

2014–15 Environmental Watering Report







Camping, Lake Wallaroo, Hattah Lakes (MCMA) Cover: Regent parrot, Hattah Lakes (Vic Hughes, MDBA)



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foreword

The Living Murray Program (TLM) has been delivering environmental water to support the health of the River Murray for over 12 years.

The 2014–15 water year saw some significant achievements for the program. In coordination with other environmental water holders, 956.2 gigalitres of environmental water was delivered across five of The Living Murray icon sites. This included just over 285 gigalitres of TLM environmental water.

The watering actions provided some fantastic site and system scale ecological outcomes, which included improvements to the health of floodplain and wetland vegetation, recruitment and breeding of native fish and successful bird breeding at a number of icon sites. These outcomes were in line with a number of Basin Plan annual environmental watering priorities, including connectivity, winter flows for fish and waterbird refuges.

Delivery of environmental water also allowed for the testing of recently completed water management structures at Hattah Lakes, Gunbower Forest, Koondrook-Perricoota Forest and the Chowilla floodplain. These structures allow for the delivery of water to icon sites more efficiently and realise the ecosystem benefits associated with watering floodplains and wetlands. The simultaneous testing of the structures presented some unique challenges that required collaboration among a range of stakeholders, including TLM partner governments, local landholders, Indigenous groups and regional natural resource management agencies.

Experience over recent years has highlighted how important coordination between environmental water holders is in achieving outcomes. In 2014–15 the Southern Connected Basin Environmental Water Committee was established. This committee promotes a coordinated approach to environmental water planning and delivery and better integrates the management of environmental water with river operations. Coordination between environmental water holders in delivering environmental water is considered key in addressing the Basin Plan annual environmental watering priorities and the longer-term outcomes of the Basin-wide Environmental Watering Strategy.

Colin Mues Executive Director Environmental Management

Highlights in 2014-15

The Living Murray program achieved some outstanding outcomes at key icon sites across the Murray System:

- \checkmark
- delivery of environmental water to the icon sites
- \checkmark contributed to the Murray–Darling Basin annual environmental watering priorities of:
 - better connectivity in the River Murray system
 - winter flows for fish in the southern Basin
 - more waterbird refuges
- \checkmark improvements in the health of floodplain and wetland vegetation
- \checkmark recruitment and breeding of native fish populations
- successful bird breeding events at some sites
- \checkmark maintenance of flows through the barrages to December 2014
- λ successful testing of new water management structures at four icon sites.







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River Murray Channel

Benefited from the environmental water used across all sites

Approx. 2,200km in length it supports and connects all sites and their ecosystems

Lower Lakes, Coorong and Murray Mouth

122.9GL

140,000ha

Chowilla Floodplain and L-W Islands

105.6GL

37,700ha

Hattah Lakes

27.3GL **48,000**ha

54,000ha

Gunbower-Koondrook

-Pericoota Forest

29.7GL

Barmah-Millewa Forest

No environmental water used due to natural inflows

66,600ha



About The Living Murray program

What is environmental water?

Over time, the regulation and development of the Murray–Darling Basin has meant changes to natural river flow patterns. These changes have reduced the occurrence of small to medium flow events and also reduced the occurrence of over bank flows as well as the inundation of floodplains and wetlands.

Floodplains and wetlands require periodic inundation to maintain the health of a whole range of water dependent ecosystems and communities. Nutrients and carbon that return with water from inundated floodplains are an important driver of food webs that underpin the health of the entire Murray system. Similarly variations in flow within the river channel and its anabranches are important, particularly in providing habitat and cues to trigger things like fish to spawn.

Environmental watering aims to improve the ecological health of river systems by providing water to support these key ecological processes. At times this may include supporting and or mimicking natural river flow and wetland inundation patterns. At other times it might include delivering water to specific sites to support species or functions at much more localised scales. such as delivering water to allow water birds to complete their nesting. The benefits of environmental water delivery are being seen rights across the Murray-Darling Basin. Not only has environmental water delivery contributed to arresting the decline in ecological health of these systems but we are beginning to see some really positive improvements.

Background

The Living Murray (TLM) program was initiated in response to evidence of the declining health of the River Murray system. In November 2003, the Murray-Darling Basin Ministerial Council announced The Living Murray First Step Decision. The decision had two key target components: to recover, over time, enough environmental water so that an average of 500 gigalitres would be available for use each year; and a works and measures program for the construction of structures at some sites to aid the efficient use of *environmental water*.

The six sites were originally chosen for the program because they are of regional, national and international importance for their ecological value. There was general agreement that the sites were at risk, and needed improved flow regimes.

Since then, water has been recovered for The Living Murray program by a combination of infrastructure projects (to improve water efficiency) and direct purchase of existing water licences. The water recovery process is now almost complete, with 482 gigalitres of water recovered since the First Step Decision took effect.

The Murray-Darling Basin Plan

Since November 2012, the Murray–Darling Basin Plan (the Basin Plan) has provided the framework for a coordinated approach to water use across the Murray–Darling Basin. The Basin Plan was developed under the *Water Act 2007* (Cth) to balance the competing demands – economic, social and environmental – on the water resources of the Basin. This balance is needed to ensure that enough water is available to support productive industries, farmers and communities into the future, while leaving sufficient water in the Basin's river systems for a healthy environment.

