Australian Government
Commonwealth Environmental Water Holder

Commonwealth Environmental Water Holder
Submission to the Productivity Commission's Murray–Darling Basin Plan: Implementation Review 2023

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Acknowledgement of Country

Our department recognises the First People of this nation and their ongoing connection to culture and country. We acknowledge Aboriginal and Torres Strait Islander People as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living culture and pay respects to their Elders past, and present.

Cover image

Great Darling Anabranch, 2022. Chris Locke.

Acknowledgement of First Nations people

The Commonwealth Environmental Water Holder (CEWH) acknowledges the First Nations communities of the Murray–Darling Basin (the Basin) and pays respect to their Elders past and present.

We acknowledge First Nations people as the Traditional Owners and custodians of the land, water and sky country across the Basin. We recognise the intrinsic connection of First Nations people to Country, and we value their enduring cultural, social, environmental, spiritual, and economic connection to the rivers, wetlands, and floodplains of the Basin.

We value the ongoing contribution that First Nations people make to the planning and delivery of water for the environment. We acknowledge this contribution is made largely through frameworks and processes that have not been determined, or endorsed, by First Nations people. More can be done to increase First Nations peoples' participation and empower them to progress towards self-determination within and beyond the environmental watering program. We are continuing to build relationships with First Nations communities, to learn from and identify ways to support cultural values alongside environmental outcomes with water for the environment.

We embrace the spirit of reconciliation, working towards equity and an equal voice for First Nations people.

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Executive Summary

The Murray–Darling Basin Plan (Basin Plan) is the most significant reform of its kind in the world. It was developed to manage the Basin as a connected system and bring it back to a healthier and more sustainable level, while continuing to support the multitude of values it provides the Australian community.

The Commonwealth Environmental Water Holder (CEWH) manages the Commonwealth's environmental water holdings to protect and restore the rivers, wetlands and floodplains of the Basin. Commonwealth environmental water is managed consistent with the Basin Plan, which provides an integrated framework for all water management in the Basin. To date, 2,889 gigalitres (GL) of registered entitlements (with a long-term average annual yield of 2,001 GL) has been recovered and is held by the Commonwealth.

Since its introduction, the Basin Plan has yielded significant benefits for the environment. Over the 5 years since the Productivity Commission's previous inquiry into Basin Plan implementation, Commonwealth environmental water has been stress-tested under extreme conditions of drought (2017-2020) and floods (a triple La Nina from 2020), delivering beneficial environmental outcomes across the Basin. It has supported connectivity along rivers and between rivers and wetlands, improvements in habitat and ecosystem health, and ensured the survival of water dependent species while also supporting cultural and community values.

Strong partnerships, a rigorous monitoring, evaluation and research program, and a culture of continuous improvement (learning through doing) are at the heart of the CEWH's approach to managing water for the environment. There have been significant environmental gains made since the Basin Plan was enacted in 2012 and in the past 5 years. These gains are underscored by the requirements of the Plan, but can also be attributed to the commitment, passion and collaboration between state and federal governments, First Nations people, communities, water users and scientists.

Since 2009, over 15,000 gigalitres of Commonwealth environmental water has been delivered to the Murray–Darling Basin – the equivalent of 30 Sydney Harbours. This has supported:

- more than 22,000 kilometres of waterways (the same distance as driving around Australia twice)
- more than 370,000 hectares of lakes, wetlands, estuaries and floodplains
- 10 Ramsar wetlands that have been recognised internationally for their ecological importance
- hundreds of species of waterbirds, native fish and plants, including threatened species such as silver perch, Murray cod and Murray hardyhead
- the flushing of more than 3.3 million tonnes of salt through the barrages.

Despite these outcomes and achievements, there is still more to do.

- Waterbird populations have experienced long-term declines over the past 40 years, while native fish populations have declined by 90% over the past 150 years – arresting and reversing these declines requires long-term and sustained action.
- Due to operational and physical constraints, rivers are not regularly connecting to key wetlands on the floodplain including in the Gwydir, Lower Darling-Baaka, mid-Murrumbidgee, Goulburn, mid-

Murray (including Werai Forest) and Lower Murray valleys. In some cases, even delivering elevated in-channel environmental flows is restricted.
- In the northern Basin, there are still far too many cease-to-flow events, which compromises recovery of rivers and their dependent communities.
- At the end of the system, flow targets to ensure salt is flushed from the system and healthy salt levels are maintained in the internationally significant Coorong, are not consistently being met.

Significant opportunities lie in the full implementation of the Basin Plan.

The full recovery of water for the environment will unlock the achievement of a greater range of environmental outcomes, as envisioned by the Basin Plan. It will also help buffer the Basin's environment against an uncertain and extreme climate.

To continue to see improvements in the achievement of environmental conditions, Basin Plan implementation will need to feature a renewed focus on constraints relaxation measures and full delivery of the Northern Basin Toolkit. While the toolkit goes some way to improve outcomes for native fish, continued intervention – including an expansion of fishways and fish-friendly pumps – is needed because without it, native fish populations are at risk of further decline.

Addressing the barriers to, and empowering First Nations participation in water management must also be a continued focus in implementing the Basin Plan and in water reform more broadly. Key issues include:

- increasing access and ownership to water and in line with the Closing the Gap targets
- resourcing First Nations organisations to be able to both manage water and waterways, and participate in broader water management and reforms
- building capacity and two-way sharing of knowledge with and between First Nations communities.

The CEWH continues to deepen and strengthen relationships with First Nations people. The CEWH *Approach to Partnering with First Nations People* focuses on: empowering First Nations to care for Country, including through their involvement in environmental water; building partnerships with First Nations people; and building the capacity and confidence of CEWH staff to engage with First Nations people and their culture. The CEWH's approach is evolving towards forming partnership and co-management arrangements with First Nations people, supporting them to care for Country and elevating their role in the management framework from consultative to decision-making.

Under climate change, a range of threats are likely to arise more frequently. This will put pressure on environmental water managers like the CEWH to address issues and emergencies beyond what was contemplated at the time of the Basin Plan's creation, while also constraining its ability to do so. In this context, consideration needs to be given to the role of all actors within the Basin's management framework to respond to extreme events, including water quality emergencies, recognising that this provides benefits for communities and other water users.

About the Commonwealth Environmental Water Holder

The Commonwealth Environmental Water Holder (CEWH) is a statutory position established under the *Water Act 2007* (Water Act) and is responsible for managing the Commonwealth environmental water holdings. Commonwealth environmental water must be managed to protect or restore the environmental assets of Murray-Darling Basin (the Basin), so as to give effect to international agreements including the Ramsar convention.

The Murray–Darling Basin is Australia's largest river system, which covers more than a million square kilometres across south-eastern Australia. It's rivers, creeks and tributaries traverse Queensland, New South Wales, Victoria, the ACT and South Australia. As the holder of Commonwealth environmental water, the CEWH considers the entire Basin in planning and using environmental water, managing the national interests of this complex and important river system.

In undertaking their function, the CEWH gives effective to international agreements, including the Ramsar Convention on Wetlands, the Japanese Australia Migratory Bird Agreement, the China–Australia Migratory Bird Agreement and the Convention on Biological Diversity. Watering actions are planned to support threatened ecological communities and species.

The CEWH is governed by the requirements of the *Water Act* 2007 and the *Basin Plan 2012* (the Basin Plan). The Basin Plan requires the CEWH to perform their functions and exercise their powers in a way that is consistent with the Basin-wide environmental watering strategy, and to have regard to the Basin annual environmental watering priorities developed by the Murray–Darling Basin Authority (MDBA). In addition, the CEWH must comply with other relevant state and Commonwealth policy, frameworks and legislation, including the *Public Governance, Performance and Accountability Act 2013* and the *Environment Protection and Biodiversity Conservation Act 1999*.

Dr Simon Banks is the current CEWH. He is supported by a highly qualified team in the Department of Climate Change, Energy, Environment and Water. CEWH staff come from a variety of fields including environmental and biological science, engineering, natural resource management, communications, policy, engagement, research, project management and business services. This includes local engagement officers (LEOs) who live and work in rural and regional centres across the Basin.

The CEWH's function and the Commonwealth environmental water holdings are a critical part of the sustainable management of the Basin's water resources over the long-term. Commonwealth environmental water management is underpinned by:

- clear objectives
- comprehensive planning, including a detailed assessment of risks
- working in partnership with state governments, First Nations people, landholders, local communities, industry, non-government organisations and scientists to deliver water when and where it is needed
- a robust program to measure and monitor water use to support accountability, assess outcomes and to inform adaptive management
- regular reporting and communication of environmental water use and outcomes achieved.

