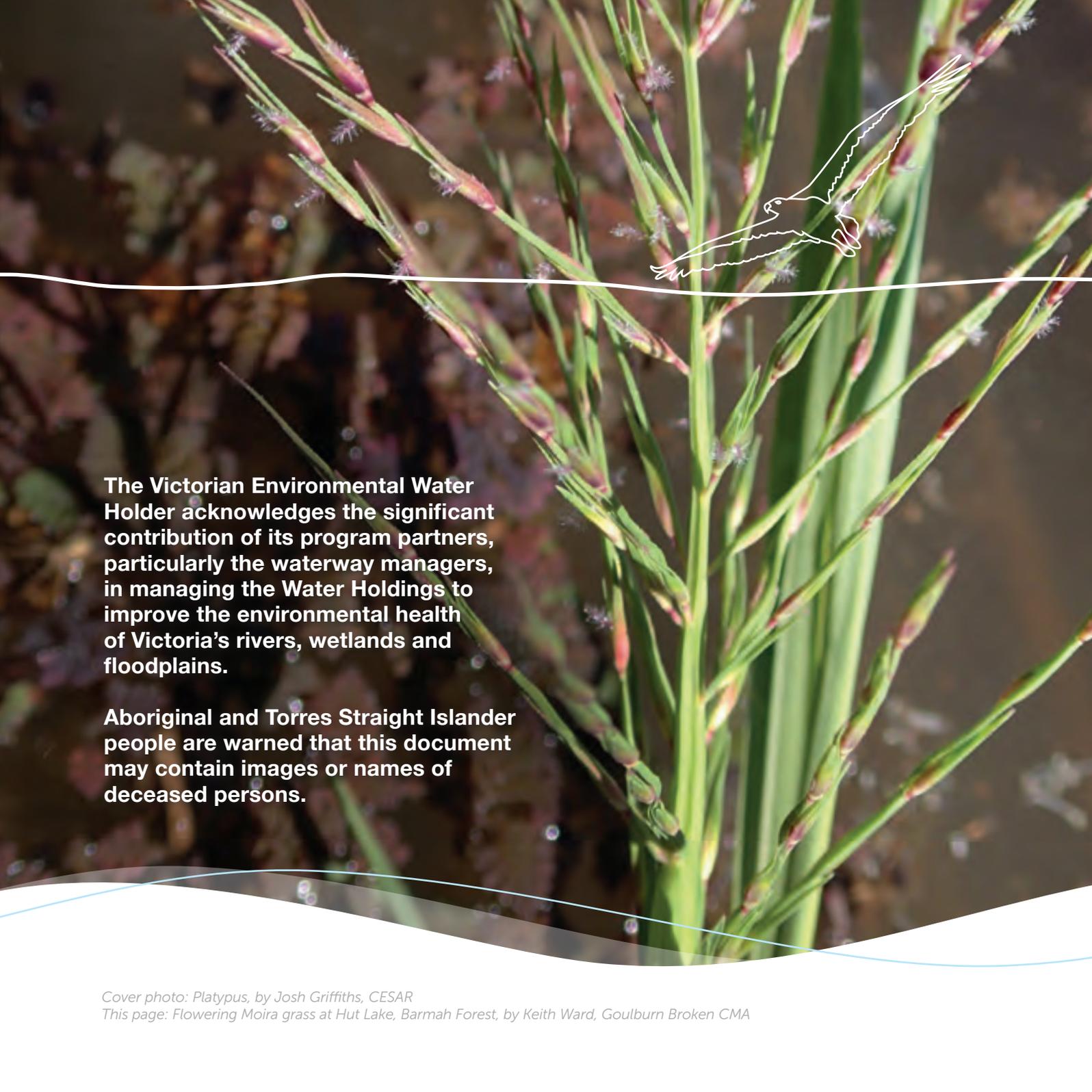


Victorian Environmental Water Holder

Reflections

**Environmental
watering**
in Victoria 2013-14

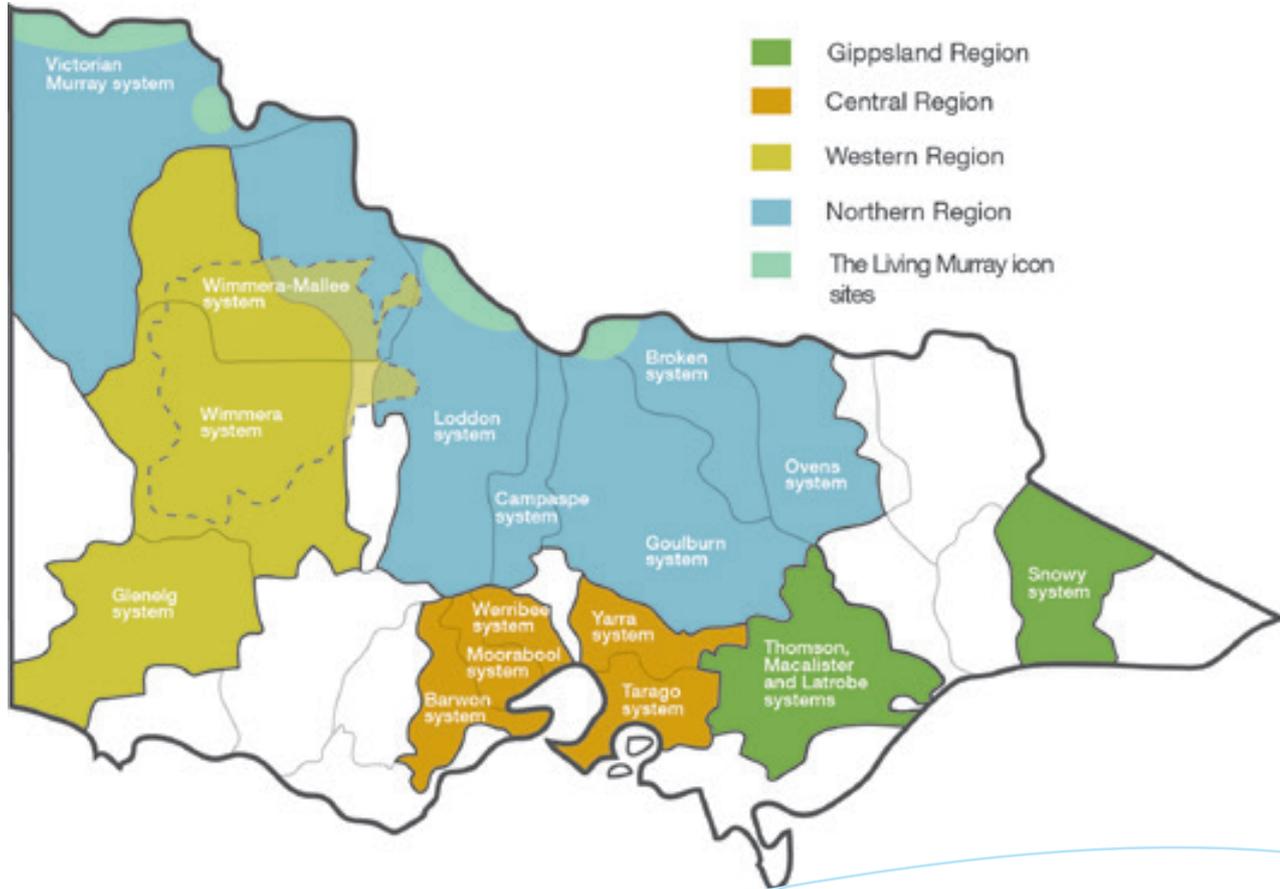


The Victorian Environmental Water Holder acknowledges the significant contribution of its program partners, particularly the waterway managers, in managing the Water Holdings to improve the environmental health of Victoria's rivers, wetlands and floodplains.

Aboriginal and Torres Strait Islander people are warned that this document may contain images or names of deceased persons.

Cover photo: Platypus, by Josh Griffiths, CESAR

This page: Flowering Moira grass at Hut Lake, Barmah Forest, by Keith Ward, Goulburn Broken CMA



Systems where environmental water was delivered in 2013-14

1. Snowy
2. Latrobe
3. Thomson
4. Macalister
5. Yarra
6. Tarago
7. Werribee
8. Moorabool
9. Barwon
10. Glenelg
11. Wimmera
12. Wimmera-Mallee wetlands
13. Goulburn
14. Broken
15. Campaspe
16. Loddon
17. Northern wetlands and floodplains
18. The Living Murray icon sites
19. Ovens



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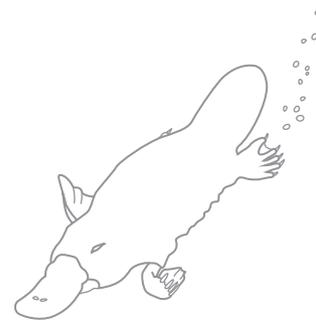
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foreword

Welcome to **Reflections – environmental watering in Victoria 2013-14**, the annual booklet reflecting the work of the Victorian Environmental Water Holder (VEWH) and its partners in the environmental watering program.

This, our third year of operation, saw a significant leap in the scale of our activities. The environmental watering program scoped 222 priority watering actions across Victoria – almost double the previous year¹. We were able to deliver more than 800,000 megalitres (ML) of water², to support environmental values for 145 river reaches and wetlands. This resulted in the full or partial achievement of 82 percent of the identified actions for 2013-14.

This swell in activity aligned well with our expectations for the role of the VEWH in our third year. We were able to water more sites this year because we had access to more water, including environmental water carried over, water purchased with our partners and increased availability of water from the Commonwealth Environmental Water Holder (CEWH).

We are continuing to improve our processes and address knowledge gaps. Flexible and adaptive environmental water management is already contributing to the improved environmental health of waterways. We are able to use environmental water where and when it is most needed.

The stories you will read in this year's **Reflections** clearly illustrate the value of our collective watering efforts. Inside, you will hear from our partners – catchment management authorities and Melbourne Water – as they recount the work they have undertaken, including the achievements, challenges and lessons learned in 19 Victorian waterway systems.

As always, I would like to recognise the ongoing time and effort of all our program partners this year, including waterway managers, storage managers, and land managers. I would also like to recognise and thank the CEWH and office, our partners at the Living Murray program and the communities who work with us to improve the environmental condition of Victoria's rivers, floodplains and wetlands.



Denis Flett
Chairperson

¹ The environmental watering program scoped 122 priority watering actions for 2012-13.

² 809,515 ML was delivered from VEWH accounts in 2013-14 (compared to 437,242 ML in 2012-13). In addition, 358,316 ML was delivered to Victorian waterways from other sources, totalling 1,167,830 ML delivered in 2013-14.



*Sandford fish ladder at Glenelg River,
by Stephen Ryan, Glenelg Hopkins CMA*

introduction

The role of the Victorian Environmental Water Holder

On 1 July 2011, the VEWH was officially established, becoming Victoria's first independent statutory body responsible for managing the State's environmental water entitlements (Water Holdings). The vision which guides the long-term management of environmental water by the VEWH is:

Environmental watering for healthy waterways

- Healthy and resilient waterways with restored watering patterns that sustain a more natural level of biodiversity.
- Collaborative partnerships that build widespread support for environmental watering and the multiple values and services provided by waterways.
- Best-practice environmental water management to achieve the most effective and efficient use of Victoria's Water Holdings.

This vision is supported by a mission statement, *"to improve the health of rivers, wetlands and floodplains by managing Victoria's Water Holdings and cooperating with partners"*.

In undertaking its mission, the VEWH:

- makes decisions on the most effective use of the Water Holdings, including use, carryover and trade
- liaises with other water holders to ensure coordinated use of all sources of environmental water
- authorises waterway managers to implement watering decisions
- works with storage managers to coordinate and maximise environmental outcomes from the delivery of all water
- commissions targeted projects to demonstrate ecological outcomes of environmental watering at key sites
- publicly communicates environmental watering decisions and outcomes.

The importance of environmental water

Environmental water supports the rich and diverse values of Victoria's waterways. Environmental values range from plants and animals, including threatened species, to water quality and habitat. Waterways are also important in connecting communities. They support a range of social values – including cultural heritage values such as traditional medicinal plants and scar trees, and recreational activities including boating, fishing and camping. Many of these environmental and social values also support economic values, including through tourism and ensuring good water quality for irrigation.

As water resources are limited, the competing uses of water (eg. for towns, agriculture and the environment) need to be balanced. Environmental water helps to restore natural flow patterns and sustain the waterways valued by Victorians.

Environmental flows are managed adaptively and are often delivered to complement naturally occurring conditions. Scientific flow studies underpin each watering action, recommending the ideal flow size, timing, duration and frequency required for the identified values in each system. Lessons from each watering action add to the existing knowledge base to continuously improve environmental water management.