A central part of the Basin Plan is the Environmental Watering Plan, which provides a framework to ensure the best possible outcomes for the environment. The Basin-wide Environmental Watering Strategy sets out the measurable environmental outcomes that are expected from the Basin Plan and how governments and communities can work together to achieve them.

The Basin's annual environmental watering priorities are identified by the Murray–Darling Basin Authority and provide guidance to environmental water managers on the annual planning of environmental watering across the Basin. These priorities are not, however, an exhaustive list of all important environmental sites and processes in the Basin – there may be other priorities that environmental water holders and managers identify and address.

The Living Murray's activities help deliver the Basin Plan. The Living Murray's environmental watering actions align with the Basin's annual environmental watering priorities, maximise environmental outcomes and have regard to the water quality and salinity targets in the Basin Plan.

Environmental water coordination

Over recent years, the total volume of environmental water available in the southern connected Basin has grown considerably. This water is held by a number of agencies and entities, called *'environmental water holders'* (see page 8).

The management of The Living Murray portfolio was in transition during 2014–15. Environmental watering planning and delivery was initially directed by the Environmental Watering Group in coordination with other environmental water holders and river operators. In January 2015, the Southern Connected Basin Environmental Water Committee was established, replacing many of the functions of the Environmental Watering Group. This forum enables better coordination between environmental water holders in the southern connected Basin and river operations.



The committee is coordinated by the Murray– Darling Basin Authority and has a dual function and governance structure:

- It coordinates the operational planning and delivery of all environmental water in the southern connected Basin to maximise environmental outcomes. The environmental water holders make the decisions in relation to the allocation of water from their respective portfolios.
- It makes decisions on the planning and use of The Living Murray portfolio, *River Murray Increased Flows* and *River Murray Unregulated Flows* (see page 9).

Annual water planning

The Living Murray Environmental Watering Plan for 2014-15 was jointly developed by the Murray-Darling Basin Authority and the Environmental Watering Group. The plan sets out the decision framework for prioritising TLM environmental watering actions across the icon sites in the River Murray system for the coming *water year*.

i) The water year runs concurrently with the financial year, from 1 July to 30 June.

Proposals that outline priority environmental watering actions for the year ahead are developed for each icon site. These are reviewed

Water planning and delivery



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and prioritised at a system scale, taking into consideration climate, water availability and river conditions. The annual plan documents the proposed watering actions at each site, provides the decision framework that determines watering priorities, and guides the implementation of watering actions throughout the year.

In developing the plan and associated proposals, decision-makers consider water availability, climate outlook, catchment and river conditions, and long-term planning for the water portfolio. Planning for the delivery of TLM environmental water is coordinated with other environmental water holders, including the Commonwealth Environmental Water Holder, to ensure that watering actions align and to achieve the best possible ecological outcomes.

River Murray Increased Flows: water recovered under investment in the Snowy Joint Government Enterprise and available as environmental water for the River Murray.

River Murray Unregulated Flows: water remaining in the river after New South Wales and Victoria have exercised their rights to access unregulated flows for consumptive use, that is, water that exceeds irrigation demands, is unable to be captured in Lake Victoria, and is, or will be, in excess of the required flow to South Australia. Commitments to watering actions require a degree of flexibility. They are often modified during the year as more information becomes available on site, river and catchment conditions, as well as on water availability and the planning of other environmental water holders. The flexibility to respond to changing conditions continues to be important as water is delivered to sites.

The Living Murray program has invested heavily in water management structures at a number of icon sites over recent years. These structures provide for the efficient delivery of environmental water to the icon sites. With the completion of works at a number of sites, The Living Murray Environmental Watering Plan for 2014-15 focused on providing water to support testing of these new structures and their operation.

The high-priority watering actions under a dry scenario included:

Chowilla Floodplain and Lindsay-Wallpolla Islands



- Inundate floodplain wetlands targeting improved vegetation and wetland animal health
- Testing of recently completed structures.

Hattah Lakes



- Follow-up watering to inundate wetlands, targeting black box and river red gum communities as well as broader ecosystem benefits, such as the provision of improved habitat and resources for fish and waterbirds
- Testing of structures to near full capacity

Gunbower-Koondrook-Perricoota Forest



- Inundate forest wetlands and floodplains to support vegetation recovery and maintenance, fish passage, riverine connection and processes
- Testing of water management structures

If conditions were to become wetter than anticipated, the plan provided flexibility to contribute to larger system-wide outcomes, such as watering actions at Barmah-Millewa Forest and the Lower Lakes, Coorong and Murray Mouth. Return flows from some of the above sites would be received by South Australia and used to assist in managing the Lower Lakes, Coorong and Murray Mouth.

Catchment and river conditions

River Murray system inflows were below the long-term average right up to the beginning of the 2014–15 water year. Despite the dry conditions and outlook, the volume of water in storage meant that water allocations were announced early in the water year. With the allocation carried over from 2013– 14, combined with early season allocation, The Living Murray program had about 190 gigalitres of environmental water available by September 2014 and 285.5 gigalitres in total during the year. River Murray system inflows continued to track well below the long-term average across 2014–15. The low inflows were most pronounced in early spring, and were up to 1,000 gigalitres a month below the long-term average (see Figure 1). Given the low inflows over spring, the triggers for larger system-wide watering actions were not met and the focus continued to be on delivering the watering actions of the dry water resource scenario.



