Basin	1,316
SA	Bookmark Creek	445
SA	Disher Creek	17
SA	Paringa Paddock temporary wetland	102
SA	Class 9 wetlands	20,929
SA	Lower Lakes, Coorong and Murray Mouth	

Appendix - Acronyms used within this report

CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water and the Environment
GBCMA	Goulburn Broken Catchment Management Authority
GL	Gigalitre (GL) = 1 billion litres
Jurisdictions	Partner governments including the Commonwealth, NSW, VIC, and SA
LLCMM	Lower Lakes, Coorong and Murray Mouth
MDBA	Murray-Darling Basin Authority
ML	Megalitre (ML) = 1 million litres; ML/d = megalitres per day
MLDRIN	Murray Lower Darling Rivers Indigenous Nations
NSW	New South Wales
NSW DPIE	New South Wales Department of Planning, Industry and Environment
RMIF	River Murray Increased Flow
RMUF	River Murray Unregulated Flows
SA	South Australia
SA DEW	South Australian Department of Environment and Water
SARDI	South Australian Research and Development Institute
SCB	Southern Connected Basin
SCBEWC	Southern Connected Basin Environmental Watering Committee
TLM	The Living Murray
VEWH	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



Planning and Environment



VICTORIAN ENVIRONMENTAL WATER HOLDER







Government of South Australia

Department for Environment and Water





Energy, Environment and Climate Action



Australian Government

Department of Climate Change, Energy, the Environment and Water

