Benefits of environmental flows

- ① Stimulate fish breeding and allow fish to move within the system
- ② Provide habitat for waterbirds and stimulate breeding
- ③ Move sediment and maintain channel shape
- ④ Improve water quality
- ⑤ Provide habitat for frogs
- ⑥ Regenerate instream vegetation
- ⑦ Trigger plants to seed or germinate
- ⑧ Allow movement of carbon (eg. leaf litter between floodplains and rivers)
- ⑨ Flush out salt from riverbanks and floodplains
- ⑩ Restore groundwater supplies
- ⑪ Provide social, recreational and tourism opportunities

Highlights of environmental watering

In 2013-14, over 800,000 ML of water was delivered to 66 river reaches and 79 wetlands. This was close to twice the amount of water delivered in the previous year, and resulted in the full or partial achievement of 181 priority watering actions (see Figure 1), benefitting a range of plant and animal species. This year, environmental water contributed to the following environmental outcomes:

- a range of achievements at Barmah Forest, including flowering of Moira grass, a vegetation species at risk of local extinction, through large-scale watering of the forest
- targeted inundation of Gunbower Forest, through completion of the Hipwell Road Channel works, to aid its river red gum, fish and waterbird populations
- regeneration of black box trees and aquatic and riparian vegetation at Hattah Lakes, resulting from the completion of infrastructure to enable more water to be delivered more efficiently to a wider range of lakes
- juvenile platypus being observed in the MacKenzie River in the Wimmera system
- successful flushing of the salt wedge in the lower Latrobe wetlands, in part from the first ever use of environmental water from the Blue Rock entitlement
- thirty-seven of fifty-two Wimmera Mallee Pipeline wetlands receiving environmental water
- increased numbers of tuong found in the Glenelg River
- spawning and recruitment of Australian grayling in the Yarra and Tarago systems
- a successful golden perch spawning event in the Goulburn River.

Pages 10-57 highlight the achievements and benefits in each system.

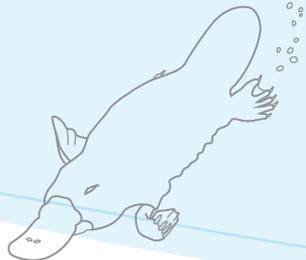
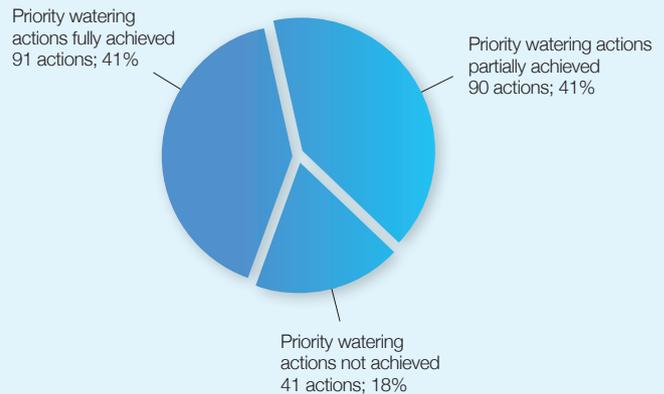


Figure 1 Achievement of priority watering actions in 2013-14



Carryover and trade

Carryover and trade are useful tools for the VEWH to help maximise benefits to the environment from the Water Holdings.

In some systems, carryover rules allow the VEWH to retain unused water in storage at the end of the year, which can then be used to meet priority watering actions in future years. For example, in the Murray system, the VEWH carried over around 16,000 ML of allocation from 2013-14 to support the continuation of a priority watering action at Gunbower Forest in early 2014-15. The ability to carry this water over mitigated the risk that opening allocations on the Murray system would not be high enough to support the early-season watering action which had commenced in the previous year.

Water trade refers to the commercial buying or selling of water allocations (or entitlements) on water markets. It also applies to transfers of water between environmental water accounts within or between connected systems (known as 'administrative transfers'). The VEWH utilises water trade to purchase or transfer allocation to meet a supply shortfall, or to sell water allocation when there is no foreseeable environmental demand for it.

Left to right: Hattah Lakes, by Mallee CMA;
Barbers wetland, by Mallee CMA;

In 2013-14, some of the VEWH's key trading activity included:

- transfer of 1,054 ML of environmental water from the Yarra system to the Thomson system to enable delivery of a summer/autumn fresh in the Thomson River
- 300 ML of water allocation purchased in the Loddon system to support the delivery of a spring fresh
- joint purchase (with Melbourne Water) of 731 ML of unused licence allocation to support environmental releases to Jacksons Creek in the Maribyrnong system – this was the first instance where the VEWH and a waterway manager purchased water in a system where no permanent Water Holdings are currently held.

Partnerships

Working with program partners is critical to the efficient and effective delivery of the environmental watering program. Waterway managers and storage managers each have a key role in the local planning and implementation of watering actions. The VEWH also works closely with other water holders, such as the CEWH (through the Commonwealth Environmental Water Office) and the Murray-Darling Basin Authority (through the Living Murray program), to negotiate use of their water in Victorian waterways.

Demonstrating outcomes from environmental water

The VEWH commissions technical work, including short-term monitoring of ecological responses to watering events, to ensure adaptive management of environmental water. In 2013-14, the VEWH aimed to improve its understanding of:

- environmental water management and its impact on river flow, water level and salinity within connected systems (eg. in the Latrobe and Thomson systems)
- understanding the role of environmental flows in managing carp populations in rivers (eg. Judas carp project in the Glenelg system)
- refining watering requirements of wetlands (eg. for wetlands connected to the Wimmera-Mallee Pipeline)
- wetland watering and outcomes achieved for vegetation, birds, fish and macroinvertebrates (eg. across the Northern Region)
- the extent, composition and vigour of reedy vegetation over time (eg. Reedy Lake vegetation monitoring in the Barwon system)
- effects of environmental flows on species that spawn in estuaries (eg. in the Snowy system).

Findings from monitoring and technical projects are valuable in addressing knowledge gaps and providing learning opportunities for future management of environmental water.



The Australian grayling: A ‘threatened species’ success story?

Healthy and sustainable native fish populations are a key objective for many environmental watering sites. As fish are top of the food chain predators, they provide an effective indicator of health for other components of the ecosystem.

This year’s *Reflections* contains a number of reports of increased sightings of one of Victoria’s most threatened fish species – the Australian grayling.

What do we know about this fish species and could the Victorian environmental watering program be making real gains in securing its future in State waterways?

The Australian grayling is a native, migratory fish found in coastal rivers and streams in south-eastern Australia. It is currently listed as ‘threatened’ under State and Federal legislation, with its decline over time being attributed to a number of factors, including altered flow regimes (due to management of rivers to provide water for homes, farms and businesses), barriers to movement up and down stream (such as roads, bridges and weirs), habitat degradation and invasive (non-native) species.

Provision of habitat and spawning opportunities for Australian grayling has been a common environmental watering objective for many of the systems in the Gippsland and Central regions – and we may now be seeing the positive results.



Wayne Koster, an aquatic ecologist at Victoria’s Arthur Rylah Institute, says improved understanding of the Australian grayling’s needs is increasing the effectiveness of the environmental watering program.

“The fact that we are now beginning to understand the key processes and water delivery requirements to induce spawning in Australian grayling is a fantastic boost in the recovery prospects for this species,” he says.

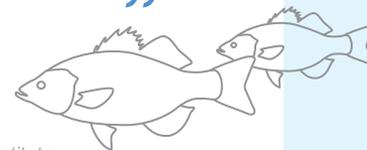
“Environmental flows for Australian grayling initially focused on short-lived flow events to cue spawning. Recent research findings indicated that these environmental flow recommendations were inadequate, as they did not consider the distance and time needed for adult fish to migrate so that they could reach spawning areas.”

“Increased flows are critical to the spawning and migration patterns of adult Australian grayling. Without high flows, it is likely Australian grayling will fail to spawn. Environmental flows for Australian grayling need to consider flow events (natural and managed) of sufficient duration and magnitude to allow adults to migrate to lower river reaches. This information will be considered as part of a review of the environmental flow recommendations for Australian grayling in the Thomson, Macalister, Tarago, Bunyip and Yarra rivers.

“Our research suggests that targeted environmental watering will play a key role in securing populations of this threatened species in Victoria’s rivers into the future.”

“ Our research suggests that targeted environmental watering will play a key role in securing populations of this threatened species in Victoria’s rivers into the future. ”

Wayne Koster, Ecologist



*Left: Australian grayling, by Arthur Rylah Institute
Right: Tom Kirby and Sharnie Hamilton record a site of cultural value at Gunbower forest, by North Central CMA*

Barapa Barapa cultural heritage mapping of lower Gunbower Forest

The primary purpose of Victoria's environmental watering program is to achieve environmental benefits in State rivers, wetlands and floodplains. However, the delivery of environmental water is likely to provide other benefits that depend on the condition of our waterways.

Where possible, when preparing environmental watering plans, community-based waterway managers identify opportunities for social and cultural benefits.

Gunbower Forest was the focus, this year, of the Barapa Barapa Cultural Heritage Mapping Project of lower Gunbower Forest. The project, delivered in partnership with North Central Catchment Management Authority (CMA) and Traditional Owners from Barapa Barapa Nation was a first step to understanding cultural values so they may be incorporated into environmental watering plans.

The project was a coming together of culture, environment, science and tradition. Ecologists Kate Bennetts, Damien Cook and Doug Froot, and archaeologist Colin Pardoe, joined three teams of Barapa Barapa people to survey selected areas of cultural significance within the forest. Cultural sites and resources recorded included plants, scar trees, earth mounds, shell middens and stone tools.

Barapa Barapa Elder, Aunty Esther Kirby, said the project was important to share knowledge, as well as pass on cultural heritage to younger generations.

"The Barapa Barapa people have walked in this place since The Dreamtime and the Gunbower Forest for us is like having oxygen."

"We feel the presence of our old people here and we have a spiritual connection to everything – the trees and the water... everything matters. And it's our right to speak for, and on, Country."

North Central CMA Project Officer, Robyn McKay, highlighted the significance of the health of the forest to Traditional Owners. "Environmental watering can help maintain the important cultural values of the forest so when people come out to care for Country, the resources they need are here," she said.

Meanwhile Kate Bennetts, ecologist, said the project had opened up her eyes to aspects of the forest she hadn't previously considered.

"Being out in Gunbower with the Barapa people has opened my eyes to a whole heap of things I wasn't even aware of," she said. "I know what a scar tree looks like but coming out I've learned what all the different types of scar trees are. I've realised that I've been walking around and over all these earth mounds that I didn't even notice because I was so busy looking at the plants. It's given me a real insight to the cultural values of the forest that I was completely ignorant of."

"The real joy has been that I've been able to pass on the Latin names of all the plants and the science behind the forest that I've learned – and that I've been able to share some of that knowledge while we're doing this two-way cross-cultural learning."

The Barapa Barapa Cultural Heritage Mapping of lower Gunbower Forest project was funded from June 2013 to June 2014 through the Australian Government's Indigenous Heritage Grant and supported by the Living Murray Indigenous Partnerships Program coordinated through the Murray-Darling Basin Authority.

“ The Barapa Barapa people have walked in this place since The Dreamtime and the Gunbower Forest for us is like having oxygen.”

Aunty Esther Kirby, Barapa Barapa Elder



Snowy system

Waterway managers: New South Wales Office of Water (New South Wales); East Gippsland Catchment Management Authority (CMA, Victoria)

Storage manager: Snowy Hydro Limited

Record water allocation and new monitoring approaches highlighted a groundbreaking year for the Snowy in 2013-14.

A total of 190,600 ML was available for release in the Snowy River in 2013-14, below Jindabyne Dam. This allocation was jointly made available by the New South Wales, Victorian and Commonwealth governments.

In Victoria, a substantial monitoring and investigation program is underway, supported by the VEWH, the Department of Environment and Primary Industries (DEPI) and the East Gippsland CMA.

Dan Stoessel, Senior Scientist at Victoria's Arthur Rylah Institute, said environmental flows of appropriate magnitude and timing have potential to bring meaningful environmental outcomes for biota within the Victorian Snowy region.

"We are gathering data as to the effect of environmental flows on water parameters within the Snowy River estuary. From this we will build a hydrodynamic model, which will be capable of predicting the influence of a given flow on salinity, dissolved oxygen, temperature and water level within the lower reaches of the Snowy."

"Our modelling and data collection methods will allow us to provide management advice regarding the magnitude and timing of future environmental flows for the benefit of biota of the Victorian section of the Snowy River. This may be of particular value for species that use the Snowy estuary for important life history stages, such as Australian bass, which are known to spawn in estuarine reaches of rivers," Dan said.