Figure 1: 2014–15 Murray system monthly inflows

Note: Excludes Snowy, Darling, inter-valley trade and environmental inflows

Table 1: Volume of water delivered to TLM icon sites by environmental water holders

	The Living Murray program	Commonwealth Environmental Water Holder	Victorian Environmental Water Holder (VIC)	NSW Office of Environment and Heritage (NSW)	Total environmental water for each site
Barmah-Millewa Forest	_	_	_	_	_
Gunbower-Koondrook- Perricoota Forest	29.7	_	15.9	18.2	63.8
Hattah Lakes	27.3	34.2	14.7	_	76.2
Chowilla Floodplain and Lindsay-Wallpolla Islands	105.6	3.8	2.9	_	112.3
Lower Lakes, Coorong and Murray Mouth	122.9	581.0	_	_	703.9
River Murray Channel	_	_	_	_	_
Total environmental water for all sites	285.5	619.0	33.5	18.2	956.2

Environmental watering in 2014–15

2014-15 saw the delivery of 956.2 gigalitres of environmental water that directly supported ecological outcomes at TLM icon sites.

This amount included 285.5 gigalitres from The Living Murray portfolio (see Table 1). More than one-third was able to be reused at downstream TLM icon sites.

Watering actions took place in partnership with other environmental water holders as part of a system-wide, coordinated approach to environmental water delivery. This cooperation contributed to effective water use and improved environmental outcomes. For example, the delivery of environmental water to Hattah Lakes was planned so return flows could support a watering action at the Lower Lakes, Coorong and Murray Mouth.

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Operational advisory groups

In 2014–15, operational advisory groups were established for some of the icon sites, and for the River Murray system as a whole, to discuss and support the delivery of environmental water. These groups provide real-time operational advice to the Murray-Darling Basin Authority's River Operations on the delivery of environmental water to a site. They have representation from environmental water holders, icon site managers, river operators, water management authorities and other stakeholders as required. The groups convene well before the beginning of environmental watering events. During the watering, they provide important information to achieve the best possible ecological outcomes, manage risks and ensure an adaptive delivery response to changing flow conditions.

The three icon sites for which groups were set up in 2014-15 were Gunbower-Koondrook-Perricoota Forest, Hattah Lakes, and Chowilla Floodplain and Lindsay-Wallpolla Islands. The Barrage Operations Advisory Group has been meeting for a number of years to inform management for the Lower Lakes, Coorong and Murray Mouth site. As a general rule, the groups meet once a fortnight; however, during critical or high-risk times, meetings are more frequent.

Overall, the advice provided by the groups to River Operations on the progress of watering actions was very successful in 2014–15 and the risks associated with each of the watering events were managed effectively.



Outcomes at icon sites

Canoeing through Barmah Choke, Barmah-Millewa (Alisha Caldwell, MDBA)



Barmah-Millewa Forest

Barmah-Millewa Forest is Australia's largest river red gum forest and the largest intact freshwater floodplain system along the River Murray. Listed under the Ramsar Convention, the forest is home to at least 381 types of native plants and 221 animal species. During times of flood, the Barmah-Millewa Forest supports large colonies of waterbirds, including 25 colonial nesting species. Open wetlands and moira grass meadows are an important part of the system's vegetation community.

Barmah–Millewa Forest straddles the Murray and Edward rivers between Deniliquin, Echuca and Tocumwal

66,600 hectares

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No environmental water used due to natural inflows

Breeding of Murray Cod and Trout Cod

Maintained good vegetation condition

Condition and past watering actions

A number of wet years in the River Murray from 2010 have seen some improvements in the health of Barmah-Millewa Forest, as indicated by positive responses from native plants and animal communities across the icon site. Over recent years, the use of environmental water has extended the duration and reach of naturally occurring over bank flow events, as well as more targeted wetland watering actions where possible, such as providing water to maintain water levels around bird nesting sites during breeding.

In 2013-14, environmental water extended the duration of inundation in Barmah Forest so that water levels could be maintained through the forest and large areas of moira grass plains could be inundated. The watering action stimulated the strongest moira grass response in seven years, improved the health of floodplain vegetation, and supported the fish, turtle and waterbird populations. While the 2013-14 watering focused on Barmah Forest, the high flows also inundated areas of the



"Because we didn't have any natural cues in 2014–15, and we had such a good year in 2013–14, we decided not to release large volumes of environmental water to inundate the Barmah floodplain, but instead to hold off and use the water at a more appropriate time in the future."

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Millewa floodplain, which had positive vegetation outcomes, such as growth of moira grass.

Environmental works

While The Living Murray program hasn't built any works at Barmah-Millewa Forest, a number of regulators are used to deliver environmental water to the forest.

Regulators are structures that manage the flow of water in the river.

Watering in 2014-15

Given the significant inundation at Barmah–Millewa Forest over recent years, a drying phase was planned for this site. However, natural flow peaks in the Murray River in July, August and November 2014 and January 2015 flooded areas of the Barmah–Millewa floodplain. While no environmental water was delivered to the site during 2014–15, the natural inflows resulted in new growth of wetland vegetation and breeding of golden perch in the river.

What is the Ramsar Convention?

A Ramsar listing denotes the inclusion of a wetland area on the List of Wetlands of International Importance – an inventory prescribed by the Convention on Wetlands, usually known as the Ramsar Convention, which was signed in Ramsar, Iran, in 1971.

Under the Ramsar criteria, wetlands are selected for the Ramsar List on the basis of their international significance in terms of the biodiversity and uniqueness of their ecology, botany, zoology, limnology or hydrology.