Summary of improvements since 2018 Productivity Commission Review

Over the past 5 years, and since the Productivity Commission's first Basin Plan implementation review, the Murray–Darling Basin has experienced extreme climatic conditions.

The 2017–2020 drought was the worst on record for the northern Basin. It was characterised by extended cease-to-flow[1] periods, well in excess of ecological tolerances and significantly worse than those experienced during the Millennium Drought. Towns went without access to fresh drinking water, large-scale fish deaths occurred, permanent waterholes dried up and local ecological assets moved to critical need. The numerous cease-to-flow periods were only broken during this time with water for the environment.

In 2020, wetter conditions returned. Immediately following the record drought, the Basin experienced only its 3rd triple La Nina since 1900. This culminated in the 2022–23 floods, which for some parts of the Basin, were the highest in over 50 years. This had devastating impacts on communities and industries. It also replenished the Basin's rivers, wetlands and floodplains, revitalised woodlands and forests, triggered waterbirds to breed in large numbers, and supported large-scale migration of native fish. The impacts were not all positive for the environment, with flooding leading to hypoxic conditions developing, resulting in mass fish deaths in April 2023.

In both climatic extremes of dry and wet, water for the environment has supported habitat, ecosystems and species while also providing synergistic benefits for communities and the achievement of cultural outcomes within the Basin.

There have been several areas of development and incremental improvement in environmental water planning and management since 2018. These include:

- improved coordination between environmental water managers and across valleys
- improved coordination and communications with river operators in the planning and delivery of environmental water
- continued maturity of the CEWH's approach to communication and engagement.

In other areas, there has been noteworthy progress (but there is more work to be done). These include:

- the protection of environmental water (including continuing to develop methods for accounting for return flows, where these do not exist, and to evaluate and improve existing methods)
- implementation of new rules (resumption of flow, active management) for the protection of planned and held environmental water to achieve greater connectivity for river systems in the northern Basin, and
- improved engagement and partnerships with First Nations across the Basin.

[1] Cease-to-flow is when there is no flow in a river, and partial or total drying of the river channel.

Reviews of the CEWH

The CEWH has been the subject of at least 11 public inquiries and reviews since 2013.[2]

In 2022, the way in which the CEWH manages its portfolio of water entitlements to improve river health was subject to a review by the Inspector-General of Water Compliance (IGWC). The 'Steady as it flows' report[3] found the CEWH to be performing professionally and in accordance with its obligations. It found a robust and effective approach to planning and delivery of water for the environment, an appropriate monitoring and evaluation program and commendable communication and outreach. It concluded that:

> *It is clear the CEWH has been subject to numerous public reviews and receives a high level of public scrutiny [and] the CEWH has a strong record of heeding the recommendations of these reviews and acting upon them in order to improve its operations. This indicates a positive culture of continuous improvement.*

To further enhance its operations, the IGWC recommended that the CEWH expand its local engagement officer network and improve the measurement and accounting of water for the environment.

The Select Committee on the Multi-Jurisdictional Management and Execution of the Murray–Darling Basin Plan made similar recommendations in its final report, tabled on 30 September 2021.

The CEWH welcomes external scrutiny and ensures feedback and recommendations are addressed. As part of the CEWH's culture of continuous improvement, the CEWH:

- has expanded the number of regionally-based staff
- has undertaken research to better understand water user information needs and preferences
- has adjusted the communications and engagement strategy to build awareness about its water use, activities, and outcomes
- is working within the range of existing committees and other multijurisdictional forums to drive improvements to modelling and mapping tools.[4]

[2] See Appendix A: reviews of the Commonwealth Environmental Water Holder since 2013.
[3] 'Steady as it flows' An assessment of River Murray operations and environmental water management (Inspector-General of Water Compliance, 2022).
[4] Response to the Inspector-General of Water Compliance 'Steady as it Flows' (dcceew.gov.au)

Managing the water portfolio

The function of the CEWH has matured significantly over its 15-year history. The CEWH and their staff continue to evolve the operation and management of environmental water to ensure an integrated and sophisticated approach that optimises outcomes across a large, complex system.

The CEWH is the only environmental water holder in the Murray–Darling Basin that takes a Basin-wide approach to its watering activities. For this reason, Commonwealth held environmental water plays a critical role in addressing Basin-wide priorities, as well as planning for and delivering outcomes that require coordination across state borders.

Commonwealth water entitlements have the same characteristics as other equivalent water entitlements in the Basin. The CEWH also has the same water management options as commercial irrigators. Accordingly, the CEWH is subject to the same fees and allocation and carryover rules as other water users.

As of 31 May 2023, Commonwealth environmental water holdings totalled 2,889 gigalitres (GL) of registered entitlements with a long-term average annual yield of 2,001 GL.

As for other water users, the options for managing Commonwealth environmental water include:

- use – delivering water to a river, wetland or floodplain to meet an identified environmental demand
- hold – carry water over for use in the next water year (carryover)
- trade – trading water, which includes
    - transferring water between connected catchments
    - buying and selling water allocations
    - using the proceeds from selling water to invest in activities that improve the outcomes from the use of water for the environment.

Environmental water use

The Basin Plan establishes the objectives, processes and principles that guide the management of water for the environment. The Basin-wide Environmental Watering Strategy provides the next level of detail on the environmental objectives and targets. It describes the environmental outcomes expected focused on 4 components:

- river flows and connectivity
- native vegetation
- waterbirds
- native fish.

At a valley scale, long-term watering plans are prepared by Basin state governments. From planning at both a Basin and valley scale, the CEWH has clear objectives and guidelines for what we want to achieve in the long-term and what success looks like. Based on these longer-term plans, each year, we develop annual plans that take a range of variables into consideration.

The CEWH follows an important process in planning, delivering, monitoring and reporting our water use. It is based on having robust planning for multiple water resource scenarios and information, science and monitoring to inform decision-making, including:

- observations and forecast weather conditions
- knowledge and science about the outcomes we are trying to achieve
- information, knowledge and advice from First Nations people, site managers, landholders, local communities, river operators and
- planning with river operators, other environmental water holders and First Nations people.

There is a strong adaptive management approach embedded in CEWH planning which considers:

- adapting and adjusting our use according to conditions as we go
- analysing monitoring results so we know where we can improve our approaches
- feeding these results into future planning and priorities.

In the 5 years since the Productivity Commission's last Implementation Review, the CEWH has delivered a total of 6,624 GL of water across the Basin.[5] This has occurred in the context of extremely varied conditions across the Basin, from low water availability (2018-20) through to flood conditions (2022-23), and ongoing operational constraints to the delivery of environmental water.

The use of Commonwealth environmental water has provided demonstrable benefits for the Basin's rivers and wetlands (including internationally significant Ramsar wetlands), and the animals and plants they support.

In extremely dry years (2017–20), Commonwealth environmental water played a pivotal role in breaking cease-to-flow events, maintaining flows to enable fish breeding and waterhole replenishment, as well as supporting core riparian and wetland habitat to promote a quick recovery of ecosystems once conditions improved.

In wet years (2021–23), Commonwealth environmental water was used to maximise the benefits of the favourable conditions. This included supporting large-scale waterbird breeding, native fish migration and building ecosystem and habitat resilience. Under recent flood conditions, Commonwealth environmental water has also played a vital role in providing refuge for native fish from hypoxic water.

Strategies to maximise the benefits of environmental water include using a parcel of water multiple times as it flows through the river system; coordinating with other sources of water (such as environmental water managed by state governments and consumptive water deliveries); and coordinating water across multiple valleys. To support this coordination between environmental water holders and river operators, committees have been established for both the northern and southern Basins.

The Southern Connected Basin Environmental Watering Committee (SCBEWC) was established in 2014 to support the coordination of the delivery of water for the environment in the Southern Connected Basin and in particular in the River Murray system. The Northern Basin Environmental Watering Group (NBEWG) was established in 2019 to coordinate the planning and delivery of water for the environment in the northern Basin to enhance connectivity and improve environmental outcomes. The

[5] Data available to 30 April 2023 (Managing water for the environment - DCCEEW).

CEWH and their staff actively engage through both SCBEWC and NBEWG, and efforts through these committees have contributed to an increase in the amount of Commonwealth environmental water delivered through successful coordinated water events.