“ Environmental flows of appropriate magnitude and timing have potential to bring meaningful environmental outcomes for biota within the Victorian Snowy region. ”

Dan Stoessel, Scientist

Left to right: Snowy River at McKillops Bridge, by Ken Judd, East Gippsland CMA; Snowy Estuary at Marlo, by Matthew Renshaw, East Gippsland CMA; Snowy River at Jacksons Crossing, by Ken Judd, East Gippsland CMA





“Surveys of the Snowy River Australian bass population, and subsequent ageing of a sub-sample of individuals, will allow us to determine what years successful spawning and recruitment of Australian bass has occurred historically. It will also, in combination with the hydrodynamic model, allow us to determine under what type of flows and estuarine conditions it occurred, and whether these conditions can be replicated using future environmental flows to improve Australian bass numbers in the Snowy.”

Liz Brown, Environmental Water Coordinator at East Gippsland CMA, indicated that the Arthur Rylah Institute is an important partner in future environmental management for the Snowy system.

“We have learnt a great deal working with the ARI on this project and we are committed to continuing our monitoring efforts to inform future environmental flows planning.”

Further information on the Snowy system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the East Gippsland CMA website at www.egcma.vic.gov.au.

The Snowy River begins at Mount Kosciuszko, draining the eastern slopes of the Snowy Mountains in New South Wales before flowing through the Snowy River National Park in Victoria and emptying into Bass Strait near Marlo. The lower reaches of the Snowy River in Victoria provide a range of habitats for endangered species as well as feeding and breeding areas for migratory birds.

The VEWH holds water entitlements in trust for the Snowy program, a joint initiative with the New South Wales and Commonwealth governments. Decisions about the preferred environmental water releases for the Snowy are made by the New South Wales Ministerial Corporation. The VEWH does not have a direct role in planning for or delivering this water.

Environmental objectives

Providing flow variability to improve habitat and connectivity for fish and macroinvertebrates; promoting growth of aquatic and riparian vegetation, limiting the encroachment of terrestrial vegetation into the river channel; and encouraging mixing of fresh and salt water in the Snowy River estuary.



latrobe system

Waterway manager: West Gippsland Catchment Management Authority (CMA)

Storage manager: Southern Rural Water

Water from three Gippsland rivers provided the power to shift the salt wedge in the Latrobe system in 2013-14.

A coordinated multi-system approach was critical in shifting the salt wedge and improving water quality for fish in the Latrobe River estuary.

Releases in the Thomson and Macalister systems, along with the first ever environmental water release from Blue Rock Reservoir to the Latrobe River, not only provided environmental benefits in each system, but were also managed in a coordinated way to assist in the mobilisation of the salt wedge in the Latrobe River estuary.

A salt wedge is the transition zone of saltwater and freshwater environments and occurs when a freshwater river flows directly into salt water, such as the Latrobe River flowing in to Lake Wellington. During prolonged low flows, the salt wedge gradually migrates further upstream and the saline water can have impacts on freshwater environments, such as adjacent wetlands.

David Stork, West Gippsland CMA Environmental Water Resource Officer, said that with careful planning, entitlements from multiple systems and various release points can be used to maximise benefits for the lower Latrobe River.

“The environmental releases in the Latrobe, Thomson and Macalister rivers were planned to attain specific environmental objectives in each of their respective systems.”

“We were able to capitalise on the river and system connectivity and establish how environmental releases can provide multiple system benefits.”

“Flushing of the salt wedge is important to improve water quality, and freshen the lower estuary, which reduces the risk of poor water quality events impacting on fish or killing vegetation. It was really positive to learn that we have the capacity to flush the salt wedge through carefully planned and timed environmental flows that can supplement natural events.”

There were also many positive outcomes for the lower Latrobe wetlands.

“Dowd and Heart Morass and Sale Common received very good winter-spring inflows, which is leading to really positive outcomes.”

“The number of ibis and spoonbill using the Dowd Morass rookery – the nesting areas that enable breeding – was substantially higher than the previous year, and a waterfowl count in spring 2013 by Field and Game Australia members identified high numbers of waterbirds birds for the third year running.”

““ The number of ibis and spoonbill using the Dowd Morass rookery – the nesting areas that enable breeding – was substantially higher than the previous year...””

David Stork, Environmental Water Resource Officer

*All images by West Gippsland CMA
Left to right: Tanjil River during environmental release; Royal spoonbill at Dowd Morass, lower Latrobe wetlands*



“These wetlands also need substantial drying phases, to promote vegetation diversity, and the long hot summer of 2013-14 caused reasonable drying for most wetlands.”

Further information on the Latrobe system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the West Gippsland CMA website at www.wgcm.vic.gov.au.

The Latrobe River rises near Powell Town in West Gippsland and eventually flows into Lake Wellington, of the Gippsland Lakes.

Located in eastern Victoria along the Latrobe River between its confluence with the Thomson River and Lake Wellington, the lower Latrobe wetlands are part of the Gippsland Lakes system, which in 1982 were listed as Ramsar wetlands of international importance. The wetlands are made up of Sale Common, Heart Morass and Dowd Morass, and cover an area of over 35 square kilometres. They support a wide variety of plant and animal species including a number of threatened vegetation types, waterbirds and fish and frog species, such as the green and golden bell frog and the growling grass frog.

Environmental objectives (Latrobe River)

Rehabilitation of the in-stream habitat by: encouraging vegetation growth low in the river channel; and improving habitat for aquatic plants and animals.

Environmental objectives (lower Latrobe wetlands)

Encouraging the growth and reproduction of wetland plants, particularly swamp scrub, tall marsh, aquatic hermland and brackish hermland; and maintaining/enhancing waterbird and/ or wetland plant habitat.

Site	Volume delivered (ML) – VEWB water only
Latrobe River	3,748 ¹

¹ Use for the Latrobe River only. Water available for use in the lower Latrobe wetlands is dependent on suitable river heights in the Latrobe River, as specified in the Latrobe River Environmental Entitlement 2010.



thomson system

Waterway manager: West Gippsland Catchment Management Authority (CMA)

Storage manager: Melbourne Water; Southern Rural Water

For the third year running, Australian grayling numbers were boosted through environmental releases in the Thomson system in 2013-14.

West Gippsland CMA Environmental Water Resource Officer, David Stork, said an autumn fresh and baseflows for the Thomson ensured a good spawning response for Australian grayling.

“We observed a clear jump in grayling egg numbers from previous years, due to the environmental water release in autumn.”

“From these results, we were able to make a link between our environmental water releases and increased spawning of Australian grayling, which will assist in the sustainability of the population.”

“The autumn fresh was also aimed at aiding movement of fish between habitats. This release provided valuable information to help us better time and link watering events throughout the Thomson River and other systems downstream.”

David said releases to the Thomson also generated an increase in various recreational activities.

“Continuing on from the previous year, rafting and kayaking on the Thomson River increased, while there were an abundance of keen recreational fishers seeking the important catch!”

Further information on the Thomson system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the West Gippsland CMA website at www.wgcm.vic.gov.au.

““ We observed a clear jump in grayling egg numbers from previous years, due to the environmental water release in autumn.””

David Stork, Environmental Water Resource Officer



Left to right: Thomson River, by West Gippsland CMA; Canoeing at Thomson River, by Jolyon Taylor, Gippsland Water; Community members on the Thomson River, by West Gippsland CMA



The Thomson River flows for 213 kilometres in a south-easterly direction from the slopes of Mount Whitelaw on the Baw Baw Plateau, to join the Latrobe River south of Sale. As a result, the Thomson River also plays an important role in providing freshwater flows to the lower Latrobe wetlands. The river is home to some of the largest and most diverse native fish populations in the Gippsland Region. These fish species include the river blackfish, southern pygmy perch, and the flat-headed gudgeon. A number of these species are migratory fish, including the threatened Australian grayling, Australian bass, tupong and the short- and long-finned eels.

Environmental objectives

Providing habitat availability and fish migration cues for Australian grayling; maintaining/enhancing native fish community structure; and regenerating and inundating riparian vegetation.

Site

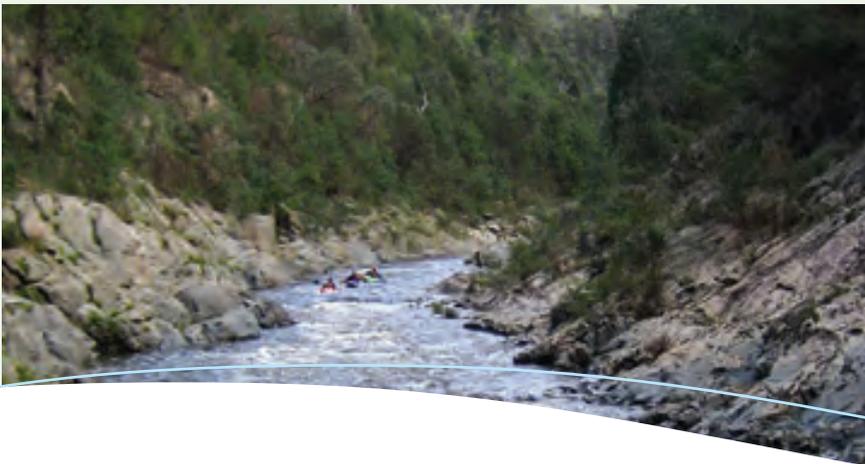
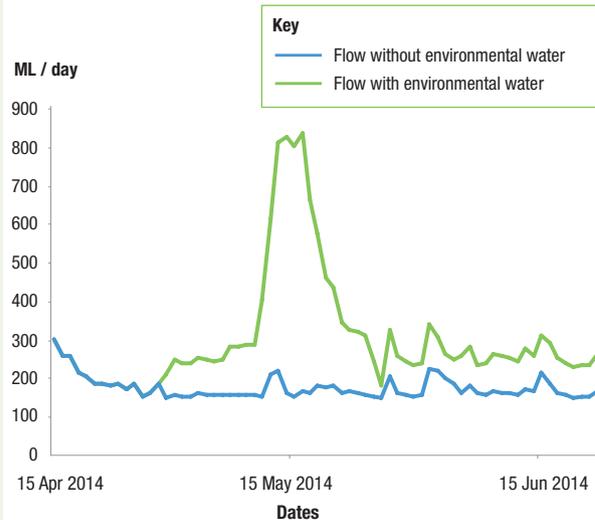
Volume delivered (ML) – VEWH water only

Thomson River

10,754

Thomson flow snapshot

This hydrograph shows how environmental water contributed to an autumn fresh in the Thomson River. Flows were recorded at Coopers Creek Gauge, downstream of Thomson Dam.



macalister system

Waterway manager: West Gippsland Catchment Management Authority (CMA)

Storage manager: Southern Rural Water

Watering in the Macalister system in 2013-14 was aimed at boosting the population of Australian grayling.

West Gippsland CMA Environmental Water Resource Officer, David Stork, said delivery of autumn freshes would help to sustain Australian grayling and other species by providing flows that are essential for migration and spawning opportunities.

“Through targeted flows in autumn, we found an increase in the spawning and recruitment numbers of Australian grayling, which was especially important because the grayling population has been declining in the Macalister River.”

David explained that other species in the system are steadily increasing following the autumn releases.

“Our monitoring indicates that since the drought year of 2010-11, there has been a gradual rise in the numbers of long-finned eel and river blackfish. This suggests these releases, coupled with favourable natural conditions, are bringing some of these iconic species back to the system.”

Irrigation releases via Lake Glenmaggie contributed to flows in the summer and autumn months. During the winter months, Lake Glenmaggie was at capacity and good winter and spring flows were provided naturally to the river.

Delivery of water to the Macalister River provided additional benefits for the lower Latrobe River and wetlands, reinforcing the connectivity of the Macalister system to other waterways within the region.

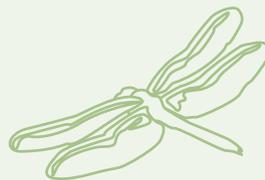
Further information on the Macalister system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the West Gippsland CMA website at www.wgcma.vic.gov.au.

“ Through targeted flows in autumn, we found an increase in the spawning and recruitment numbers of Australian grayling, which was especially important because the grayling population has been declining in the Macalister River. ”

David Stork, Environmental Water Resource Officer



*All images by West Gippsland CMA.
Left to right: Macalister River; Macalister River
at Lake Glenmaggie; Upper Macalister River*



The Macalister River joins the Thomson River between Maffra and Sale and has a diverse catchment, with its upper reaches beginning in the forested and mountainous areas of the Alpine National Park. It then flows into the Macalister Irrigation District near the township of Maffra – the largest irrigation area south of the Great Dividing Range. The Macalister River features two major structures – Glenmaggie Weir and Maffra Weir – which supply the irrigation district. The river is home to some of the largest and most diverse native fish populations in the Gippsland Region.