Ramsar sites within The Living Murray are:

Barmah-Millewa Forest

Gunbower-Koondrook-Perricoota Forest

Chowilla Floodplain and

Lindsay-Wallpolla Islands

Lower Lakes, Coorong and Murray Mouth

Chinamans Bend, Gunbower (Ben Dyer, MDBA)

C. A. B.



Gunbower-Koondrook-Perricoota Forest

Gunbower-Koondrook-Perricoota Forest is a large mosaic of river red gum, black box and grey box forest interspersed with floodplain wetlands.

Gunbower-Koondrook-Perricoota Forest straddles the River Murray in the mid-Murray floodplain over northern Victoria (Gunbower Forest) and southern New South Wales (Koondrook-Perricoota Forest). The forests extend from the townships of Koondrook in the north to Torrumbarry in the south

54,000 hectares (approximately)

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- 29.7 gigalitres of TLM water was delivered
- 3,800 hectares of forest watered at Gunbower
- 4,000 hectares of floodplain forest watered at Koondrook-Perricoota
- Large volume of small fish recruitment and movement at Gunbower
- Strong vegetation response at Koondrook-Perricoota
- Testing of structures at both sites

Gunbower Forest spans an area of approximately 22,000 hectares. It is home to more than 230 types of native plants and 143 types of animals. The site provides important feeding, nesting and breeding habitat for more than 22 waterbird species and is one of only two known breeding sites for the intermediate egret, a medium-sized waterbird. The forest is listed under the Ramsar Convention.

Koondrook-Perricoota Forest covers an area of 32,000 hectares and contains river red gum, black box and grey box communities. It has rare wetland types, including floodplain lakes and reed swamps, that can support more than 20,000 waterbirds. During times of flood, the forest provides an important native fish breeding habitat. Floodwaters returning from the forest carry carbon and nutrients that are important in sustaining the food chains of the River Murray.

Condition and past watering actions

Widespread natural flooding in 2010–11 and 2011– 12 across Gunbower-Koondrook-Perricoota Forest improved the ecological health of the site.

No environmental water was delivered to Gunbower Forest until late in 2013–14, in preparation for the planned 2014–15 watering event. At Koondrook– Perricoota Forest, environmental works were still being completed in 2013–14, so no managed environmental water was delivered to the site to allow for the completion of construction.

Environmental works

Environmental works were completed at Gunbower Forest and Koondrook-Perricoota Forest in early 2014. These new structures, which include channels, regulators, levee banks and fishways, enable environmental water to be delivered to each site in the absence of natural floods. The works can also be used to extend the duration and extent of small natural floods.



Watering in 2014-15

At Gunbower Forest, just over 56 gigalitres of environmental water was delivered from May through to November 2014. For the 2014-15 water year, 37.4 gigalitres was delivered, which included contributions from the Victorian Environmental Water Holder (15.9 gigalitres) and The Living Murray program (21.5 gigalitres). More than 3,800 hectares of the forest was watered, including



1,180 hectares of high-priority wetlands and 2,570 hectares of river red gums.

Native wetland plants responded positively to the watering action, setting seed and increasing seedbank reserves. This was particularly important in sustaining the health of a number of plants species such as the threatened wavy marshwort and river swamp wallaby grass.

Native fish responded well to these flows and the spawning of small-bodied native fish was observed. Towards the end of the event, outflows from the forest were managed to provide cues for fish exit from the forest. Many thousands of small-bodied native fish (such as Australian smelt and native gudgeons) were recorded leaving through the Hipwell Channel fishway.

A drying regime had been implemented at Koondrook-Perricoota Forest over the previous year to allow completion of construction, so delivery of water to the site was a high priority. Over recent years, the aquatic vegetation communities were beginning to suffer the effects of the extended dry and terrestrial vegetation was beginning to encroach into the wetland areas.

Delivery of environmental water to Koondrook-Perricoota Forest began in early August 2014 and continued through to the end of September. Given the sheer size of the forest, it took the water almost two months to reach the outlet at Barbers Creek, which began to flow in early October. As large areas of the forest were relatively dry before the watering event, much of this water was retained within the floodplain – replenishing the wetlands that support animal and plant communities of the forest, as well as recharging into the soil profile.

A total of 26.4 gigalitres of environmental water was delivered to Koondrook-Perricoota Forest. This amount included contributions from the New South Wales Office of Environment and Heritage (18.2 gigalitres) and The Living Murray program (8.2 gigalitres). Just under 2 gigalitres flowed from the outlet of the forest through Barbers Creek – these outflows did not reconnect with the Wakool River or downstream Murray River.

The watering action inundated more than 4,000 hectares of floodplain forest. Major wetland areas responded positively, with growth in understorey, semi-aquatic and aquatic vegetation. Significantly, the watering suppressed the growth of terrestrial vegetation that had begun to encroach into wetland areas because of the recent dry conditions.

Small-bodied native fish were recorded moving through the upstream fishways that connect the River Murray to the forest. Larval native fish and frogs were observed within the wetlands of the forest and large numbers of colonial nesting waterbirds – including ducks, herons and ibis – were observed. Towards the end of the watering, flows to the forest were managed so as to provide cues and provide sufficient time for fish to exit the forest and return to the River Murray channel.

The watering action at Koondrook was a relatively small event that allowed for initial testing of environmental structures and their operation. In the future, much larger watering actions may be possible at the site.