The management and delivery of environmental water also relies on considerable advice and assistance from delivery partners and water management authorities.[6] These includes state environmental water holders and environmental water managers, river operators, catchment specific partners, First Nations groups, irrigation operators, community groups and scientists. The CEWH's partnerships make it possible to deliver environmental water where it is needed.

In some cases, these partnerships enable innovative delivery methods that help to achieve outcomes that might not have otherwise been possible. For instance, the CEWH's partnership with Murray Irrigation Limited (MIL) meant that MIL's network of channels and escapes have been used to deliver small volumes of oxygenated water to create areas of better-quality water to support native fish and other aquatic life at critical times.

Appendix B provides additional case studies, illustrating the impact and outcomes of water for the environment and CEWH partnerships.

Carryover

Carryover is an important option for all water users, as it allows water allocations to be strategically moved from one year to the next.

Environmental water use follows different patterns of demand than consumptive delivery and therefore requires different carryover decisions to be made by the CEWH. However, carryover rules are set by Basin states and vary markedly for different entitlements, different valleys and in different states.

The CEWH does not receive special treatment in the way it uses carryover provisions. Carryover limits, account limits and use limits apply to all entitlement holders, including the CEWH. As a result of the rules, no water holder can fill up dams to the exclusion of other water users. Whether a year is wet or dry is a more important determinant of whether a dam spills or not than the choices of any individual entitlement holder. The largest volume of water carried over by the CEWH to date was 1,081 GL into 2022–23 – this only represented 4.8 % of the capacity of major storages in the Basin.

When making carryover decisions, key considerations for the CEWH include having sufficient water in accounts for environmental water use early in a water year and Reserving water in wet years, to minimise the risk of no or low water allocations in future dry years.

in the southern Basin, rivers naturally peak in winter-spring. However, new allocations are made progressively across the water year. The ability to carry over water into the new year before new allocations become available can therefore be necessary to meet the early season demands. In northern and central valleys (e.g. Gwydir, Macquarie and Lachlan valleys), the multi-year accounting and carryover arrangements means water is often allocated in wet years, which can often be used over multiple years and provide a reserve if condition gets dry.

[6] Delivery partners - DCCEEW

Historically, the CEWH uses about 70% of its annual allocation each year on average and carries over about 30% of allocations. The CEWH's usage and carryover is similar to the annual take observed across the Basin under the allowable take limit set by the Basin Plan.[7]

Trade

The CEWH trades water (including transferring water between accounts) so it is available where it is needed, to help manage water availability between valleys and years, and to fund complementary measures that enhance the outcomes achieved with water for the environment in the long term. The CEWH is subject to the same trade rules as other water users. In addition, the sale of Commonwealth environmental water is governed by Section 106 of the Water Act, which outlines the circumstances under which water can be sold and the purpose of the trade.

The Commonwealth Environmental Water Trading Framework[8] was developed to help ensure that the CEWH's trading activities:

- support enhanced environmental outcomes
- have regard to social and economic outcomes
- consider impacts on the market, including any third-party impacts
- are undertaken in a manner which meets legislative requirements
- are financially responsible, fair, equitable, transparent and accountable and that
- the CEWH and staff act with integrity and high ethical standards.

The CEWH publishes its trading intentions quarterly, or more frequently if needed, on the website. The CEWH has not traded (bought or sold) environmental water allocations since the most recent Productivity Commission in 2018.

The CEWH is investigating options to streamline its trading process and improve its responsiveness to the market conditions. The aim of this improvement is to increase the CEWH's capacity to engage more frequently in the water market to support the capacity of the Commonwealth's environmental water holdings to maximise environmental outcomes across the Basin.

Sales of annual water allocations that took place before December 2018 have been used to fund environmental activities that help improve the delivery of Commonwealth environmental water. The CEWH's Environmental Activities Framework (CEAF)[9] has been used to:

- remove blockbanks that inhibit the flow of water between the Warrego and Darling rivers
- fund works to enable water to reach wetland sites in the Renmark district
- improve fish passage in the Macquarie Marshes, Edward Kolety-Wakool catchment, Ovens River and Loddon River.

The CEWH is expanding the investment through the CEAF to maximise the outcomes that can be achieved with water for the environment, including funding fish screens, reinstatement of fish snags and habitat and First Nations projects.

[7] https://www.dcceew.gov.au/sites/default/files/documents/usage-and-carryover-summary-2012-21.pdf
[8] https://www.dcceew.gov.au/water/cewo/trade/trading-framework
[9] CEWO Environmental Activities Framework (CEAF) - DCCEEW.

Engagement and communication

Communication and engagement with communities and stakeholders across the Basin continues to be an important priority for the CEWH. Local information and experience are critical to being able to effectively manage and deliver Commonwealth environmental water.

All of the CEWH's communication and engagement activities are strategically aligned to the Communications and Engagement Approach.[10] The CEWH is continually uplifting communication activities, responding to feedback, growing distribution channels and providing tailored, timely information on where environmental water is used and how it is making a difference. These activities are important to the transparency and reporting that is undertaken by the CEWH.

Engagement

The planning, delivery and monitoring of Commonwealth environmental water is undertaken in partnership with a range of organisations and communities across the Basin. This includes state government agencies, First Nations people, wetland managers, landholders, irrigators, community organisations and scientists. Commonwealth environmental water cannot be delivered without the coordinated effort of many stakeholders and local information and experience. The time, expertise and advice provided by others is essential to the success of our work.

The CEWH engages directly with First Nations people to establish genuine relationships that work towards building partnership arrangements that are determined by First Nations people (see *Partnering with First Nations people* for more details).

The CEWH and their staff engage extensively with Basin communities and stakeholders and have built meaningful, strong and genuine relationships over time. The CEWH and their staff – including LEOs) travel throughout the Basin to directly engage face-to-face with stakeholders where possible.

The LEOs live and work in regional towns throughout the Basin and have extensive networks and a strong understanding of local issues. They often work alongside state and local land and water management officers. This embedded, local engagement model is recognised as a very effective engagement approach with regional communities.[11] As noted by the IGWC,[12] "investment and effort in local, quality outreach programs has resulted in positive on-ground relationships and engagement. LEOs strengthen the CEWH's connections to on-ground knowledge, actions, concerns and aspirations – important principles for environmental watering under the Basin Plan. LEOs have real impacts in their communities."

At the valley-scale, state government agencies have established local environmental watering advisory groups. The CEWH is an active member of these groups, which provide local community members with the opportunity to both provide advice and input to environmental water planning, but also receive information on environmental use, outcomes and issues.

[10] communications and engagement approach 2021–24.
[11] Local Engagement Officers.
[12] 'Steady as it flows', An assessment of River Murray operations and environmental water management (Inspector-General of Water Compliance, 2022).

Communication

The CEWH has embedded continuous improvement into its communication strategy and related activities. The CEWH is continually uplifting communication efforts, building distribution channels and providing tailored, timely information on where water for the environment is being used and how it's making a difference.

In addition to sharing information through staff's direct engagement with community, the CEWH's communication channels include:

- the CEWH website which is currently being redeveloped to meet users' needs
- The CEWH's Science Program Website (FLOW MER website) which highlights monitoring and research findings
- Other resources such as a monthly newsletter and bespoke communication products which are both published on the website and emailed to stakeholders directly.
- social media engagement (Facebook, Twitter).
- Proactive media engagement with print, TV, radio and online media outlets
- representation and presentation at conferences.

In addition, approximately 10 per cent of the CEWH's science program budget is spent on scientist outreach activities to share the monitoring, evaluation and research findings through a range of channels. The CEWH is looking to build on this commitment going forward. The next iteration of the CEWH's Flow Monitoring Evaluation and Research Program (Flow-MER2.0) will be accompanied by a Flow-MER Communications and Engagement Strategy.

The CEWH also publishes:

- annual water management plans
- all trading decisions, including the purpose, the status of all current actions and the outcomes
- all monitoring reports
- monthly updates on the Commonwealth environmental water holdings, including volumes of water available and delivered
- all monitoring and science reports on data.gov.au
- quarterly updates on trading intentions.

In addition, the CEWH meets a number of statutory reporting requirements. Under the Water Act, the CEWH must report annually on:

- achievements against objectives of the environmental watering plan
- the sale of any water and the purposes for which the proceeds of sale were used
- management of the Environmental Water Holdings Special Account
- all directions from the Secretary of the Department or the Minister.