Site

Volume delivered (ML) – VEWB water only

Macalister River

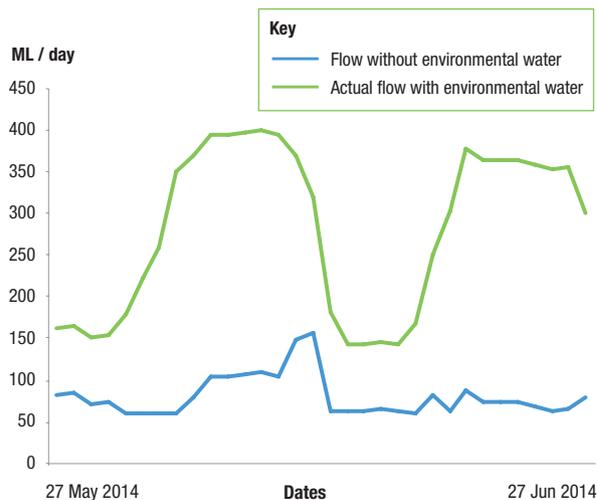
12,849

Environmental objectives

Restoring self-sustaining populations of Australian grayling, long-finned eel and river blackfish; and achieving ecological outcomes for the Thomson, Latrobe and Macalister systems as a whole.

Macalister flow snapshot

This hydrograph shows how environmental water contributed to autumn and winter freshes in the Macalister River. Flows were recorded at Lake Glenmaggie, north-west of Maffra.



yarra system

Waterway and storage manager: Melbourne Water

New watering sites and monitoring capped a productive 2013-14 for the Yarra system.



Helen Clarke, Senior Environmental Flow Planner at Melbourne Water, said that fish monitoring projects in the Yarra River identified really positive outcomes for the endangered Macquarie perch.

“Our results over the past two years have indicated that Macquarie perch have been spawning in the system,” Helen said.

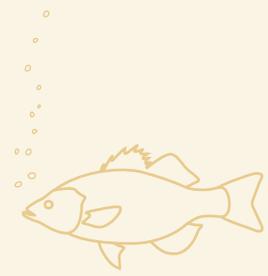
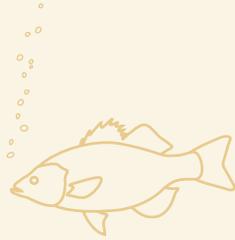
“Even better news this year is that we have also captured juvenile Macquarie perch, which shows that spawning was successful and the next generation of Macquarie perch is in the system.”

There is strong evidence that Macquarie perch spawning opportunities were aided by environmental flows, which were achieved through managed releases from storages and through the temporary cessation of harvesting water into Melbourne Water storages.

“ Even better news this year is that we have also captured juvenile Macquarie perch, which shows that spawning was successful and the next generation of Macquarie perch is in the system.”

Helen Clarke, Environmental Flow Planner

Top left: Yarra River at Millgrove, by Melbourne Water; Bottom Left: Yarra River at Dee Road Bridge, by Melbourne Water; Right: Juvenile Macquarie perch caught in the Yarra, by Zeb Tonkin, Arthur Rylah Institute; Far right: Yarra River at Warburton, by Melbourne Water



“In September 2013, harvesting was stopped to enable a natural spring fresh flow to pass through, which judging from monitoring of this event, supported the spawning of Macquarie perch at this time and ensured the survival to juvenile stage.”

“We are always investigating innovative water delivery methods from new locations to reach new and previously watered sites.”

One new site is Yering Backswamp – near Yarra Glen – a billabong adjacent to the Yarra River that contains a regionally important vegetation community, swamp paperbark woodland, that requires periodic inundation.

“In May 2014, we were able to deliver water directly to the billabong via the Maroondah Aqueduct. This benefitted the swamp paperbark and aquatic herblands at the site,” Helen said.

“We also took the opportunity to accurately measure the extent of inundation achieved, which provides information we will use to determine the most efficient use of the water at Yering Backswamp in future years.”

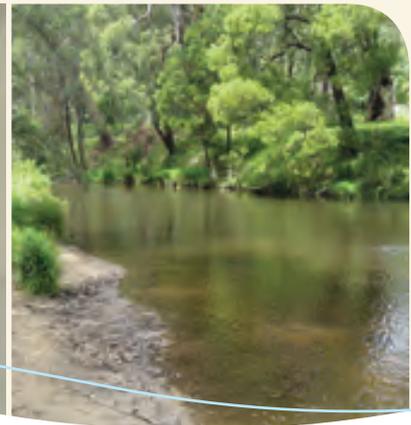
Further information on the Yarra system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Melbourne Water website at www.melbournewater.com.au.

The Yarra River is one of Victoria's iconic waterways, providing a range of social and recreational opportunities for metropolitan and outer Melbourne. It spans over 4,000 square kilometres from the Yarra Valley through to the centre of Melbourne. The Yarra River supports many important environmental values, including platypus and a number of nationally significant fish species such as the Australian grayling and Macquarie perch. It also supplies around 70 percent of Melbourne's drinking water.

Environmental objectives

Improving access to suitable habitats for fish and macroinvertebrates; maintaining water quality; assisting priority fish species, including Macquarie perch and Australian grayling spawning and migration; maintaining longitudinal connectivity for fish passage; and targeted billabong watering.

Site	Volume delivered (ML) – VEWB water only
Yarra River	16,826
Yering Backswamp	9
Total	16,835



Tarago system

Waterway and storage manager: Melbourne Water

Provision of migration and spawning opportunities for Australian grayling underpinned environmental releases for the Tarago system in 2013-14.

The Tarago and Bunyip Rivers environmental entitlement provides the ability to increase the abundance of endangered Australian grayling, by delivering well-timed flows in spring and autumn for migration and spawning.

Sarah Gaskill, Environmental Water Planner at Melbourne Water, says Australian grayling are highly dependent on appropriately timed flows of a specific duration and magnitude.

“Australian grayling have a complicated life cycle and they require specific freshes in autumn to trigger migration of adults living upstream to the downstream spawning sites,” Sarah said.

“When spawning is successful, the eggs and larvae drift to the sea, with juveniles returning upstream in spring in response to high flows at that time of year.”

In 2013-14, Melbourne Water managed releases to trigger migration and spawning opportunities for grayling at the right time of the year, resulting in some really positive outcomes.

“For a second consecutive year, we detected successful spawning via net samples taken in April 2014. This, combined with monitoring of adults, will provide us with further knowledge on the relationship between the timing of flows and increase in the grayling population,” Sarah said.

“One of the benefits of the environmental entitlement held in Tarago Reservoir, is that we can actively deliver the autumn spawning flow for grayling even when flows are naturally too low for this to occur.”

“These releases are also important for other fish species, such as river blackfish, as well as improving vegetation condition, which is important habitat for bugs and frogs. “

The timing, magnitude and duration of flows for fish and other values is supported by an increasing weight of evidence that Melbourne Water gathers through monitoring and research projects.

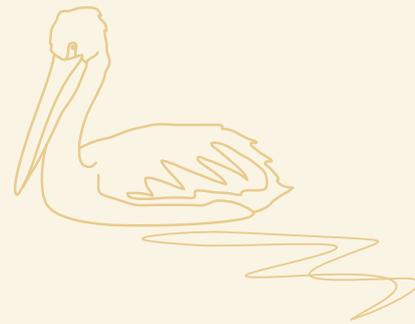
“Through regular monitoring, we are able to learn more about the conditions required to favour fish movement and behavior. This will increase our chances of providing optimal flows with the water we have available in future years.”

Further information on the Tarago system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Melbourne Water website at www.melbournewater.com.au.

““ Through regular monitoring, we are able to learn more about the conditions required to favour fish movement and behavior. This will increase our chances of providing optimal flows with the water we have available in future years. ””

Sarah Gaskill, Environmental Water Planner

All images by Melbourne Water. Left to right: Tarago River fishway at Drouin West; Sorting for Australian grayling



The Tarago system covers an area of over 950 square kilometres and includes the Tarago and Bunyip rivers. The Tarago River headwaters are within the Tarago State Forest and flow into the Tarago Reservoir at Neerim. Downstream of the reservoir, the Tarago River flows through the towns of Rokeby and Robin Hood before meeting the Bunyip River at Longwarry North, supplying water to a number of irrigators in the catchment.

Environmental objectives

Maintaining and improving aquatic species' habitat; assisting native fish spawning and migration; maintaining habitat connectivity; and discouraging terrestrial vegetation encroachment into the channel.

Site

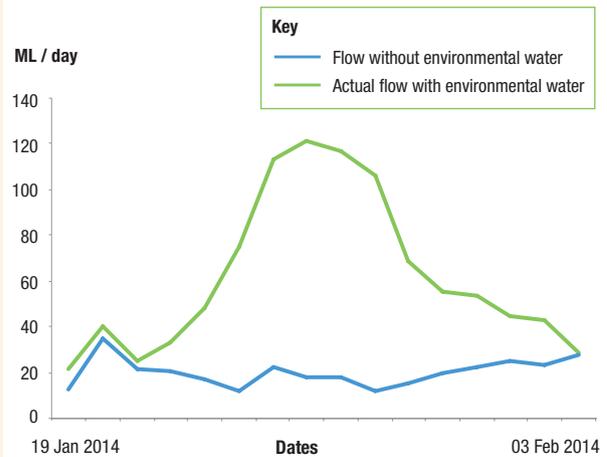
Volume delivered (ML) – VEWB water only

Tarago River

1,784

Tarago flow snapshot

This hydrograph shows how environmental water contributed to a summer fresh in the Tarago River. Flows were recorded at Drouin West.



Werribee system

Waterway and manager: Melbourne Water

Storage manager: Southern Rural Water

Scientific research undertaken in the Werribee system in 2013-14 will help future environmental water releases provide even greater benefits.

In 2013-14, Melbourne Water continued to collect information to ensure current and future environmental water releases achieve their goals.

Bill Moulden, Environmental Water Planner at Melbourne Water, said that a review of environmental objectives for Pyrites Creek and subsequent revised flow recommendations will provide greater confidence that the maximum benefit can be gained from use of the water available under the Werribee River environmental entitlement.

"Using the information we have available, and with community consultation, we have decided which highest priority values we will manage for in Pyrites Creek, which include providing habitat for frogs, pygmy perch and macroinvertebrates," Bill said.

"We now also have a better understanding of the hydrology of Pyrites Creek from the assessment of groundwater interaction with streamflows. This greatly assists our ability to prioritise environmental water use and better support the environmental values of Pyrites Creek."

A monitoring program gathered information regarding the recruitment and dispersal of juvenile black bream which will help planning for future summer releases for the Werribee River estuary.

"It is thought that black bream lay eggs in the upper reaches of the river. Summer freshes disperse the larvae and juvenile fish downstream to the estuary, where large seagrass beds are present."

"When this occurs, survival rates are high because the juvenile bream are provided with abundant food resources and protection from predators within the seagrass. If we can determine the preferred flow conditions and timing for this to occur, we can actively deliver a fresh to disperse juvenile fish at the right time," Bill said.

"The good news in 2013-14 is that we captured juvenile bream in the estuary, and there should be high survival rates for juvenile fish this year."

Further monitoring in 2014-15 will help determine the role of environmental flows in dispersing these fish and improve our understanding of the impact of environmental releases on the black bream population in the estuary."

Further information on the Werribee system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Melbourne Water website at www.melbournewater.com.au.

“ The good news in 2013-14 is that we captured juvenile bream in the estuary, and there should be high survival rates for juvenile fish this year. ”

Bill Moulden, Environmental Water Planner

All images by Bill Moulden, Melbourne Water. Left to right: Werribee Gorge; Lerderberg diversion weir; Winter high flow release at Pyrites Creek.



The Werribee River flows south-east from the Wombat State Forest to the undulating plains of basalt soils north of Ballan before flowing into Port Phillip Bay at Werribee. The Lerderberg River is a major tributary that joins the river at Bacchus Marsh. Some tributaries of the Werribee River, such as Pyrites Creek, maintain healthy vegetation and macroinvertebrate communities. The middle reaches of the Werribee River provide good habitat for fish and a significant platypus population. The lower reaches of the river are home to migratory wading birds and many fish species and are lined with highly-valued river red gums.

Environmental objectives

Enhancing fish populations in the lower reaches and estuary; enhancing macroinvertebrate and frog populations in Pyrites Creek; and improving vegetation and platypus populations in the lower reaches of the Werribee River.