Testing of structures and lessons learned

The 2014–15 watering was the first operation of the new Living Murray works at both Gunbower Forest and Koondrook–Perricoota Forest. Water delivery allowed for the testing of structures and trialling of their operation. Information from the watering was used to refine computer-based models, which will inform future planning and delivery decisions.



At Gunbower Forest, all structures were sound and performed as they were designed to do, including levees, fishways and regulators.



At Koondrook-Perricoota Forest. inflows were initially delivered at 500 megalitres per day. As the event progressed, it became apparent that more water than expected was being retained within the floodplains and wetlands of the forest. Water delivery to the forest was ramped up to 1,000 megalitres per day for a short period, which provided better commissioning outcomes (such as testing inlet structures to 1,000 megalitres per day), increased the distribution of water through the forest and also increased outflows to Barbers Creek.

Q CASE STUDY

Fluker post, Gunbower (Kathryn Stanislawski, NCCMA)

Working with the community

The engagement of the wider community in environmental watering actions is a useful mechanism to gather data and generate a wider community understanding of the importance of environmental watering. This kind of engagement is also a rewarding activity for all those involved.

In 2014-15, Gunbower Forest adopted a new and innovative approach to monitoring environmental watering and engaging the wider community. The Living Murray monitoring program funded the installation of two fixed photo points (called Fluker posts) where members of the community can take a photo using their mobile device and upload it to a central website maintained by the North Central Catchment Management Authority. The log of photos allows the condition of the site to be tracked over weeks, months and years and informs management of the changing condition of the site.

For more information on environmental watering and monitoring in Gunbower Forest, visit www.nccma.vic.gov.au/Water/Environmental_Water/ The_Living_Murray.



LAKE VICTORIA MILDURA ROBINVALE

Hattah Lakes

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Hattah Lakes is composed of more than 20 permanent and semi-permanent freshwater wetlands. Twelve of these are listed collectively as a Ramsar site, known as the Hattah-Kulkyne Lakes (see page 17). The lakes are surrounded by mosaics of flooddependent species, such as river red gum forests, and floodtolerant species, such as black box woodlands and shrublands. The lakes support nearly 50 species of waterbirds protected under national and international migratory bird agreements.

Hattah Lakes sits on the bank of the River Murray between Robinvale and Mildura in north-western Victoria

- 48,000 hectares, including 13,000 hectares of floodplain
- 27.3 gigalitres of TLM water
- 6,100 hectares of lakes and floodplain inundated

Strong vegetation response, including black box vegetation

Return flows returned carbon and nutrients back to main river system

Regulated flows are controlled flow rates resulting from the influence of a regulating structure, such as a dam or weir.

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Environmental works

The environmental works at Hattah Lakes include sill lowering, regulators, levee banks and a large pumping station. These were completed in 2013 and enable 6,000 hectares to be watered, including all 12 Ramsar-listed lakes. Under natural conditions, the lakes were filled when River Murray levels were relatively high. The environmental works allow natural inflows to occur more often and for water to be pumped into the lakes, even when river levels are quite low.

When the lakes are full, regulators and levee banks enable water to be held on the floodplain long enough to meet the water needs of the wetland and floodplain communities. This water can then be released back to the river to support downstream watering actions. The returning waters carry nutrients and carbon from the floodplain, as well as large numbers of larval and juvenile native fish.



Condition and past watering actions

Due to the elevation difference between Hattah Lakes and the River Murray, the system is disconnected from the river under regulated flows. The large natural flows in 2010-11 connected the system to the River Murray, filling several of the lakes at Hattah, but did not extend to the outer floodplain. The filling of these wetland systems led to some localised improvements in the health of the site. To allow construction of regulators and a pumping station, the site was deliberately kept dry for the following two years.

In 2013–14, the completion of environmental works allowed for the first major environmental water delivery. Just over 97 gigalitres of environmental water was pumped to the central lake system. This watering filled the lakes, including Lake Bitterang, which received water for the first time in 20 years, but did not extend onto the outer floodplain. Just under 6 gigalitres of this volume was returned to the River Murray.

Watering in 2014-15

As large volumes of water were retained within the lakes following the previous year's watering, water delivery in 2014-15 focused on providing topup flows to extend the area of inundation. These flows particularly targeted the fringing black box community, and further tested the new environmental works.

Watering began in May 2014, and by mid-September just over 91 gigalitres had been delivered to the lakes. This included 61 gigalitres of environmental water that was delivered in 2014-15 (July-September), with contributions from the Commonwealth Environmental Water Holder (19.1 gigalitres), the Victorian Environmental Water Holder (14.7 gigalitres) and The Living Murray program (27.3 gigalitres). In addition to the watering, the Commonwealth Environmental Water Holder delivered a further 15.1 gigalitres to Lake Kramen, which is high on the floodplain and only watered by very high river flows. Delivery to Lake Kramen began in September 2014 and was completed by January 2015.



More than 6,100 hectares of lakes and floodplain were watered in 2014-15, including Lake Kramen. Outer-reaching river red gum and black box forests and woodlands received water for the first time in 20 years, which resulted in an increase in the canopy cover of these vegetation communities. Fresh regrowth of black box vegetation provided important habitat for bush birds, colonially nesting waterbirds and the nationally vulnerable regent parrot, which were all observed feeding on plants responding to the environmental water delivery.