Under the Basin Plan, the CEWH must report annually on:

- the extent to which local knowledge and solutions inform the implementation of the Basin Plan
- the identification of environmental water and the monitoring of its use
- the implementation of the environmental management framework (Part 4 of Chapter 8)

- the implementation of the water quality and salinity management plan, including the extent to which regard is had to the targets in Chapter 9 when making flow management decisions
- for environmental watering other than in accordance with the Basin annual environmental watering priorities, a statement of reasons why environmental watering has not been undertaken in accordance with the Basin annual environmental watering priorities.

The CEWH must also report every 5 years on the achievement of environmental outcomes at a Basin scale, by reference to the targets in Schedule 7 of the Basin Plan.

The CEWH also reports to the MDBA each year on how the holders of held environmental water have considered Indigenous values and Indigenous uses and involved Indigenous people when planning for environmental watering. This is to support the MDBA to meet its statutory reporting requirement under the *Water (Indigenous Values and Uses) Direction 2018*.

Monitoring, evaluation and research

The CEWH has invested over $100 million in science and research since 2009. The CEWH's primary science program is the Flow Monitoring, Evaluation and Research program (Flow-MER). This had its genesis in 2014, with the Long-Term Intervention Monitoring (LTIM) and Environmental Water Knowledge and Research (EWKR) projects. These programs were integrated into Flow-MER, which started in July 2019. The next phase of the science program (Flow-MER 2.0) will start in July 2024 (after being designed over the next 12 months). This program is supplemented by CEWH-funded short-term intervention monitoring projects, The Living Murray monitoring program and state government monitoring programs and projects.

The Flow-MER Program[13] consists of evaluation, research and engagement at a Basin-scale and on ground monitoring, evaluation, research and engagement across 7 selected areas. The program involves partnership with scientists, water managers and communities across the Basin to examine the contribution of Commonwealth environmental water to the environmental objectives of the Basin Plan and demonstrate environmental outcomes.

The program is collecting long-term data sets under a range of climatic conditions. It is also providing critical evidence needed to understand how water for the environment is helping maintain, protect, and restore the ecosystems and native species across the Murray–Darling Basin. The scientists participate in the planning of environmental flows and provide on-ground observations during an environmental flow to support real-time decisions and the adaptive use of water for the environment. In this way, the program has been essential to demonstrating outcomes, informing management of Commonwealth water for the environment and helping meet legislative reporting requirements.

Outcomes to date

The CEWH has over 10 years of robust scientific results, collected by some of Australia's leading universities and research institutions, showing Commonwealth environmental water is improving local environments and contributing to the longer-term environmental objectives of the Basin Plan.

Commonwealth environmental water has supported:

- more than 22,000 kilometres of waterways (the same distance as driving around Australia twice)
- more than 370,000 hectares of lakes, wetlands, estuaries and floodplains
- 10 Ramsar wetlands that have been recognised internationally for their ecological importance
- hundreds of species of waterbirds, native fish and plants, including threatened species such as silver perch, Murray cod and Murray hardyhead
- the flushing of more than 3.3 million tonnes of salt through the barrages, and reduced 17.9 million tonnes salt from the seawater entering the Coorong.

Flows and connectivity

The significance of Commonwealth environmental water is most apparent at the end of systems in dry years – the Barwon-Darling in the northern Basin and the Lower Murray in the southern Basin. In the

[13] https://flow-mer.org.au/

7 years between 2014 and 2021 (the most recent cumulative reporting period for the Flow-MER Basin scale evaluation), Commonwealth environmental water supported:

- a 10% increase in flows in the Barwon-Darling River in 5 out of the 7 years
- a 30% increase in flows in the Murray River in 3 out of the 7 years.

Further, Commonwealth water accounted for 100% of flows into the Coorong in 3 out of 7 years.

While the barrage releases did not meet the target of greater than 2,000 GL/year (3-year rolling average) across this period, Commonwealth water ensured that 2-year minimum flows did not fall below 600 GL (a minimum flow target to be achieved 100% of the time). Without Commonwealth water, in only 1 out of 7 years would barrage flows have been more than 650 GL/year (a minimum flow target to be met in 95% of years). With Commonwealth water, this flow target was met 6 out of 7 years. Flows into the Coorong contribute to flushing salt from the Basin, maintaining healthy salinity levels in the Coorong, and maintaining connection between the river and the Coorong to facilitate fish movement.

During the 2017-2020 drought in the northern Basin, Commonwealth environment water:

- played a vital role in breaking cease-to-flow periods in numerous valleys. For example, the Barwon-Darling at Walgett experienced 5 cease-to-flow events from 2017-2020, the longest was 328 days. Without the use of Commonwealth and New South Wales environmental water, it is estimated that this cease-to-flow period would have totalled 666 days
- maintained flows to enable fish breeding and waterhole replenishment, as well as core riparian and wetland habitat to provide a quick recovery when ecosystem conditions improved.

Threatened Species

Since 2014, 45 species listed as threatened under state or national legislation (including fish, waterbirds, frogs and turtles) have potentially benefited from delivery of Commonwealth water for the environment. This includes:

- supporting the establishment of new populations of Murray hardyhead (Commonwealth – Endangered)
- successful Southern bell frog (Commonwealth – Vulnerable) recruitment in the Murrumbidgee and Mid and Lower Murray River valleys, with populations in the Lower Murrumbidgee wetlands returning to pre-Millennium drought levels
- supporting 36 waterbird species of conservation significance, 34 of which are listed as threatened under state or national legislation, and 21 are listed in the EPBC Act migratory waterbird list and/or international treaties
    - this includes providing habitat in the Barmah-Millewa Forest for up to 25% of the threatened Australasian bittern (Commonwealth – Endangered) population
- supporting Aromatic peppercress – *Lepidium hyssopifolium* (Commonwealth – Endangered), which was found at monitoring sites in the Lachlan River for the first time in 2020-21.

Native fish

The Flow-MER assessments have reported a range of benefits for native fish.[14] The assessment of long-term monitoring data on spawning and population size has indicated that water for the environment

[14] Basin Theme: Fish - Flow-MER

provided a range of benefits to native fish populations and supported critical life-history processes, such as breeding success, body condition and population growth.

For golden perch, environmental water contributed to increased spawning rates and improved body condition, while for Murray cod (Commonwealth – Vulnerable) environmental water has contributed to increased population growth rates, recruitment and improved body condition.

It's not just the big fish that are benefiting from water for the environment. Improvements have been observed in some areas for breeding, recruitment and expanded distributions of smaller species such as Murray–Darling rainbowfish and Australian smelt. Water for the environment improved native fish species distribution by supporting connectivity within and between rivers, wetlands and floodplains, thereby increasing available habitat and food resources, and providing more suitable conditions for fish movement and colonisation.

All monitoring, evaluation and research reports are published on the CEWH website annually, and all monitoring data collected by the CEWH's Long Term Intervention Monitoring project and Flow-MER program is publicly available.[15]

Appendix B presents further detailed case studies, which demonstrate the impact of Commonwealth environmental water on a range of outcomes throughout the Basin, as well as the role of monitoring in assessing this impact.

[15] data.gov.au

The future of the Basin

While significant achievements have been made to date within the Basin's existing management framework, there are several areas that must be advanced to secure the best outcomes for the Murray–Darling Basin and the Australian community over the coming decades.

Going forward, the focus of water reform must continue to shift towards recognising, resourcing and empowering the participation of First Nations people within the water management framework. Here, the CEWH has a direct role to play, through the involvement of First Nations people in planning, delivering and monitoring of water for the environment.

Basin Plan implementation must feature a renewed focus on the Basin's climate. The work of the CEWH is inherently forward-looking, however increased uncertainty and the emergence of new and more frequent threats under a changing climate requires careful planning and consideration by all governments. At the same time, the framework for managing the Basin's water resources must mature to ensure that environmental water is protected throughout the system and is able to be managed as envisioned by the Basin Plan.

Partnering with First Nations people

The CEWH values the ongoing contribution that First Nations people make to the planning and delivery of water for the environment. We acknowledge this contribution is made largely through frameworks and processes that have not been determined, or endorsed, by First Nations people. More can be done to increase First Nations peoples' participation to empower them to progress towards self-determination within and beyond the environmental watering program. We embrace the spirit of reconciliation, working towards equity and an equal voice for First Nations people.

Waterway health and environmental health affect the social, cultural and economic outcomes for First Nations communities. The holistic approach of First Nations people to the management and health of land, water and people, is not integrated with the Murray–Darling Basin's frameworks. At the same time, water management, and the information that underpins it, would be significantly enhanced through the integration of First Nations peoples' ecological knowledge and management practices.