Site

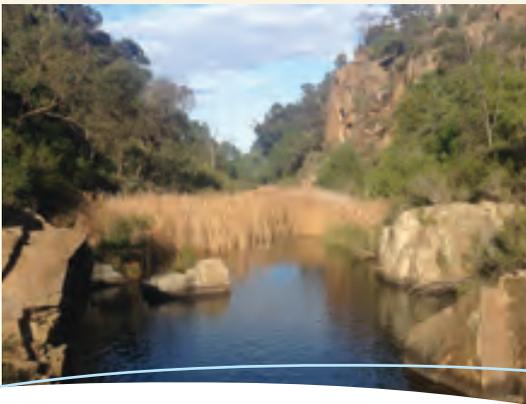
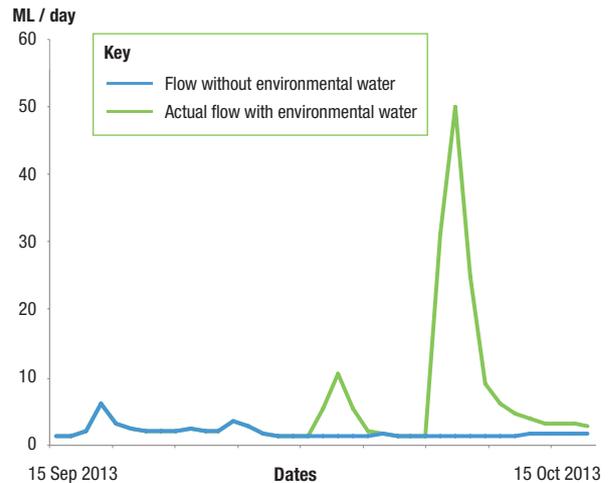
Volume delivered (ML) – VEWH water only

Werribee River

461

Werribee flow snapshot

This hydrograph shows how environmental water contributed to a spring fresh in Pyrites Creek. Flows were recorded below Lake Merrimu.



moorabool system

Waterway manager: Corangamite Catchment Management Authority (CMA)

Storage manager: Central Highlands Water

Maintaining water quality for native fish during summer was central to watering in the Moorabool system in 2013-14.

Environmental flow releases helped to maintain water quality and fish habitat in the Moorabool River during the hot and dry summer.

Saul Vermeeren, Coordinator Environmental Water at Corangamite CMA, says that delivery of summer flows is important to support the condition of the river throughout the hottest part of the year.

“Pools that sustain fish in the Moorabool River throughout summer are susceptible to severe declines in water quality when flows are low during summer,” Saul said.

“The main threat is from increased temperature, algal blooms and associated loss of oxygen from the water. As such, delivery of water available under the Moorabool River environmental entitlement is a high priority in summer and autumn, so we can protect the habitat that is available for fish and allow them to survive through this critical period.”

“In summer and autumn 2013-14, we released almost 2,000 ML of water from Lal Lal Reservoir to the Moorabool River and our water monitoring program indicates that satisfactory water quality was maintained. We also provided opportunities for fish, such as southern pygmy perch, to move between habitats and increase their chances of survival.”

In June 2014, water was released to provide a winter fresh, which resulted in flows making it to the final reach of the river.

“Our first priority is to protect the habitat in the upper reaches of the Moorabool River during summer and autumn,” Saul said.

“Depending on seasonal influences each year, we try to provide a freshening flow in winter to extend as far downstream as possible. In June 2014, we were successful in delivering a winter fresh flow that reached as far downstream as Batesford. This flow event increased connectivity and refreshed habitat pools throughout the system, from Lal Lal Reservoir to the confluence with the Barwon River.

“Successful environmental releases such as this winter fresh are important to ensure that the needs of aquatic and riparian ecosystems are met. The Moorabool is one of the most flow-stressed rivers in Victoria, and these flows are crucial in protecting the system’s environmental assets.”

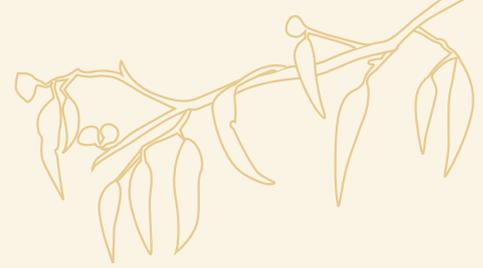
Over the 2014-15 period, the Corangamite CMA will be undertaking a fish survey project that will provide detail of the river’s current fish diversity and abundance. The results of this project will also be used to assess the benefits of environmental water delivery over the past four years.

“As a waterway manager, it is important that we demonstrate the ecological benefits of environmental flows to the broader community. We anticipate that projects like this will provide opportunities for interested local community members to take part in monitoring and protecting the health of the Moorabool River.”

“ Delivery of summer flows is important to support the condition of the river throughout the hottest part of the year.”

Saul Vermeeren, Environmental Water Coordinator

*All images by Saul Vermeeren, Corangamite CMA.
Left to right: Saul Vermeeren at Coopers Bridge,
Moorabool River; Winter release from Lal Lal Reservoir;
Instream habitat connection at Slate Quarry Road*



Further information on the Moorabool system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Corangamite CMA website at www.ccma.vic.gov.au.

The Moorabool River flows southward from the Central Highlands between Ballarat and Ballan, flowing south to join the Barwon River at Fyansford and passing through Meredith. It is a highly regulated waterway with several large water storages in the upper reaches including Lal Lal Reservoir. Moorabool River retains many environmental values, including native fish of high conservation value and areas of significant remnant vegetation.

Environmental objectives

Providing habitat for short-finned eel, southern pygmy perch and Australian smelt; maintaining diverse macroinvertebrate communities; reshaping the channel form to maintain physical processes; and maintaining habitat diversity and complexity.

Site

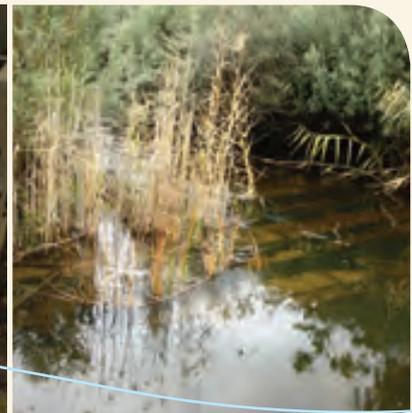
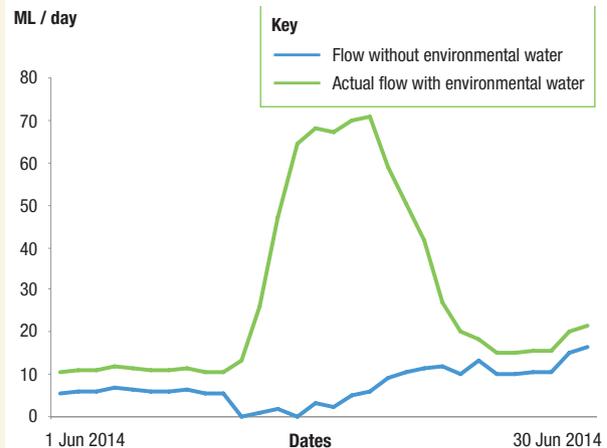
Volume delivered (ML) – VEWH water only

Moorabool River

2,500

Moorabool flow snapshot

This hydrograph shows how environmental water contributed to winter high flows in the Moorabool River. Flows were recorded at Morrisons, downstream of Lal Lal Reservoir.



barwon system

Waterway manager: Corangamite Catchment Management Authority (CMA)

Storage manager: N/A

Brolgas were spotted breeding in Hospital Swamps following effective water management of the lower Barwon wetlands in 2013-14.

The lower Barwon wetlands – part of an internationally significant Ramsar site – are carefully managed to improve the condition of vegetation and increase habitat for fish and birds. Both wet and dry conditions are required in wetlands to promote bird and fish breeding, provide habitat, nourish vegetation and to manage nutrients and water quality.

Saul Vermeeren, Coordinator Environmental Water at Corangamite CMA, said that an outcome of this year's management regime was a boost in the rich variety of vegetation at Hospital Swamps.

"In implementing a natural wetting and drying cycle this year at Hospital Swamps, we've been able to support rare and unique coastal saltmarsh communities, herbfields, and provide habitat

for the diverse species of wildlife that are dependent on the system. Undertaking a drying regime also maintains soil health by promoting natural soil salinisation," Saul said.

"A breeding pair of brolga were also observed at Hospital Swamps. It's great to see evidence of how effective management of these flows has maintained the health of the wetland and the fauna it supports."

Corangamite CMA also launched a number of monitoring projects in 2013-14 to improve knowledge and assist in management of the lower Barwon wetlands.

"We began a number of projects including a wetland habitat connectivity study and vegetation monitoring of Reedy Lake, as part of our efforts to maintain and improve the ecological integrity of the lower Barwon wetlands," Saul said.

"We're also undertaking a soil contaminants study to learn more about the environmental, social and economic impacts of implementing a drying regime of Reedy Lake."

“A breeding pair of brolga were also observed at Hospital Swamps. It's great to see evidence of how effective management of these flows has maintained the health of the wetland and the fauna it supports.”

Saul Vermeeren, Environmental Water Coordinator

Left: Hospital Swamps, by VEWH; Right: Reedy Lake, by VEWH; Far right: Ian McLachlan at Reedy Lake, by Saul Vermeeren, Corangamite CMA; Top right: Hospital Swamps, by Saul Vermeeren, Corangamite CMA





These studies will build on previous CMA investigations and stakeholder consultation and help to inform the most appropriate water regimes for Reedy Lake and Hospital Swamps.

Further information on the Barwon system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Corangamite CMA website at www.ccma.vic.gov.au.

The Barwon River rises in the Otway Ranges and flows through Geelong, joining the coast at Barwon Heads. It receives inflows from major tributaries, including the Moorabool and Yarrowee/Leigh rivers. The estuarine reach of the Barwon River incorporates a system of wetlands and lakes, including Lake Connewarre, Reedy Lake, Hospital and Salt swamps, and Murtnaghurt Lagoon. These wetlands form part of the internationally significant Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site.

Reedy Lake and Hospital Swamps support a diverse range of aquatic vegetation communities, providing important feeding and breeding habitat to native grayling, dwarf galaxias and Yarra pygmy perch. They also support a number of wetland-dependent bird species, including the Australian painted snipe, Latham's snipe, Caspian tern and whiskered tern.

Water available for use in the Barwon wetlands is dependent on suitable river heights in the Barwon River, as specified in the Barwon River Environmental Entitlement 2011.

Environmental objectives

Maintaining the ecological character of the wetlands, including its saltmarshes, abundant waterbirds and native plant species, aligning with the management obligation of Ramsar sites (for wetlands of international importance). Ecological character is defined as the combination of ecosystem components, processes, benefits and services that characterised the wetland when listed as a Ramsar site in 1983.



glenelg system

Waterway manager: Glenelg Hopkins Catchment Management Authority (CMA)

Storage manager: Grampians Wimmera Mallee Water

It was an award-winning year for the Glenelg River in 2013-14. Aside from scooping up the Australian Riverprize for the Glenelg River Restoration Project, the river also recorded increasing numbers and distribution of key fish species.

The wet winter in the Glenelg system meant natural flow from tributaries helped meet many of the environmental watering objectives for the river. In contrast, January and February 2014 were among the driest on record with environmental water releases being required to provide the summer baseflows and freshes needed to support the river and its inhabitants.

River blackfish, estuary perch and black bream are now abundant in the river and tupong have been observed in record numbers. Along with the Glenelg River Restoration Project, the ability to manage environmental flows in the Glenelg has been a significant contributor to the river's health.

Stephen Ryan, Waterways Health Planner with Glenelg Hopkins CMA, said the success of the Glenelg River Restoration Project highlighted the community connection and interest in the health of their river, which was at the point of collapse around 10 years ago due to poor water quality and loss of habitat.

"The award-winning project involved approximately 620 farming families, a range of conservation groups, industry representatives and community members, all with the common goal of restoring the ecological significance and health of the Glenelg River," Stephen said.

The infrastructure works completed as a part of the project, such as the Sandford fish ladder in 2013, combined with managed environmental flows, have ensured the passage of a variety of

native fish in the river. This fish ladder has enabled fish to extend their distribution back into their traditional habitats.

"Prior to installation of the fish ladder, migration was cut short and confined fish to the lower part of the Glenelg River. As the fish ladder has become fully operational, tupong have taken advantage of the good conditions and opportunity to migrate, and turned up all over the Glenelg catchment," Stephen said.

"Routine fish surveying, aimed at gauging the effectiveness of environmental flows in the Glenelg River, has shown that numerous species are using the fish ladder during prescribed environmental flow releases."

Use of the 5-mile outlet provides the ability to deliver a variety of managed flow releases, and support the operation of the Sandford fish ladder, which is designed to work with freshening flows.

“ You don't have to be Einstein to work out that the improved fishing in the Glenelg is on the back of improved conditions and flow in the river. ”

Stephen Ryan, Waterways Health Planner

*All images by Glenelg-Hopkins CMA.
Left: Tupong caught at Glenelg River;
Right: Waterbirds at Glenelg River*



“Other migratory fish, such as galaxids, Australian smelt and the popular angling species estuary perch, have also benefited from the fish ladder. Fish surveys have revealed that estuary perch have journeyed as far as Harrow and reports from anglers have indicated that large fish have been taken near the Wannon and Glenelg junction just upstream of the fish ladder.” Stephen said.