Of the water delivered to the lakes, 39.3 gigalitres, including 11.7 gigalitres of TLM water, was able to be released back into the River Murray between September and December 2014. These flows supported watering actions at downstream icon sites.

Testing of structures and lessons learned

2014–15 was the second consecutive watering at Hattah Lakes using the new environmental works. Most of the structure testing had already been completed in the previous year, but the second commissioning allowed a few minor engineering issues to be resolved.

An interesting observation from the watering in 2014–15 was that lower numbers of carp larvae were pumped into the lake system than in the previous year. This may be due to the water delivery occurring over the cooler winter months – a possible consideration for future watering actions.





Optimising the value of environmental water

At some locations in the River Murray system, environmental water is able to be delivered to a TLM site and flow through to a downstream site.

In 2014-15, a good example of reuse was the delivery of just over 61 gigalitres of environmental water to Hattah Lakes. The water was retained in the lakes and floodplains for a few months and then some water was returned to the River Murray system. The return of the water was timed to support watering actions downstream at the Chowilla Floodplain and Lindsay-Wallpolla Islands and the Lower Lakes, Coorong and Murray Mouth icon sites. The water returning from floodplain wetland sites was important for distributing nutrients and carbon through the system.

The use and reuse of environmental water reduces the pressure on environmental water portfolios and means that a wider range of watering activities can be considered in any given year.



MORGAN	LAKE VICTORIA	MILDURA ROBINVALE
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Chowilla Floodplain and Lindsay–Wallpolla Islands

The Chowilla Floodplain and Lindsay-Wallpolla Islands icon site is an area of highly diverse terrestrial and aquatic habitats and supports populations of rare, endangered and nationally threatened plant and animal species.

The Chowilla Floodplain and Lindsay-Wallpolla Islands icon site comprises four separate locations: Lindsay, Mulcra and Wallpolla islands are located in north-western Victoria and the Chowilla floodplain spans the South Australia – New South Wales border

More than 37,700 hectares

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- TLM water: 105.6 gigalitres
- 2,300 hectares of wetlands and floodplain watered

Strong vegetation response

25 water bird species observed

Six species of frogs observed breeding

The major vegetation communities of the floodplain are river red gum forest and woodlands, black box woodlands and lignum shrubland. The site provides important habitat for large-bodied native fish (such as Murray cod and perch) and a diverse assemblage of birds (up to 170 species) that includes national and international migratory birds. Seventeen native mammals have been recorded at the site as well as eight species of frog, including the southern bell frog, which is listed nationally as vulnerable.

Condition and past watering actions

High natural flows in 2010-11 flooded more than half of Chowilla Floodplain and Lindsay-Wallpolla Islands, providing widespread ecosystem benefits that included improvements in black box and river red gum community health. The site continues to recover from the millennium drought, whose full impacts continue to be evident. Environmental watering actions are part of remedying the broader impacts of river regulation and extraction.

No large-scale watering actions were undertaken at Chowilla floodplain in 2013-14 as works were still under construction. However, small volumes (4.7 gigalitres) of environmental water have been pumped to key Chowilla Floodplain and Lindsay-Wallpolla Islands wetland sites since 2004. These discrete actions have improved floodplain vegetation at a local scale and provided important drought refuge, maintaining habitat for birds and frogs. In 2013–14, just under 4 gigalitres of environmental water was delivered to Mulcra Island (Lindsay– Wallpolla Islands), which inundated more than 500 hectares of river red gum and black box forest and lignum shrubland. The watering provided connectivity between the River Murray and the Mulcra floodplain, to the benefit of wetlands and native fish.

Environmental works

Recently completed environmental works at Chowilla floodplain include new regulators and fishways and upgraded weirs on inlet creeks. These works enable the managed inundation of almost half of the floodplain area when the regulator and Lock 6 are operated at maximum operational height.



At Lindsay Island, construction of the Mullaroo Creek and upper Lindsay regulators provide for fast river flows along 26 kilometres of river channel.







At Mulcra Island, the environmental works enable increased flow within Potterwalkagee Creek and allow the inundation of 800 hectares of floodplain. Initial testing of the environmental works at Mulcra Island was undertaken as part of the 2013-14 watering.

Watering in 2014-15

With the completion of environmental works at Chowilla floodplain in 2014, testing of the operation of new structures was a high priority. The test results will pave the way for the delivery of a range of different-sized watering events into the future, which may include much larger floodplain inundation. And since a drying regime had been implemented at the site (to allow for the completion of construction), delivery of environmental water would provide significant ecological benefits.

The watering action at Chowilla Floodplain and Lindsay-Wallpolla Islands was a small to mediumsized event for the site. The Living Murray program delivered 105.6 gigalitres of environmental water (including 11.7 gigalitres of return flows from Hattah Lakes), which helped to enhance flows at the South Australian border through the site to 10,000 megalitres per day. The Chowilla testing resulted in the inundation of approximately 2,300 hectares of wetlands and floodplains.



Without the environmental works, an equivalent river flow of approximately 55,000 megalitres per day would have been required to achieve the same extent of inundation.

The watering event produced many positive ecological responses – improvements in the health of river red gum communities (emergence of saplings and fresh flushes of new foliage) and positive responses from moira grass (locally known as spiny mud grass), which have not been recorded at the site for some time. Twenty-five waterbird species were observed at the site during the watering, many of them drawn to the area by the increases in food and habitat. Six species of frogs, including the nationally threatened southern bell frog, were observed breeding. Productivity boosts were recorded within the Chowilla anabranch and downstream in the River Murray. An **anabranch** is a branch of a river that leaves the main stream and rejoins it further downstream.