Addressing the barriers to, and empowering First Nations participation in, water management must be a continued focus in implementing the Basin Plan and in water reform more broadly. Key issues include:

- increasing access to, and ownership of water to meet the full suite of needs and values of First Nations people
- resourcing First Nations organisations to both manage water and waterways, and participate in broader water management and reforms and
- building capacity and two-way sharing of knowledge with and between First Nations communities.

First Nations peoples' involvement in planning, delivering, and monitoring water for the environment

The CEWH is committed to working with First Nations people with connection to Country in the Murray–Darling Basin. To this end, the CEWH has published its *Approach to Partnering with First Nations People,*[16] which is focussed on:

- providing opportunities to support and empower First Nations people to care for Country, including through their involvement in planning, delivery and monitoring of environmental water
- building partnerships with First Nations people in ways that they determine and
- building the confidence of our staff to engage with First Nations people and their culture.

The CEWH's approach is evolving towards forming partnership and co-management arrangements with First Nations people, supporting them to care for Country and elevating their role in the management framework from consultative to decision-making. Examples of how the CEWH currently works with First Nations organisations are provided below.

At the Basin scale, First Nations representative groups participate in cross-border environmental water planning and coordination. In the northern Basin, First Nations people participate in the NBEWG which is involved in the cross-catchment planning and coordination of environmental water for the northern Basin. In the southern Basin, staff and delegates of the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) actively participate in the SCBEWC and annual workshops with the CEWH to support First Nations input into system-scale planning of environmental water. The CEWH is also working to develop arrangements for longer-term support for MLDRIN's capacity to input into environmental water management in the southern Basin.

State government agencies lead engagement with First Nations people on environmental water use at the site or valley scale. The CEWH seeks to support and complement these processes, to avoid duplicating efforts and consultation fatigue.

The CEWH also engages directly with individual First Nations, through their representative organisations. This can include both formal partnerships and funding for projects. For example, the CEWH has a 10-year partnership with the Nari Nari Tribal Council, which supports the planning, delivering and monitoring of Commonwealth environmental water on Nari Nari Country.

The CEWH's science program, Flow-MER, includes funding for First Nations organisations to input into and undertake monitoring and research of environmental flows. Examples to date include:

- appointing cultural advisors in the monitoring teams for the Gwydir Valley and the Warrego-Darling regions
- involving students in on-Country learning opportunities such as the "Indigenous Ecology in Action" workshops help at Calperum Station in South Australia, and the "Down the Track" program at Lake Cargelligo.
- training and employing Indigenous River Rangers to undertake monitoring activities.

The CEWH is further embedding First Nations knowledge and science into the future science program, Flow-MER2.0.[17] This new program will be developed over the next 12 months.

[16] First Nations Partnership approach (dcceew.gov.au)
[17] https://www.dcceew.gov.au/sites/default/files/documents/cewh-science-program.pdf

Managing for climate change

While the climate of the Basin has natural variability and is prone to extremes, evidence shows it will be warmer in the future, with increased variability and intensity of events. The CSIRO prepared several climate scenarios for the Murray–Darling Basin Authority (MDBA) which were published as part of the MDBA's 2020 Basin Plan Evaluation. Under the most plausible scenario, in 2050 to 2060 the Basin will be 2 degrees warmer and will receive 10% less annual average rainfall compared to the historical record.[18] This is likely to reshape both the availability of water, as well as patterns of demand for water of all types. Moreover, the increase in extreme events will result in more natural disasters, including heatwaves, extreme flooding, poor water quality and pest and weed outbreaks. A key focus area for the MDBA's Basin Plan Review in 2026 will be incorporating up-to-date climate data and science in the Basin Plan's strategies and activities. Understanding the future impact of climate change on the resilience of river systems is of vital importance for all water users, including the CEWH.

Environmental water managers already plan for all climatic scenarios and consider multi-year needs.[19] Water use is then adaptively managed as conditions unfold. The CEWH maximises environmental outcomes with the water that is available and plans ahead to manage for long-term variability. This means using wet conditions to build resilience and prepare for the future uncertainty, while also mitigating the impacts of dry conditions as best as possible so that species and ecosystems can rebound when conditions improve. Building resilience means buying time between floods for the rivers and wetlands of the Basin, which will be impacted by potentially more severe droughts in the future. By way of example Commonwealth environmental water has slowed the rise in salinity levels in the Coorong between floods ensuring this community remains in a healthier state for longer.

Work is underway to develop climate adaptation actions for the Basin's internationally important Ramsar sites. The $3.5 million Murray–Darling Basin Ramsar sites climate vulnerability and adaptation study will conduct climate vulnerability assessments and develop recommendations for adaptation actions for at least three Basin Ramsar wetlands. The study will aim to create a body of knowledge for each site, including climate data, species and habitat information, plausible future scenarios, data gaps and monitoring needs. The study will also include evaluation of results and will provide recommendations for rolling out the methodology to more Ramsar sites, wetlands or protected areas. It will include training and capacity building for site managers and stakeholders to support the community to understand and deal with climate impacts at specific sites as well as at the Basin, National and international levels.

The CEWH sits on the governing panel for the Murray–Darling Water and Environment Research Program (MD–WERP). MD–WERP is a 4-year, $20 million Australian Government Initiative to strengthen scientific knowledge of the Basin through generating new knowledge, innovation and tools across 4 themes, including climate adaptation.

[18] bp-eval-2020-snapshot-climate.pdf (mdba.gov.au)
[19] See Section 1.2 https://www.dcceew.gov.au/sites/default/files/documents/cewo-water-mgt-plan-2022-23-chapters-1-2.pdf

River management still geared for consumptive use

The needs of environmental water managers are different from irrigators and town water authorities. The timing of use is often different, with typically higher use in winter-spring. How water is used is also different, with water often delivered down the river or left in-stream (i.e. not extracted).

Most of the water governance arrangements in the Murray–Darling Basin pre-date the emergence of environmental water as an appreciable portion of the water in the system. While these arrangements have evolved significantly under the Basin Plan and have been improved through collaborative efforts by states and the Commonwealth, they still largely reflect a system that is designed to support the delivery of consumptive water. 'Retrofitting' environmental water planning and delivery onto this consumption-driven framework has its limitations. To continue to progress modernisation of river operations, there is now a body of 'practice' in river management to support environmental water use that needs to be embedded in system operations and rules.

To maximise the benefits of water recovered for the environment, there is a continuing need to evolve river management policies and practices and upgrade river infrastructure.

Key issues include:

- relaxing constraints[20] that limit rivers from connecting with their floodplains
- increasing longitudinal connectivity along rivers, including through the protection of environmental water and removal of barriers to native fish passage
- inadequate management provisions to help mitigate impacts of extreme events and
- upgrading or removing infrastructure (weirs, regulators, pumps, fishways) that due to design, operation or malfunction limit the movement of, or cause physical mortality, to native fish and other biota, and/or do not adequately support the delivery of environmental water.

Full implementation of the Northern Basin Toolkit[21] is also critical to support environmental outcomes in the Basin's northern rivers and cuts across many of the key issues identified above. The toolkit was born out of the Northern Basin Review (2017) and resulted in a 70 GL/y reduction to the water recovery target in the north. The New South Wales and Queensland governments agreed to adopt a range of measures with assistance from the Australian Government. The toolkit includes important steps towards the protection of environmental flows, the development of event-based mechanisms, the removal of constraints in the northern Basin and the improvement of fish movement.

As identified by the MDBA in their mid-year report card,[22] the full package of toolkit measures will not be delivered by the June 2024 agreed timeframe. Of the 6 toolkit measures, 2 are on track for completion, 2 are at risk and 2 will not be completed by June 2024. The 2 that won't be completed are the removal of constraints in the Gwydir catchment and environmental works and measures. These projects must remain a priority for timely completion.

[20] A 'constraint' is a technical term for anything that reduces the ability to deliver water for the environment, for example, physical features like low-lying bridges, crossings, or operational aspects like river rules or operating practices.
[21] Northern Basin Toolkit - DCCEEW
[22] Murray-Darling Basin Authority Report Card: Basin Plan 2022 mid-year (mdba.gov.au)

Relaxing constraints

Under current rules, there is limited capacity to deliver environmental flows that connect rivers with wetlands and low-lying floodplains. As a result, the frequency and duration of environmental water requirements for many wetlands and floodplains are not met. This has negative consequences for the health of wetland plants, forests and woodlands, and the native animals they support. The lack of connection between rivers and their floodplains also reduces food for, and limits the movement of, aquatic species, and increases the risk of hypoxic events (due to the lack of regular flushing of organic matter from the floodplain).