Coordinating environmental releases with native fish migration is important, as some fish may start or cease movement with changes in flow, and rely on these flow cues to complete their life cycle.

“Management of environmental flow is key for fish populations in the Glenelg,” Stephen said.

The improvement has pleased the local recreational fishing community. As Dartmoor Angling Club president Ricky Owens said, “You don’t have to be Einstein to work out that the improved fishing in the Glenelg is on the back of improved conditions and flow in the river.”

Further information on the Glenelg system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Glenelg Hopkins CMA website at www.ghcma.vic.gov.au.

The Glenelg River, in South-West Victoria, starts in the Grampians Ranges and runs for over 500 kms, making it one of the longest rivers in Victoria. A short stretch of the estuary winds through South Australia before returning to Victoria to enter the sea at Nelson. One reach is listed as a heritage river reach due to the high-value aquatic life it supports, including the endangered Glenelg freshwater mussel and Glenelg spiny crayfish. It is also the only river system in Victoria where yarra pygmy perch, variegated pygmy perch and southern pygmy perch can all be found in the one location.

Environmental objectives

Maintaining endemic populations of native and endemic fish species; providing connectivity between river reaches to enable fish movement; maintaining appropriate aquatic habitat and food resources for fish; and ensuring water quality is maintained throughout the year.

Site	Volume delivered (ML) – VEWH water only
Glenelg River	10,207



Wimmera system

Waterway manager: Wimmera Catchment Management Authority (CMA)

Storage manager: Grampians Wimmera Mallee Water

Environmental water helped reduce impacts to Wimmera wildlife from record-breaking heat and bushfires over the 2013-14 summer.

The bushfires in mid-January 2014 burnt a large percentage of the Grampians National Park surrounding Lake Wartook. Fortunately, no heavy rain followed the fires, avoiding significant erosion and water quality issues in the water supply system and MacKenzie River.

Monitoring for platypus in the MacKenzie River (during the environmental releases and after the fires) discovered four platypuses, including two juveniles, all in good health. It was the first time that juvenile platypus have been caught, indicating successful recruitment of platypus in the MacKenzie system.

Clare Wilson, Floodplain and Water Management Officer at the Wimmera CMA, explained that environmental water releases played a small but important role in the survival of the platypus population.

“The river flowed continuously through the fire period, thanks to environmental water releases, which we believe helped the platypus to survive.”

“Given the fires burnt right down to the river’s banks, the water was welcome relief as certain reaches of the river were particularly dry,” she said.

Clare also indicated that environmental releases during the hot and dry summer months were important to support a range of values.

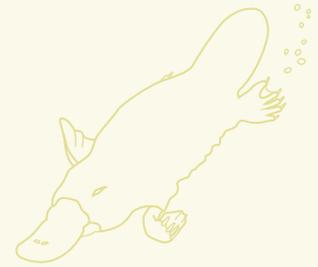
“Environmental flows maintained good water quality of the lower Wimmera River, preventing widespread fish kills. Without environmental flows over summer to the lower Wimmera River, the remnant pools would have reached very high salinity levels.”

“The health of our waterways is dependent on environmental flows. They provide critical environmental benefits that support our natural assets, which we need to pass onto future generations.”

David Grimble, Horsham Mayor

All images by Wimmera CMA. Left to right: Wimmera River at Dimboola Weir; Platypus at MacKenzie River; Fish monitoring in the MacKenzie River after bushfires





“Environmental water not only provided a lifeline to the aquatic ecosystems that depend on the Wimmera River, it also contributed to a range of social and recreational benefits.”

“Events like the Dimboola Rowing Regatta and Horsham and Jeparit Fishing Competitions are major events on these towns’ calendars and attract visitors from far and wide.”

Horsham Rural City Mayor, David Grimble, who is also a landholder in the Wimmera town of Brimpaen, emphasised the environmental and community benefits of environmental watering in the Wimmera region.

“The health of our waterways is dependent on environmental flows. They provide critical environmental benefits that support our natural assets, which we need to pass onto future generations.”

Further information on the Wimmera system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Wimmera CMA website at www.wcma.vic.gov.au.

The Wimmera River system, is situated in western Victoria, beginning in the Pyrenees and flowing into Lake Hindmarsh (the largest freshwater lake in Victoria) before overflowing into Outlet Creek and into Lake Albacutya (a Ramsar-listed wetland). This system contains many important sites of Indigenous cultural heritage, and the lower reach of the Wimmera River, downstream of Polkemmet (near Horsham) is listed as a ‘heritage river’. A range of high-value rivers and creeks also flow into the Wimmera River, including the MacKenzie River and Mount William, Burnt and Bungallaly creeks. The Wimmera system is home to Victoria’s only self-sustaining population of freshwater catfish as well as platypus and a wide range of significant plant species.

Environmental objectives

Maintaining water quality and supporting the self-sustaining freshwater catfish in the Wimmera River; supporting the health of Wimmera bottlebrush communities; providing suitable habitat for platypus and high-value fish populations in the MacKenzie River; providing habitat for fish populations in Mount William and upper Burnt creeks; and maintaining vegetation condition in lower Burnt and Bungallaly creeks.

Site	Volume delivered (ML) – VEWH water only
Wimmera River	19,532



Wimmera mallee wetlands

Waterway manager: Wimmera, Mallee and North Central catchment management authorities (CMAs)

Storage manager: Grampians Wimmera Mallee Water

Environmental watering entered a new era in 2013-14 with 52 wetlands now connected to the Wimmera-Mallee Pipeline.

The connections enabled 37 wetlands to be watered in 2013-14, including wetlands such as Jesse Swamp and Corack Lake which received environmental water for the first time.

In August 2013, local community members came together at Roselyn Wetland in Birchip to celebrate the completion of the Wetlands Connection Project. Sharyon Peart, Mallee CMA Chair, said the event highlighted the importance of the project in supporting wetlands previously reliant on water from the (now defunct) open channel irrigation system.

“The pipeline has provided us with much greater connectivity within the Wimmera-Mallee wetlands system and with it, the opportunity to water a wider range of sites. It’s anticipated that these wetlands will reap environmental benefits in the years to come,” she said.

“A record 29 Mallee wetlands were watered in 2013-14. This is the largest number of wetlands ever watered in the region and an almost five-fold increase to the number of Wimmera-Mallee wetlands watered in 2012-13.”

Additionally, seven wetlands were watered in the North Central region and one other in the Wimmera region.

Greg Fletcher, Planning and Project Officer at the Wimmera CMA, said the watering at Sawpit Swamp, near Murtoa, had visible results.

“We’ve witnessed the growth and recruitment of a number of wetland plant species as well as a boost in frog and bird activity within the region,” he said.

““ This is the largest number of wetlands ever watered in the region and an almost five-fold increase to the number of Wimmera-Mallee wetlands watered in 2012-13. ””

Sharyon Peart, Mallee CMA Chair

Left to right: Sawpit Swamp, by Wimmera CMA; Lake Tchum, by Mallee CMA.





As a result of the water savings achieved by the Wimmera Mallee Pipeline project, an annual entitlement of 1,000 ML per year, is held by the VEWH, and can be used to water these wetlands.

Further information on the Wimmera-Mallee wetlands is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Wimmera (www.wcma.vic.gov.au), Mallee (www.mcma.vic.gov.au) or North Central (www.nccma.vic.gov.au) catchment management authorities.

The Wimmera-Mallee wetlands system is made up of 52 small dams and wetlands including freshwater meadows, open freshwater lakes and freshwater marshes located on public and private land in north-western Victoria. There is great variation in the character of the wetlands, providing habitat, feeding and breeding opportunities for a range of waterbirds and animals, including brolgas, egrets, blue-billed ducks, freckled ducks, Australian painted snipe and glossy ibis. Important vegetation communities, such as spiny lignum, ridged water milfoil and cane grass are also present in the wetlands.

Delivery of environmental water to the Wimmera-Mallee wetlands in 2013-14 occurred at:

Mallee CMA: Barbers Swamp; Beulah Weir Pool; Broom Tank; Bull Swamp; Chiprick Bushland Reserve; Clinton Shire Dam (Towma Bushland Reserve); Coundons Wetland; Cronomby Tanks; D Smith; Goulds Reserve (Box Swamp); Greens Wetland (2); J Ferrier Wetland; John Ampt; Lake Danaher Bushland Reserve; Lake Tchum North Lake Reserve; Mahoods Corner; Moreton Plains Reserve; Pam Juergens Dam; Part of Gap Reserve (Stephen Smith Dam); Paul Barclay; R Ferriers Dam; Rickard Glenys Dam; Roselyn Wetland/Reids Dam; Round Swamp Bushland Reserve; Shannons Wayside; Towma (Lake Maribed); Cokym Bushland Reserve; Considines; Poyner;

North Central CMA: Cherrip Swamp; Corack Lake; Creswick Swamp; Davis; Falla Dam; Jeffcott Wildlife Reserve; Jesse Swamp;

Wimmera CMA: Sawpit Swamp

Environmental objectives

Providing habitat for waterbirds, reptiles and frogs; maintaining the condition of fringing wetland vegetation; and improving the condition of aquatic and terrestrial wetland vegetation to ensure that animal species have habitat and water resources available.

Water Source	Waterway manager	Volume delivered (ML)		Total
		VEWH	Other Source	
Wimmera-Mallee wetlands	Mallee CMA	218.9	15.6 ¹	234.5
	North Central CMA	12.7	-	12.7
	Wimmera CMA	33.1	-	33.1
Total		264.7	15.6	280.3

¹ Water delivered to the Wimmera-Mallee wetlands in supply system 5 was supplied by GWMWater.



Goulburn system

Waterway manager: Goulburn-Broken Catchment Management Authority (CMA)

Storage manager: Goulburn-Murray Water

More golden perch and vegetation recovery marked an important 2013-14 for the Goulburn system.

The largest volume of environmental water was delivered to date in the Goulburn River, consisting of water made available by the VEWH, CEWH and the Living Murray program.

Flows released throughout the year aimed to encourage breeding among the river's near-threatened golden perch, as well as recover vegetation on the lower banks which was lost during the 2010-11 floods.

Simon Casanelia, Environmental Water Reserve Coordinator at the Goulburn Broken CMA, said important work had been done to encourage golden perch breeding, which has been observed only once in the last 10 years.

"Following the spring freshes of environmental water in 2013-14, we have observed successful golden perch breeding, which is the first major breeding event of perch since the 2010 floods."

Providing a range of flows through environmental releases during the year also saw good progress in regenerating lower bank vegetation.

"Supporting re-establishment of vegetation on river banks has been a key aim of environmental watering since the floods, as vegetation on the lower banks helps keep them stable and reduces excessive erosion."

"The higher flows in particular were aimed at giving some vegetation a watering, as well as disturbing fine sediment that settles on the bed and on logs and reduces habitat for plants, bugs and fish."

Further information on the Goulburn system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Goulburn Broken CMA website at www.gbcma.vic.gov.au.

“ Following the spring freshes of environmental water in 2013-14, we have observed successful golden perch breeding, which is the first major breeding event of perch since the 2010 floods. ”

Simon Casanelia, Environmental Water Coordinator

Left to right: Goulburn River at Hurricane Bend, by Keith Ward, Goulburn Broken CMA; Golden perch, by Jarod Lyon, Arthur Rylah Institute; Goulburn River at Yambuna Outfall, by Goulburn Broken CMA





The Goulburn River basin is Victoria's largest, covering over 1.6 million hectares or 7.1 percent of the State's total area. The Goulburn River is an iconic heritage river which flows from the Great Dividing Range upstream of Woods Point to the River Murray east of Echuca for approximately 570 kilometres. It supports areas of intact river red gum forest and provides habitat for threatened species such as the great egret, Murray cod and Macquarie perch.