A further 6.7 gigalitres of environmental water was delivered to Mulcra and Wallpolla islands by the Commonwealth Environmental Water Holder and the Victorian Environmental Water Holder. The watering action built on the outcomes of the previous year's watering at Mulcra Island, generating a positive response from river red gums and lignum shrublands, and providing connectivity between the river and the floodplain. The watering stimulated the spawning of small-bodied native fish and, as flows receded, both Murray cod and golden perch were observed moving from Potterwalkagee Creek back to the River Murray.

Testing of structures and lessons learned

Water delivery to the Chowilla floodplain wetlands and Mulcra and Wallpolla Islands provided the opportunity to test new structures at these sites. Overall, the structures were sound and performed as designed. No major operational issues were identified during the events.

At Chowilla floodplain, the watering action was a 'low floodplain' inundation: larger watering events will be possible in the future when larger river flows are available. The testing contributed to learnings about the benefits and risks associated with floodplain inundation, with significant carp breeding recorded, particularly in some larger wetland sites. No significant water quality issues were observed during the event. Low dissolved oxygen levels were recorded in the Coppermine wetland complex during a period of reduced through flow. However, these levels were rapidly restored by increasing flow rates through the Woolshed Creek South and Woolshed Creek East regulators.

(CASE STUDY

Managing water delivery to new structures

Environmental water was delivered to a number of icon sites in 2014–15 to allow for the testing and operation of environmental works – at some sites, for the first time.

There are inherent risks associated with the operation of new structures. Because these structures have just been built, it is essential to confirm that they are structurally sound and can be operated as they were originally designed.

When new works are commissioned at the icon sites, a staged testing approached is adopted. Instead of delivering large volumes of water to fully test these structures in one go, environmental water is introduced to the system in stages over several years. While this means that full testing of a particular structure may be prolonged, the risks associated with its operation can be managed appropriately, with sufficient time to repair any damage, rectify problems or adjust to any issues that might unfold.

Overall, the testing of the new structures and operation of the works was very successful in 2014–15. Despite a few minor issues that were readily resolved, the structures performed according to their design and will be ready to undergo further testing in the coming water years.







Lower Lakes, Coorong and Murray Mouth

Lakes Alexandrina and Albert (the 'Lower Lakes'), the Coorong and Murray Mouth is a complex freshwater and estuarine environment listed under the Ramsar Convention. It includes 23 different wetland types that range from freshwater to very saline. The site is one of 10 major Australian havens for waterbirds and is recognised internationally as a breeding ground for many species of waterbirds and native fish.

The Lower Lakes, Coorong and Murray Mouth icon site sits at the very end of the River Murray system. It is bounded by the Mount Lofty Ranges to the west, the Murraylands to the north, the Upper South East drainage scheme to the east and the Southern Ocean to the south.

More than 140,000 hectares

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122.9 gigalitres (including 89.6 gigalitres of returned flow)

Barrage outflows at or above 2 gigalitres/day till late December

31 species of fish at and around barrage fishways

Condition and past watering actions

The delivery of environmental water, coupled with relatively high system inflows over the past few years, has driven improvements in the health of the Lower Lakes, Coorong and Murray Mouth icon site. Flows through *the barrages* have meant that the Murray Mouth has been opened – dredging of the Murray Mouth began in January 2015 in response to high volumes of sand ingress and insufficient flow to scour the mouth. Fish movement through fishways has been increasing, bird numbers have improved and salinity levels in Lakes Alexandrina and Albert continue to improve. However, given the size and complexity of the system, improvements in ecosystem health are slower to realise than at other sites.

The barrages are five low, wide weirs built at the Murray Mouth to reduce the amount of seawater flowing in and out of the mouth due to tidal movement.

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In 2013–14, more than 700 gigalitres of environmental water was delivered to the site, supporting the continued recovery of native seagrass (*Ruppia tuberosa*), an important part of the Coorong ecosystem that provides food and habitat for birds, small fish and water bugs.

Watering in 2014-15

The Living Murray environmental water and water from the Commonwealth Environmental Water Holder supported ecological outcomes in the Lower Lakes, Coorong and Murray Mouth in 2014–15. In total, The Living Murray program contributed 122.9 gigalitres of environmental water, which included 89.6 gigalitres of water returning from upstream watering actions. A further 581 gigalitres of environmental water was delivered by the Commonwealth Environmental Water Holder across the water year.

Environmental water delivery to the Lower Lakes and seasonal mixing continued to lower the salinity in Lake Albert and supported native fish and waterbird populations. Thirty-one species of fish were recorded and a total of 843,324 individuals were sampled at and around the barrage fishways between October 2014 and January 2015. *Congolli* constituted more than 25 per cent of the total catch, which is significantly higher than in recent years.

The environmental water ensured that barrage outflows were maintained at or above 2 gigalitres per day until late December 2014, which helped to minimise sand ingress into the Murray Mouth. Significant freshwater was delivered to the Coorong in 2014–15, contributing to estuarine fish and waterbird outcomes. These outflows through the mouth of the River Murray also assisted in the export of salts from the system, which is a key requirement of the Basin Plan.