Relaxing constraints in the form of system operations, rules and physical constraints, will enhance the outcomes that can be achieved with environmental water. This is particularly important for the Gwydir, Mid Murrumbidgee wetlands, Mid Murray forests and wetlands (including Werai Forest), Goulburn River, Lower Darling-Baaka floodplain and the Lower Murray River and floodplain. Full implementation of the constraint measures proposed under the Basin Plan's Sustainable Diversion Limit Adjustment Mechanism (SDLAM) is needed.

It is also important that river operations and management arrangements are adapted and decision-making tools are available to support the delivery of water under relaxed constraints. Continued development and implementation of the *Enhanced Environmental Water Delivery* project is therefore critical to maximise the benefits of any relaxation of constraints.

While the challenge of constraints relaxation is complex and broad in scale, there is benefit in 'stepping stone' projects that would produce immediate benefits in terms of the ability of the CEWH to manage and deliver Commonwealth environmental water. These include:

- replacing four defunct existing regulators within the Werai Forest to allow environmental water to be delivered through them
- addressing constraints at Koondrook-Perricoota Forest to allow existing environmental watering infrastructure installed under the previous The Living Murray (TLM) program to be used to its potential
    - With constraints at Koondrook-Perricoota Forest addressed, exploring options and investigating impacts of delivering higher flows downstream of Torrumbarry
- addressing constraints that limit flows above 18,000 ML/day in the Lower Darling
- addressing constraints that limit flows in the Murrumbidgee River to 22,000–25,000 ML/day at Wagga Wagga (noting the Water Sharing Plan identifies 32,000 ML/day at Gundagai as channel capacity constraint) and
- continuing to prioritise opportunities for modest increase in flows in the mid-Murray and Goulburn valleys.

Supporting longitudinal connectivity and protecting environmental flows

Traditionally, water management has focused on minimising the amount of water that can leave a certain valley to maximise use and agricultural productivity. There needs to be greater recognition that northern valleys including the Gwydir and Macquarie do connect to the Barwon-Darling River and that this connectivity plays a vital role in the overall health of rivers and wetlands and the plants and animals that depend on them. Water for the environment can and does play an important role in improving this connectivity, which will support improved outcomes. While there has been some progress in protecting environmental flows as they move from one valley to another, more needs to be done.

The protection of environmental water across the Basin is a pre-condition for the effective use of Commonwealth environmental water, and the achievement of environmental outcomes contingent upon it. Through close cooperation and partnership, the Commonwealth and Basin state governments have made significant advancements towards the protection of environmental water within the Basin, however water for the environment is still not protected throughout the entire river system.

Environmental water can differ from extractive use in that it remains in the river and can be present and accounted for at multiple points as it moves downstream supporting a myriad of environmental outcomes. Under the Basin Plan, the prerequisite policy measures (PPMs)[23] program established arrangements to account for and protect held environmental water as it flows downstream in the southern Basin. Similar rules have been implemented in the northern Basin, with the NSW Government establishing rules to improve the protection of low flows and held environmental water as it moves into and through the Barwon-Darling River.

While noting the significant advancements towards the protection of environmental water within the Basin, water for the environment is still not protected throughout the entire river system.

A clear example of this is the re-regulation of environmental water once it reaches the Menindee Lakes. Commonwealth environmental water that is released from northern tributaries and flows downstream and/or unregulated licences that are activated so water is left in the river to flow downstream, increases the total volume flowing down the Barwon-Darling River and into Menindee Lakes. The NSW Government has established rules to protect this water as far as Menindee Lakes, recognising that this is additional flow that historically would have been diverted for consumptive use. However, under current arrangements, this additional water is reregulated once it enters the Menindee Lakes and is no longer recognised as environmental water. Being able to account and protect this water through Menindee Lakes, would increase environmental flows into the southern Basin and maximise the outcomes of water recovered in the northern Basin.

In addition to protecting held environmental water as it flows downstream, communities have also raised concerns about the lack of connectivity between valleys under low flow conditions (when there may be low or no held environmental water). These concerns have been most apparent in communities along the Darling-Baaka River. Lack of connectivity reflects that rivers are managed primarily for consumptive purposes. Providing minimum baseflows to reduce the risk of cease-to-flow periods is a matter that needs to be addressed as a core foundation to water management.

Action by Basin governments is needed to implement solutions that enhance the protection of environmental water throughout the system, as agreed under the Intergovernmental Agreement on Implementing Water Reform in the Murray–Darling Basin (the Water Reform IGA). This includes ensuring that PPMs are operating effectively to enable environmental water to be used at multiple locations along the river through 'return flow' provisions, as well as by enabling water for the environment to be released (or 'piggybacked') on top of unregulated flow events. Full implementation of the northern Basin toolkit also underpins this outcome.

Finally, the CEWH recognises the inherent value of planned environmental water (PEW) and the important role this water plays in contributing to, and achieving environmental outcomes. Under the Basin Plan, there are two types of environmental water – PEW and held environmental water (HEW). PEW is typically established as rules under state water sharing plans, while HEW is water held as an

[23] Prerequisite policy measures | Murray–Darling Basin Authority (mdba.gov.au)

entitlement that provides a legal right to access a share of water. The Basin Plan requires[24] for no net reduction in the protection of PEW and this is assessed by the MDBA (along with 54 other requirements) through the accreditation process of Basin states submit their water resource plans.

The operation of water resource plans is a critical part of enhancing and embedding the water management framework in the Basin and protecting PEW. Water resource plan accreditation by the MDBA will enable accounting and compliance practices and provide fairer and more consistent arrangements for all users. The CEWH notes that all water resource plans are operational in Victoria, South Australia, the ACT and Queensland. Of the 20 water resource plans in New South Wales, only 5 are accredited.

Inadequate management provisions to help mitigate impacts of extreme events

Managing through extreme climate conditions

The CEWH recognises and appreciates the challenge of managing water during dry and extreme conditions. The CEWH also acknowledges that managing rivers during drought is defined and driven by water delivery shortage. The recent drought in the northern Basin highlighted the limitations of the current arrangements.

The river systems of the northern Basin are adapted for some cease-to-flow periods. According to the New South Wales long term watering plans, these normally range from between 20 and 160 days depending on the location and severity of a drought. All river systems in the northern Basin far exceeded their cease-to-flow thresholds during the 2017–2020 drought. It was only through the strategic use of water for the environment that cease-to-flow events were broken during the worst of the drought.

Under the New South Wales Extreme Events Policy, remaining water supplies were quarantined in 2019-20 to protect the supply of critical water needs. This affected most Commonwealth environmental water holdings across the northern and central Basin including Queensland Border Rivers, Macquarie, Namoi, Peel and Lachlan. This action significantly restricted the CEWH's ability to provide environmental water during such a critical time.

Further, water orders were met in 'block releases'. These releases increase the efficiency of the water delivery as less conveyance water is required to deliver these flows. However, these strategies give false cues to fish and other aquatic biota, which may perceive sudden, high flows from a bulk release as an opportunity to move into higher habitat or instigate a breeding event, only for the flows to subside quickly once consumptive delivery has been achieved. The timing of block releases is also prioritised to align with consumptive demands, lessening their value for environmental outcomes.

Explicit provisions for meeting critical environmental (as well as human) water needs along the full length of the river system are needed. Considering how water delivery methods may impact the environment would help to protect and support river systems and their dependant ecosystems during drought.

It is also clear that in some cases, state-based allocation frameworks are underpinned by inflow sequences that do not reflect a contemporary understanding of the Basin's climate. Where this persists, inadequate provisioning for critical environmental needs is likely to emerge more frequently

[24] Section 10.28.

as a matter of course. In the absence of explicit provisions for critical environmental needs, Commonwealth environmental water is expected to fill the gap and the volumes currently held are insufficient to meet this need.

Water quality incidents

River regulation and development has reduced the frequency of flows that flush organic matter from floodplains, particularly in the cooler months when it is less likely to create water quality issues. It has also reduced connectivity and baseflows during dry times. This has led to more severe hypoxic events, which will likely be exacerbated by climate change.