Environmental objectives

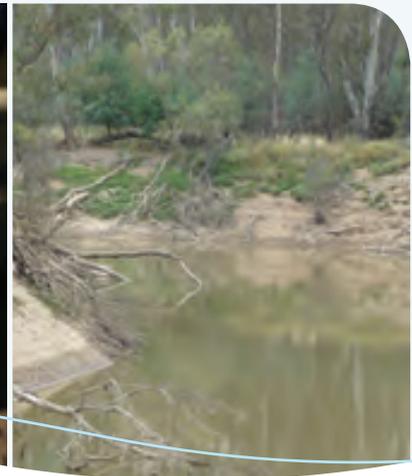
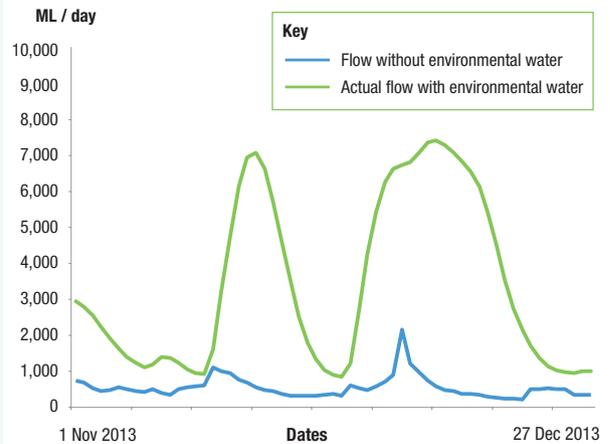
Initiating spawning and pre-spawning migration and recruitment of golden perch; providing habitat for larvae/ juvenile recruitment and adult habitat for small-bodied fish; removing terrestrial vegetation and re-establishing amphibious vegetation on river banks; and maintaining water quality suitable for macroinvertebrates.

Water source Volume delivered (ML)

VEWH	CEWH	Living Murray	TOTAL
33,349	215,000	64,000	312,349

Goulburn flow snapshot

This hydrograph shows how environmental water contributed to spring and summer high flows in the Goulburn River. Flows were recorded at McCoys Bridge, north of Shepparton.



broken system

Waterway manager: Goulburn Broken Catchment Management Authority (CMA)

Storage manager: Goulburn-Murray Water

Environmental flows released into the lower Broken Creek in 2013-14 worked to control low dissolved oxygen levels and support movement of native fish.

The key environmental objective of environmental water delivery to the lower Broken Creek is controlling dissolved oxygen levels. Oxygen levels in the water commonly fall in the hotter summer months, and in some instances can result in fish deaths.

Following thorough planning between key program partners, including Goulburn Broken CMA, Goulburn-Murray Water, CEWH and VEW, environmental water was delivered to maintain dissolved oxygen levels, preventing them from reducing to critical levels.

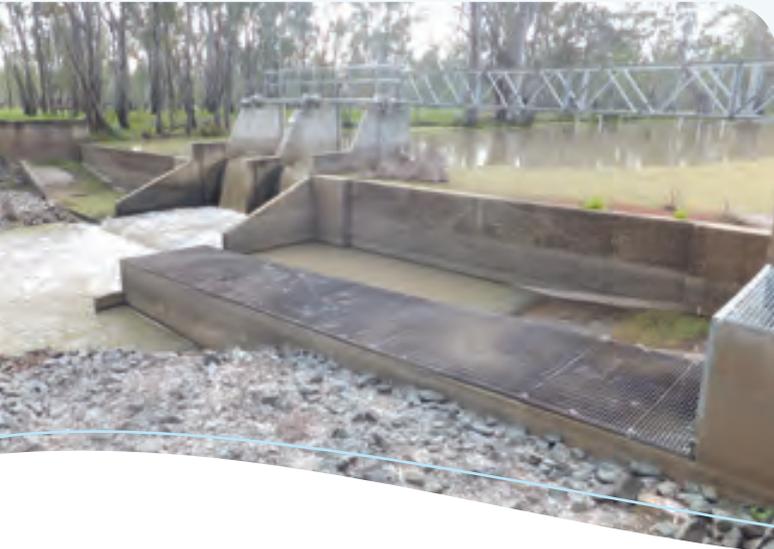
Flows in the lower Broken Creek were also important to allow native fish to move along, into and out of the creek for migration and breeding purposes. This was achieved by providing a minimum flow of 40 ML per day throughout the irrigation season (August 2013 to May 2014) to allow the fish ladders to be open, and increasing to 250 ML per day between September and December 2013 to increase native fish habitat during migration and breeding season. Fish ladders being open allowed fish to move upstream when they needed to, while the September to December flows provided better habitat during these movement periods.

Arthur Rylah Institute scientists funded by the Commonwealth Environmental Water Office monitored fish movement in 2013-14, and found all fish moved around, but that some Murray cod and golden perch moved several kilometres.

“ We have had numerous sightings of fish moving through fish ladders at lower Broken Creek, demonstrating the effectiveness of the flows and the fishways at the site. ”

Jarod Lyon, Scientist

All images by Goulburn Broken CMA. Left to right: Broken Creek at Rices Weir; Broken Creek between Cemetery and Wrights Bridges; Broken Creek at Wrights Bridge.





Findings showed that the Murray cod tended to move in September and October in response to flow changes, while golden perch tended to move later in November to February.

Jarod Lyon, Principal Research Scientist at the Arthur Rylah Institute indicated the fish ladders enhanced fish movement throughout the creek.

“We have had numerous sightings of fish moving through fish ladders at lower Broken Creek, demonstrating the effectiveness of the flows and the fishways at the site.”

Environmental flows in the lower Broken Creek were also supplemented by re-routing consumptive water from the Goulburn and Murray rivers via the creek on their way to the lower River Murray. Around 16,000 ML of consumptive water was delivered via the creek, assisting in achieving environmental objectives en route to consumptive water users.

Further information on the Broken system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the Goulburn Broken CMA website at www.gbcma.vic.gov.au.

The Broken Creek flows from the Broken River at Casey's Weir north west to the River Murray, just downstream of Barmah Forest. It supports threatened plant and animal species including six native fish of State and National conservation significance and icon species such as the Murray cod. The Broken Creek also supports riparian vegetation, especially in the lower reaches, as does the lower Broken Creek.

Environmental objectives

Providing native fish passage; providing suitable water quality conditions for native fish; and improving fish habitat during migrations and breeding seasons.

Site	Volume delivered (ML) – CEWH water only
Lower Broken Creek	38,594



Campaspe system

Waterway manager: North Central Catchment Management Authority (CMA)

Storage manager: Goulburn-Murray Water; Coliban Water

Integration of environmental watering and complementary works brought a range of benefits to the Campaspe system in 2013-14.

The Campaspe River's long-term environmental health prospects received a big boost through the combination of increased environmental water availability and the implementation of on-ground works to support native riparian vegetation growth and fish movement in the river.

This was the first full year during which the VEWH's Campaspe River environmental water entitlement was available for use. Darren White, Environmental Flows Project Manager at North Central CMA, said access to the additional 23,000 ML per year would provide greater opportunity and security for the river and the life within it.

"Together with the water held by the CEWH and the Living Murray program, the extra water provided us with the flexibility to plan for and provide a greater range of important flow events in the river, rather than one or two single events."

Environmental flows delivered in 2013-14 aimed to connect in-stream habitats and enable fish to move and spawn, in addition to providing benefits to native bank vegetation, water quality and macroinvertebrates.

Murray-Darling rainbowfish were found at five sites in the stretch of the river between the Campaspe Siphon and the Campaspe Weir.

"This was a significant finding for us because this species has been absent from previous surveys and was presumed to be lost from this reach of the river."

"Anglers also reported that there were good catches of Murray cod and golden perch during the higher environmental flow periods."

Darren said sampling last year reaped positive results with a variety of native fish and other fauna located in the Campaspe system.

"In our surveys, we noticed good numbers of Murray-Darling rainbowfish and flathead gudgeons, and there were sightings of platypus, which is a positive sign that the health of the river is improving."

Providing important support to environmental flow outcomes was the implementation of complementary projects in the Campaspe River. These projects are expected to provide significant benefits in the longer term. One of these projects was the installation of a fishway at the Echuca Weir in May 2014.

"Installation of the fishway complemented the removal of the Echuca Weir gauge, which opened up around 45 kilometres of river between the River Murray and the Campaspe Siphon. This maintains water levels which provides greater opportunities for fish such as Murray cod, golden perch and silver perch to move into the Campaspe River from the River Murray," Darren said.

"Opening up greater areas for fish is an important development in that it helps to rejuvenate native populations."

“ Anglers also reported that there were good catches of Murray cod and golden perch during the higher environmental flow periods. ”

Darren White, Environmental Flows Project Manager

All images by North Central CMA. Left to right: Campaspe River fishway; Winter flow in Campaspe River at English's Bridge

In addition, the Victorian Government-funded 'Caring for the Campaspe' project continued its progress in 2013-14, with the commencement of complementary on-ground works that will protect and enhance the health of the Campaspe River. Overseen by the North Central CMA, the project involves representatives of community, Indigenous groups, local government and Goulburn-Murray Water, and targets improvement of native riparian vegetation along the banks of the river from its headwaters to the Murray.

"With strong community support, we saw a range of works completed, including fencing, re-vegetation, and weed (including willow) control – all of which are complementary benefits to aid the system in its post-drought and flood recovery phase."

"This is a great example of community interest and involvement in the health of the Campaspe."

The project began in 2012-13 and will continue until 2015-16.

The storages and reserve for the Coliban River, an upstream river reach in the Campaspe system, spilt during September to November 2013. Monitoring of passing flows at the cessation of the spills ensured river flows were maintained.

"Careful management of the water levels ensured a flow rate for the Coliban River to help maintain the connectivity of the river over summer," Darren said.

Further information on the Campaspe system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the North Central CMA website at www.nccma.vic.gov.au.

The Campaspe system extends from the Great Dividing Range in the south to the River Murray at Echuca in the north. Its major waterways include the Campaspe and Coliban rivers. The Campaspe River lies in north-central Victoria. Downstream of Lake Eppalock, the Campaspe River supports a wide range of native and significant fish populations, including Murray cod, silver perch and Murray-Darling rainbowfish. Iconic river red gum communities are also prevalent within the system. Platypus populations are present in the Campaspe system which helps to bolster populations in the River Murray and its anabranches downstream of Echuca. The Coliban River runs upstream of Lake Eppalock and provides habitat for a range of native fish, platypus and water rats.

Environmental objectives

Maintaining pool habitat and water quality for fish populations; improving the potential for fish movement; maintaining macroinvertebrate populations; reducing encroachment of terrestrial vegetation in-stream; maintaining aquatic vegetation; and enhancing river red gum recruitment.

Water source Volume delivered (ML)

VEWH	CEWH	Living Murray	TOTAL
6,280	6,517	1,768	14,565



Loddon system

Waterway manager: North Central Catchment Management Authority (CMA)

Storage manager: Goulburn-Murray Water

An increased water entitlement and watering that benefited native fish species were key milestones in a busy 2013-14 for the Loddon.

A range of fish species prospered as a result of spring and summer freshes in the Loddon system in the last watering year.

Phil Slessar, Project Officer at North Central CMA, said that surveys conducted after environmental releases continued to find diverse types of fish.

“In the Loddon River, we saw increased numbers of Murray-Darling rainbowfish, golden perch and galaxias.”

Survey results also established that populations of Murray cod and golden perch were located in the Loddon River at Bridgewater and downstream.

“These findings are encouraging because it appears the populations are now more widespread than past surveys have shown.”

“More sightings of Murray cod and golden perch highlighted the improving health of the Loddon River.”

In addition to benefits for a variety of fish, riparian vegetation health in the Loddon River also improved through delivery of winter-spring low flows, provided by Water Holdings from both the VEWH and the CEWH.

“We saw in-stream vegetation, such as water ribbon, thrive as a result of the winter and spring releases. Water ribbon had declined in previous drought and flood years, so this was a welcome result.”

Increases to the Water Holdings in the Loddon system also provided additional water late in the season, which helped maintain winter flows in the river to the end of the water year.

“The increased entitlement gives us more security and flexibility in planning for and providing flows to the Loddon River throughout the season.”

“ More sightings of Murray cod and golden perch highlighted the improving health of the Loddon River. ”

Phil Slessar, Project Officer

*All images by North Central CMA. Left to right:
Loddon River at Borung-Hurstwood Road;
Loddon Environmental Water Advisory Group;
Loddon River at Whites Lane near Kerang.*





The river blackfish population at Birch's Creek, an upstream tributary of the Loddon system, benefited from natural flows throughout the year which were adequate to support its habitat and food sources.

"We were able to establish the creek was in good condition without needing to deliver any environmental water, which helps us to underwrite water availability for next year by keeping our allocation in storage."

Further information on the Loddon system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the North Central CMA website at www.nccma.vic.gov.au.

The Loddon River is located in north-central Victoria. The system is home to a range of native fish species, such as the river blackfish, Murray cod, golden perch and silver perch. It is also a popular spot for tourists due to its intact forests and high value vegetation. The Bullarook system, which includes Birch's Creek, also forms part of the Loddon system and has its own environmental water entitlement which focuses on providing habitat and food sources for its river blackfish population.