Congolli (Pseudaphritis urvilli) are sometimes called freshwater or marbled flathead, marble fish or tupong. They are a medium-sized fish that inhabit the coastal rivers of south-eastern Australia and easily move between brackish and fresh water.





The River Murray Channel

The River Murray Channel connects riverine ecosystems, floodplains, wetlands and estuarine systems along its course and provides an important link between the other five TLM icon sites. It provides habitat for many native plants, fish and other animals, and its banks support river red gum forests of high natural and cultural value.

The River Murray Channel icon site starts below the Hume dams and extends to Wellington, South Australia

Approximately 2,200 km

Fish breeding

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System connectivity



Condition and past watering actions

The wet conditions between 2010 and 2012 led to improvements in the condition and health of the River Murray Channel icon site. Over the past few years, environmental water has been used to deliver flow pulses along a number of reaches, targeting both fish and vegetation outcomes. Some of these watering actions have been able to build on the outcomes of recent flood events.

There were no specific TLM watering actions in the River Murray Channel in 2013–14. However, the delivery of environmental water to other icon sites provided benefits to the river, too, as it flowed through the system – including increased flows that stimulated the breeding of native fish. Water returning from icon sites to the River Murray also transported carbon and other nutrients that are important for the food chains of the whole system.

Watering in 2014-15

Where possible, the delivery of environmental water to the icon sites considered River Murray Channel outcomes through the timing of water delivery and return flows. However, the timing and magnitude of flows to the River Murray Channel were limited by channel capacity constraints as well as by delays to the release of environmental water from upstream sites. In South Australia, flows were managed to promote in-channel native fish recruitment and to provide connectivity with a number of small off-channel wetlands.

(CASE STUDY

Dealing with changes in water quality

The transfer of floodplain carbon in the form of leaf litter and other organic matter into wetlands and rivers is a natural process that drives the health and productivity of aquatic ecosystems. When organic matter is flushed into waterways, it is consumed by bacteria, which in turn feed organisms higher up the food chain.

While carbon plays a vital role in sustaining the ecology of aquatic systems, it can lead to changes in the water chemistry, including the levels of dissolved oxygen. When bacteria feed on the organic matter, they consume oxygen and, under certain conditions – such as when there are high carbon loads and warm water temperatures – the bacteria can multiply rapidly, stripping large amounts of dissolved oxygen from the water.

Fluctuating levels of dissolved oxygen are not generally a problem in aquatic ecosystems. It is only when the dissolved oxygen falls to very low levels that it begins to stress the animals that live in the affected waterbody – this is known as a hypoxic blackwater event.

Environmental water managers understand the risks associated with hypoxic blackwater and factor them into the design and delivery of environmental watering events. Some of the important risk management measures implemented at TLM sites include:

 computer-based water quality models for sites where hypoxic blackwater is a known risk. These models allow managers to simulate different delivery scenarios and define those scenarios that minimise hypoxic blackwater events. This can be done through reducing the size of the event, beginning delivery when ambient temperatures are cooler, and completing delivery prior to the hottest periods, or increasing inflows to increase water movement, mixing and aeration.

- managing flows through the site to ensure that minimum water exchange rates are achieved
- comprehensive water quality monitoring programs that provide real-time dissolved oxygen data to managers at key locations such as at inlets, highrisk areas within a site and at outlet points before the water returns to the river. Tracking dissolved oxygen levels allows for efficient implementation of risk management measures.
- identifying contingency measures before each watering event. These define the response to low dissolved oxygen and hypoxic blackwater events.
 Some of the contingency measures may include increasing flows to dilute low dissolved oxygen water or increase aeration, and closing off outlet regulators to prevent low dissolved oxygen water entering back into the main river system.

In 2014–15, water quality monitoring identified low dissolved oxygen levels at locations within a number of sites; however, none of these resulted in widespread hypoxic blackwater.

Bird watching, Lake Powell (MCMA)



Looking forward

The 2014-15 water year represented a major step forward for The Living Murray program. Delivery of 285 GL of environmental water across 5 icons sites generated some really positive ecological outcomes. The testing of the operation of new environmental works at a number of sites has shown that we can achieve good ecological outcomes and be efficient with the use of environmental water.

As we move through 2015-16 and beyond, the program will continue to work with other environmental water holders to optimise ecological outcomes in the southern connected basin as well as continue to learn how to optimise the use of environmental water through the use of environmental works.



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MURRUMBIDGEE RIVER

BROKEN RIVER

Acknowledgement of the Traditional Owners of the Murray-Darling Basin

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The Murray-Darling Basin Authority acknowledges and pays respect to the Traditional Owners, and their Nations, of the Murray-Darling Basin, who have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. The MDBA understands the need for recognition of Traditional Owner knowledge and cultural values in natural resource management associated with the Basin.

The approach of Traditional Owners to caring for the natural landscape, including water, can be expressed in the words of Darren Perry (Chair of the Murray Lower Darling Rivers Indigenous Nations) –

'the environment that Aboriginal people know as Country has not been allowed to have a voice in contemporary Australia. Aboriginal First Nations have been listening to Country for many thousands of years and can speak for Country so that others can know what Country needs. Through the Murray Lower Darling Rivers Indigenous Nations and the Northern Basin Aboriginal Nations the voice of Country can be heard by all'.

This report may contain photographs or quotes by Aboriginal people who have passed away. The use of terms 'Aboriginal' and 'Indigenous' reflects usage in different communities within the Murray–Darling Basin.

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