State jurisdictions retain the primary management response role to water quality incidents and extreme events through Water Resource Plans (Basin Plan Chapter 10, part 13). For example, New South Wales has a water quality incident response plan including an inter-agency incident response process for blackwater. There has been significant improvement in interjurisdictional water quality coordination and communication since 2016–17. In the southern connected Basin, there are better mechanisms for information sharing and coordination. For example, NSW-led blackwater response groups in recent years have included SA and Victorian participation. Joint government committees, such as the MDBA led Water Quality Advisory Panel, have helped with regular water quality risk scans and timely information sharing across jurisdictions.

While acknowledging these improvements, it is important to note that with many water quality incidents there are very few levers available to river operators to address or mitigate the impacts beyond the use of held environmental water. In 2022–23 alone, over 300 GL of Commonwealth environmental water was used to mitigate the impacts of hypoxic water in the Mid Murray, Lower Murrumbidgee and Lower Darling-Baaka rivers. While this was important based on it being used to support native fish populations, the water quality incidents had broader environmental, social and cultural impacts.

Water quality is a shared responsibility for all water users – it is not solely an environmental water manager's issue to address. As such, water management plans need to identify management options for water quality issues beyond the use of held environmental water. Improving water quality, particularly during an emergency, needs to be foundational to valley and system-based water management planning to improve certainty and flexibility of the response by state governments.

Infrastructure causing harm and working against environmental outcomes

Achieving environmental objectives is more than just setting aside a volume of water for the environment. It includes enabling the right flows, at the right places and the right times and ensuring these flows move freely through the system. This is of critical importance to native fish life cycle objectives and system productivity. River regulation and the associated infrastructure have negatively impacted aquatic biodiversity in the Murray–Darling Basin. However, some of these impacts can be mitigated, and in some cases environmental objectives enhanced, through improvements in the design, operation and maintenance of water management infrastructure.

For example, some weir designs, such as undershot weirs, cause physical mortality to fish larvae and juveniles – undermining environmental watering outcomes and fish stocking efforts. Alternative weir designs such as overshot or lay-flat gate designs can avoid this, however undershot weirs continue to be installed due to their lower capital cost. Many weirs are lacking fishways and some installed

fishways in key locations are not functioning due to poor design and/or lack of adequate maintenance or training for operational staff. This limits fish movement, feeding, breeding and dispersal, and results in a less resilient fish population to survive and recover from inevitable dry periods. It also reduces the success of outcomes achieved from environmental water.

Private infrastructure also has a significant negative impact on fish populations. Many irrigation pumps and gravity offtakes are not fitted with screens to prevent the intake of fish, larvae and other biota. Installation of screening technology can both benefit the irrigator through decreased running and maintenance costs and ensure return on public investment in fish restocking and environmental watering is fully realised. There are programs in place to address these issues, however, greater effort and funding support is needed to make the necessary upgrades – particularly for larger and more expensive infrastructure such as weirs and fishways. Learnings and successes from these programs should be propagated throughout the Basin, wherever they would be of most benefit.

Projects funded through the northern Basin toolkit go some way to promote fish movement and reduce fish extraction during pumping. These projects are critical to protecting native fish, however it must also be noted that in New South Wales alone, there are more than 2,000 barriers in the form of dams and weirs that prevent fish movement. Continued intervention and investment to enable free movement for native fish is critical to prevent extinction of native fish species.

Equally important is the expansion of fish friendly pumps and related irrigation infrastructure – some of which has been funded through the northern Basin toolkit and the CEWH's CEAF. Modern screens can reduce losses of native fish by 90 percent.[25] The evidence is clear that the roll-out of fish friendly pumps and infrastructure needs to be extended.

Enhancements are needed to achieve better environmental outcomes

Through the collaboration and cooperation of the Commonwealth and Basin state governments, the Basin Plan has driven significant improvements to environmental outcomes, and provided synergistic benefits for Cultural, consumptive and community uses of water. However, the experience of the CEWH in planning for and delivering environmental water shows that there are significant environmental outcomes that are going unrealised.

The scale of Commonwealth held environmental water in proportion to the magnitude of the Basin and its environmental requirements is small. This means that there will always be environmental objectives that are beyond the reach of the CEWH. For example, many northern valleys experience cease-to-flow conditions well in excess of what would naturally occur and in excess of ecological tolerances. Here, Commonwealth environmental water plays a critical role in replenishing waterholes and providing intermittent connectivity. Likewise, end-of-system flow targets that are important to the internationally significant Coorong site are frequently not met. In both cases, outcomes are driven primarily by large, unregulated flows and the role of the CEWH is therefore to maintain ecological condition until conditions improve.

However, in many cases there are administrative, institutional, or practical barriers to the achievement of environmental objectives with Commonwealth environmental water. Achieving connection to key

[25] Why Australian Farmers Should Use Fish Screens - Fish Screens Australia

wetlands in the Mid-Murrumbidgee, Mid-Murray, Werai Forest and broader parts of the Barmah Forest remains beyond the influence of environmental water but could be achieved with relaxation of system constraints. Likewise, connection to riparian and low-lying floodplains of the Goulburn River is currently out of reach. As previously touched on, the re-regulation of environmental water at Menindee Lakes prevents the recognition of flows from the northern to southern Basin, which is important for the achievement of whole-of-system connectivity objectives. These are objectives that could be better met through further work, cooperation, innovation and the delivery of the Basin Plan as intended.

Underpinning all of these actions however, is the need to achieve full recovery against the Basin Plan's water recovery targets. Additional held environmental water will increase the ability of the CEWH to achieve a broader range of outcomes including those described above, particularly during dry to moderate conditions where an increased share of available water will enable the environmental demands to be met with more certainty.

The advice on environmental utility remains consistent with past advice which highlights ideal characteristics of water recovered for the environment including:

- entitlements should be unencumbered and secure
- entitlements should be readily tradable, and any exceptions should be considered on a case-by-case basis
- the entitlements should provide long-term environmental watering capacity on terms that are no less favourable than those provided to other holders of equivalent entitlements
- the deliverability of the water acquired should be considered in the assessment of water acquisitions
- where possible, the ongoing costs of managing the water should be considered in the assessment of water acquisitions
- a portfolio of entitlements that maximises environmental utility should be acquired and
- except where specific advice has been provided to indicate otherwise, a balanced portfolio is preferred without excessive reliance on a particular class of entitlement in any particular jurisdiction or catchment.

It is important to note that water recovery is not an all-or-nothing proposition: there is value in incremental improvement and every extra megalitre recovered translates to additional environmental outcomes on the ground.

Appendix A: Reviews of the Commonwealth Environmental Water Holder since 2013

- 'Steady as it flows' An assessment of River Murray operations and environmental water management (Inspector-General of Water Compliance, 2022)
- Senate Select Committee on the multi-jurisdictional management and execution of the Murray–Darling Basin Plan (Senate Select Committee, 2021)
- Review of the Southern Spring Flow Event 2019 (Murray–Darling Basin Authority, 2021)
- Murray–Darling Basin water markets inquiry (Australian Competition and Consumer Commission, 2021)
- Review of Performance Against Objectives and Outcomes – 2020-21 (Independent River Operations Review Group, 2021)
- Final Report: Independent assessment of social and economic conditions in the Murray–Darling Basin (Sefton et al., 2020)
- Impact of lower inflows on state shares under the Murray–Darling Basin Agreement (Interim Inspector-General of Murray–Darling Basin Water Resources, 2020)
- Socio-economic outcomes of environmental watering in northern Victoria (Natural Capital Economics, 2020)
- Murray–Darling Basin Plan: Five-year assessment, Productivity Commission Inquiry Report (Productivity Commission, 2018)
- Review of the Commonwealth Environmental Water Holder's operations and business processes (Natural Capital Economics, 2017)
- Commonwealth environmental watering activities, Performance Audit (Australian National Audit Office, 2013)

Appendix B: Case studies on the impact and monitoring of Commonwealth held environmental water

Murray hardyhead (Commonwealth – Endangered)

The Murray hardyhead is a small fish that is highly tolerant of saline water. It has been listed nationally as a threatened species and was considered extinct in New South Wales for over a decade. In an effort to protect the Murray hardyhead, options for the translocation of fish from existing wetland populations to new homes where it can thrive and survive were undertaken.

In 2018, Murray hardyhead were translocated to the little Frenchmans Creek on Wingillie Station following delivery of environmental water to optimise habitat conditions for the species. A second translocation was conducted in 2021 to promote genetic diversity within the new population. Individuals for translocation were sourced from known populations in the Riverland region of South Australia. The translocations aimed to reduce the risk of the species becoming extinct and represents the first known re-introduction of a locally extinct fish species back into New South Wales.

For the last four years, water for the environment has been delivered to support the translocated population of Murray hardhead. Population monitoring has been conducted by New South Wales Fisheries to inform delivery of water to target suitable salinity levels and habitat maintenance for the species.

This monitoring has identified that the species has survived and thrived in the wetland, multiplying at an incredible rate annually, with catch rates during netting surveys ranging from several hundred to around 6,000 Murray hardyhead. When the site connected briefly with the River Murray during 2021, high flows a productivity 'boom' and over 200,000 Murray hardyhead were recorded in a single sampling event.

The success of this reintroduction has been a collaborative effort between Ken and Anne Warren, Hazel L Henry Farmland Nature Refuges, The Murray-Darling Wetlands Working Group, NSW Department of Primary Industries - Fisheries, NSW Department of Planning and Environment – Environment and Heritage, Western Local Land Services, SA Department of Environment and Water and Aquasave - Nature Glenelg Trust.

Source: dcceew.gov.au[26]

[26] Wingillie Station - DCCEEW

Narran Lakes (Dharriwaa) (Internationally important Ramsar site)

For only the second time since 2013, the spring and summer of 2022-2023 saw thousands of colonial waterbirds breed within the Narran Lakes (Dharriwaa) Ramsar site. Some of the species that were recorded included Straw-necked ibis, Royal spoonbills, Glossy ibis, egrets and cormorants. Pelicans have also been breeding with many colonies observed. Drone surveys of just one of these colonies identified around 14,000 nests and 28,000 adult pelicans.

By April 2023, the wet conditions that had enabled the breeding event were rapidly subsiding. Most birds had finished breeding however there were still many sitting on nests, with thousands of adult and young chicks in the area. Anticipating all these extra mouths to feed, the CEWH entered into an grant arrangement (known as an event-based mechanism) for the release of 6.5 gigalitres of water into the Narran River from the on-farm storages of Eastern Australia Agriculture during February 2023.

This water provided refreshing flows in the Lower Balonne, reconnecting waterholes and improving habitat and food sources for fish and birds along the Narran River, with around 2.4 gigalitres reaching Narran Lakes. These flows successfully ensured that key wetlands areas remained wet at a critical time for waterbird breeding, while also ensuring there was enough food around to support the breeding event fully.

On-ground and aerial surveys confirmed the success of the breeding event. Furthermore, researchers from the University of New South Wales banded pelicans as part of a long-term Basin wide project. Black bands have been placed on the ankles of 400 pelican chicks at Narran Lakes, which will help to track their movements over the course of their life.

Source: dcceew.gov.au[27]

[27] Collective effort helps bird breeding at Narran Lakes - DCCEEW

Northern Basin coordinated flows

The CEWH and New South Wales Government have coordinated multiple flows across the northern Basin, to provide both in-valley and downstream outcomes. These flows have been particularly significant during dry periods. Some of these coordinated events are summarised below.

The Northern Connectivity Event (April – July 2018)

In January 2018 over 1,000 km of the Barwon-Darling River downstream of Brewarrina ceased-to-flow. Native fish and other aquatic life were under considerable stress. Water for the environment was released from Glenlyon and Copeton dams near the Queensland/NSW border. Connectivity between waterholes was achieved to the Menindee Lakes, near Broken Hill. In total, over 2,000 km of the Gwydir, Mehi, Dumaresq, Macintyre and Barwon-Darling rivers benefited from the flow. The water for the environment was contributed by both the CEWH (16.6 GL) and New South Wales (6.6 GL) and improved water quality and enabled fish to move between watering holes.

The Northern Fish Flow event (April – July 2019)

In early 2019, the Barwon River in the northern Murray–Darling Basin had not flowed for over 200 days (which is the longest period since the early 1900s). Waterholes dried back with poor and deteriorating water quality, threatening the survival of native fish in the region. To help native fish survive the drought and improve water quality, CEWH (18 GL) and New South Wales environmental water (18 GL) was released water from dams in the Northern Murray–Darling Basin. These flows supported the health of the Dumaresq, Macintyre, Mehi and Barwon River systems and ran from April to July 2019.

The Northern Refresh Flow (April – May 2023)

High flows during 2022 and into early 2023, coupled with hotter weather towards the end of the summer created poor water quality conditions, resulting in fish death events including in the Barwon-Darling (Baawan-Baaka) River. Looking to guard against further damage, the CEWH and New South Wales provided environmental water to improve water quality, keep streams and rivers connected, and support native fish to move along waterways until cooler conditions in the middle of the year arrived and lessened water quality risks. Water was released in the Gwydir and Namoi catchments to build on water protected along the Barwon-Darling (Baawan-Baaka) through the activation of the Commonwealth's unregulated licences. Flows provided through New South Wales Planned Environmental Water and 'translucent' Environmental Water Allowance releases from New South Wales tributaries also contributed to the event.

Monitoring undertaken following the Northern Refresh Flow found that dissolved oxygen levels had increased. The flow also helped to improve water quality overall by diluting salt concentrations, nutrients and algae along the Barwon-Darling (with some areas such as Walgett experiencing amber alerts for algal growth before the flow).

Source: dcceew.gov.au [28]

[28] Northern Refresh - 2022-23 - DCCEEW, Northern Refresh flow 2022-23 update 1 May 2023 (dcceew.gov.au)

Drought resilience in the Coorong (part of the Coorong, and Lakes Alexandrina and Albert Wetland Ramsar site)

The Coorong is a unique, 140 km stretch of estuarine habitat that sits at the end of the River Murray system. Influenced by water from both the River Murray and the adjacent Southern Ocean, the Coorong provides an important link between salt and freshwater habitats and supports a unique variety of species.

Salinity levels in the Coorong are increased by evaporation and the incursion of seawater through the Murray Mouth. They are decreased by river water which gets diverted into the Coorong on its journey out to sea, providing a dilution and replenishment effect. River water exiting the system through the Murray Mouth also mitigates the incursion of seawater, further supressing salinity. At the height of the millennium drought, low River Murray flow rates meant that the Coorong became too salty for many plants and animals to survive.

Similarly, severe drought conditions characterised much of the Basin throughout 2017-2020. However, this time the environmental damage to the Coorong seen during the Millenium Drought was not repeated. The reason for this can be found in the Basin Plan and the emergence of water for the environment to provide specifically for environmental outcomes, including outcomes for the Coorong.

Between 2014 and 2020, 4,000 GL of water for the environment has flowed to the Coorong. In 4 out of 6 years, this was the only water to flow through the barrages into the Coorong. These flows provided the Coorong with vital replenishment and dilution of salt levels. Over this period, environmental flows also prevented an additional 20 million tonnes of salt from seawater entering the Coorong.

Due to its large scale and its position at the end of the system, outcomes in the Coorong are generally driven by large, unregulated flow events which happen under certain conditions and in a minority of years. By contrast, environmental water holdings are modest and cannot replicate the effect of unregulated flows consistently. However, environmental water plays a vital role in maintaining a baseline level of condition in the Coorong during dry periods that allows it to 'bounce back' once conditions improve. This was seen in more recent years, with the Coorong able to share in the benefit of wet conditions despite the 2017-2020 drought.

Partnering with the irrigation sector

Partnerships are critical to delivery of Commonwealth environmental water.

For example, the CEWH works with Renmark Irrigation Trust, Murray Irrigation Limited, Coleambally Irrigation and Murrumbidgee Irrigation to deliver via their network of channels and pipes to local wetlands and creeks. These are "win-win" arrangements for both the environment and industry. By using irrigation networks, water can be delivered to wetlands and creeks that it would otherwise not be possible to reach, while for irrigation operators, it increases their customer base.

These partnerships have been beneficial to the local environment, and in some cases, have been critical to supporting native fish survival during poor water quality events.

The 2022–23 floods in the Mid Murray valley led to widespread hypoxic (low oxygen) conditions. As observed in previous floods, hypoxic events have a devastating impact on native fish. In response, the CEWH and New South Wales environmental water managers worked with Murray Irrigation Limited to divert small volumes of oxygenated water via their channels. This water was then flowed back in via 'escapes' to create refuge areas of better-quality water throughout the Edward/Kolety-Wakool river system. Native fish could move to these areas, improving their chances of survival. This action started in September 2022, with over 200 GL of Commonwealth environmental water delivered via Murray Irrigation Limited's network of channels. This intervention was reliant on the input and support from the local community and scientists who were monitoring the response to the refuge flows.