Environmental objectives

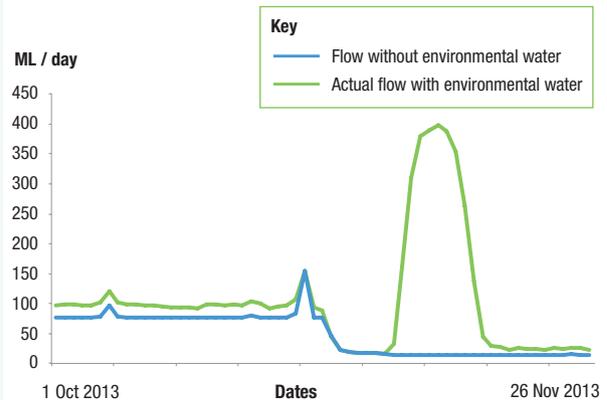
Enhancing the condition of riparian vegetation; and providing appropriate conditions for fish and macroinvertebrate colonisation.

Water source Volume delivered (ML)

VEWH	CEWH	TOTAL
6,593	2,775	9,368

Loddon flow snapshot

This hydrograph shows how environmental water contributed to a spring fresh in the Loddon River. Flows were recorded at Loddon Weir.



Northern wetlands and

Waterway managers: Mallee, Goulburn Broken and North Central catchment management authorities (CMAs)

Storage managers: Goulburn-Murray Water and Lower Murray Water

Mallee wetlands

Environmental water was delivered to 14 Mallee wetlands in 2013-14, the largest number of wetlands watered since the VEWH was established.

The Mallee's hot and dry summer, along with below average rainfall throughout 2012 and 2013, meant that environmental watering was important to assist in maintaining its wetland ecosystems. Water provided by both the VEWH and the CEWH supported river red gums, black box and a number of critically endangered native fish.

Heywoods and Cardross Lakes received the largest amount of water. Heywoods Lake – a highly-elevated wetland – was not naturally inundated during the natural floods of 2010-11

and required 5,000 ML of water in spring to support its aquatic vegetation. Cardross Lakes received over 1,000 ML to provide habitat for the critically endangered Murray hardyhead and support saline aquatic meadow vegetation and waterbird habitat.

Sharyon Peart, Mallee CMA Chair, said that the watering at Cardross Lakes and also Brickworks Billabong was part of a long-term program to secure Murray hardyhead populations.

“Environmental water was essential for preparing Brickworks Billabong for the translocation of Murray hardyhead this year.”

Brickworks Billabong received environmental water in 2012-13 as part of the long-term Murray Hardyhead Recovery Plan. In 2013-14, a number of Murray hardyhead were relocated to the site. The aim of the watering program at the wetland is for these fish to eventually breed and migrate into the Murray system.

“*Environmental water was essential for preparing Brickworks Billabong for the translocation of Murray hardyhead this year.*”

Sharyon Peart, Mallee CMA Chair

*All images by Mallee CMA. Left to right:
Cardross Lakes; Brickworks Billabong;
Sandilong Creek*



floodplains



Numbers of pest fish also declined in Brickworks Billabong due to effective management of environmental water and salinity levels in the wetland, while the condition of fringing vegetation has improved. Ruppia, a wetland plant, has also established on the wetland bed, which provides important habitat for Murray hardyhead.

Ms Peart said other wetland watering had been similarly successful.

“Robertson Wetland received environmental water in 2012-13 and 2013-14 and we have observed a significant increase in waterbird activity and black box seedlings emerging, in addition to observing five species of bat inhabiting the wetland.”

“More generally, we can see the influence of the watering program on ecological values across all of our wetland watering sites – from the black box and river red gum communities in Robertson Wetland to the freshwater catfish population at Sandilong Creek and Billabong.”

Environmental objectives

Maintaining the sites as permanent saline lakes which provide habitats suitable for endangered Murray hardyhead; maintaining and improving health of river red gums; improving health of black box communities; and providing suitable waterbird habitat.



Sites (Mallee Wetlands)	Water Source Volume delivered (ML)		
	VEWH	CEWH	Total
Bridge Creek	200	200	400
Bullock Swamp	266	266	532
Burra Creek South	300	300	600
Heywoods Lake	5000	-	5,000
J1 Creek	209	209	418
Karadoc Swamp	200	200	400
Liparoo East	236	236	472
Psyche Lagoon	400	400	800
Robertson Wetland	601	-	601
Butlers Creek	207	-	207
Sandilong Creek	142	-	142
Brickworks Billabong	174	174	348
Cardross Lakes	506	506	1,012
Woorlong Wetland	176	176	352
Total	8,617	2,667	11,284



North Central wetlands

The north-central community congregated at Hird Swamp on World Wetlands Day to witness the thousands of birds that had flocked to the wetland following the spring/summer watering program.

A spring 'fill' and two summer top-up flows of environmental water attracted over 6,500 birds to the swamp, representing 30 different species from across the globe.

Around a hundred people converged at the Ramsar site to witness the success for themselves at North Central CMA's 'Breakfast with the Birds' celebration.

Heidi Kleinert, Project Officer at North Central CMA, said some people had travelled hundreds of kilometres to join the celebration.

"The range of people who came to see the birds included interstate bird-watchers and local people, including some who had never actually visited the swamp before."

"Our community is very interested in the outcomes of our work and in 2013-14 the results were very visible."

"Of the 30 species recorded at Hird Swamp in February 2014, nine are considered significant including Ballion's crane, brolga, freckled duck and blue-billed duck," she said.

Wetland watering also occurred at Round Lake, McDonalds Swamp and Lake Elizabeth this year, with similarly successful results.

Bree Bissett, Project Officer at North Central CMA, explained that a series of top-up flows at Round Lake continued to maintain a healthy population of critically endangered Murray hardyhead.

"Following watering at McDonalds Swamp in spring, we recorded over 1,100 waterbirds across 22 species. We also witnessed river red gum saplings thriving at the north and south boundaries of the wetland."

A top-up flow was provided to Lake Elizabeth in early summer 2013 to promote aquatic plant growth and prime the wetland for potential future translocation of Murray hardyhead under the **Murray Hardyhead Recovery Plan**.

Phil Slessar, Project Officer at North Central CMA, said environmental releases to Lake Yando resulted in a range of frog sightings and increased resilience of existing river red gums.

"After watering at Lake Yando, four species of frogs were found, including pobblebonk, common froglet, spotted marsh frog and common spadefoot toad," Phil said.

“ The range of people who came to see the birds included interstate bird-watchers and local people, including some who had never actually visited the swamp before. ”

Heidi Kleinert, Project Officer

Images by North Central CMA, Left: Lake Meran; Right: Lake Yando; Far right: McDonald Swamp; Top right: Freckled duck at Round Lake





Existing river red gums particularly benefited from the delivery, with the watering helping to drought-proof the established trees.

2013-14 also saw the first regulated environmental water delivery to Lake Meran, near Kerang. The delivery aimed to increase lake levels by around 1.5 metres to provide deep-water habitat for the lake's plants and animals, and support the health of surrounding trees.

Lake Meran is a fairly unique site within the Boort region, as it is deeper and larger than most of the other wetlands in the area and can therefore support a different range of habitats for birds, fish and other animals.

Phil said the delivery is part of a longer-term watering regime that aims to vary water levels in the lake.

“As we hadn't watered this site before, a key aspect of the delivery to Lake Meran this year was to learn more about the environmental responses, water levels and salinity over the next 12 months. What we learn from this year will help inform future environmental watering decisions.”

Environmental objectives

Supporting a diversity of plant and animal populations in shallow freshwater marshes; providing suitable waterbird habitat; providing conditions suitable for Murray hardyhead translocation; and supporting diverse aquatic and amphibious plant species communities.

Sites (North Central wetlands)	Volume delivered (ML) – VEWH water only
Lake Elizabeth	1,455
Round Lake	509
Hird Swamp	3,343
McDonalds Swamp	1,240
Lake Meran	1,849
Lake Yando	151
Total	8,547



Goulburn Broken wetlands

Environmental water was delivered to Kinnairds Swamp and Black Swamp in 2014, just two months after the wetlands were burnt during the February bushfires that swept through Wunghnu and surrounds.

At Black Swamp, the fire destroyed dead river red gums in the wetland bed which had previously provided habitat for birds and small mammals. While the burn damage at Kinnairds Wetland was severe, most plants had been dormant as the wetland was experiencing a dry phase when the flames went through.

Jo Wood, Environmental Water Coordinator at Goulburn Broken CMA, explained how the wetlands had bounced back to once again support a range of macroinvertebrate and bird habitat after the bushfires.

“It’s remarkable that, following the devastation of bushfires in the summer months, we have seen a range of birds return to these wetlands,” she said.

“At Black Swamp, which was particularly affected, we observed shield shrimp for the first time and prolific wallaby grass growth.

“We saw very positive results in the improvement of river red gum and vegetation health for Kinnairds Wetland, despite the impact of fires to this area.”

Delivery of Commonwealth environmental water to Moodies Swamp, off the upper Broken Creek, supported its range of aquatic vegetation communities, including its Environment Protection and Biodiversity Conservation-listed rigid water milfoil. The important cane-grass wetlands provided welcome breeding and feeding habitat for the many waterbird species at Moodies Swamp.

“Following watering at Moodies Swamp, we had the pleasure of seeing brolgas there,” Jo said.

“In the Goulburn region, we observed a range of species, including sandpipers from Siberia, plumed whistling ducks and the powerful owl.

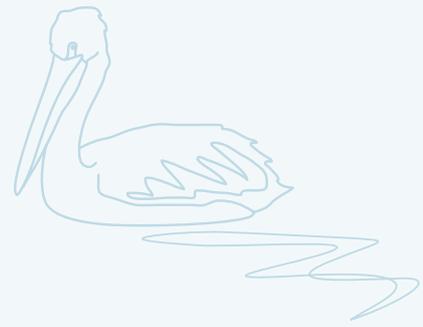
“All these observations and return of species illustrates how timely the environmental flows for this region were, in particular to support the many and varied macroinvertebrates, birds and vegetation.”

“ All these observations and return of species illustrates how timely the environmental flows for this region were, in particular to support the many and varied macroinvertebrates, birds and vegetation. ”

Jo Wood, Environmental Water Coordinator

*All images by Jo Wood, Goulburn Broken CMA.
Left: River red gums at Kinnairds Wetland;
Right: Brolgas at Moodies Swamp; Far right:
Auroras mating at Moodies Swamp; Top right:
Male yellowbilled spoonbill at Black Swamp*



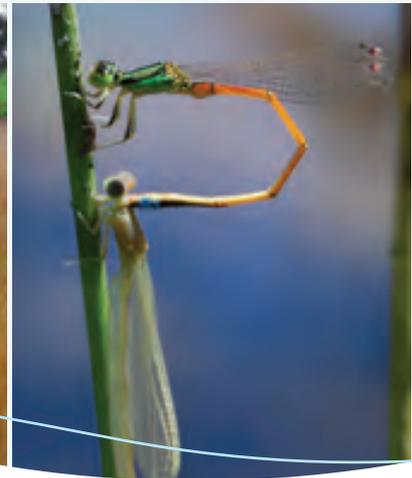


Environmental objectives

Maintaining and improving the condition of river red gum and red gum swamp; protecting the vulnerable river swamp wallaby grass and rigid water milfoil; and maintaining water levels within wetlands if waterbirds nest to ensure the waterbirds do not abandon nest sites.

Sites (Goulburn Broken wetlands)	Water Source Volume delivered (ML)		
	VEWH	CEWH	Total
Kinnairds Wetland	180	–	180
Moodies Swamp	–	121	121
Black Swamp	50	–	50
Total	230	121	351

Further information on the Northern wetlands and floodplains is available in the *VEWH Seasonal Watering Plan 2014-15*, or by visiting the Goulburn Broken (www.gbcma.vic.gov.au), Mallee (www.mcma.vic.gov.au) or North Central (www.nccma.vic.gov.au) catchment management authorities.



the living murray icon

Waterway manager: Goulburn Broken, Mallee and North Central catchment management authorities (CMAs)

Storage manager: Goulburn-Murray Water; Murray-Darling Basin Authority (River Murray Water); South Australian Water Corporation; State Water Corporation New South Wales

Barmah Forest

Large-scale watering at Barmah Forest in 2013-14 extended natural floods to provide a unique opportunity for ecosystem recovery.

Over 360,000 ML of water was delivered to the forest, resulting in the growth and flowering of Moira grass during spring 2013. In addition, it provided a range of benefits to broader floodplain vegetation communities, waterbirds, fish and other native fauna in the forest, and at downstream sites in the River Murray system.

In the winter of 2013, natural floods began to inundate the forest. When high natural flows started to cease, environmental water managers commenced the release of additional flows, extending the natural flood to create conditions which would support the growth and reproduction of the wetland's Moira grass communities. Moira grass forms part of an endangered vegetation community and is known to provide breeding and feeding habitat for some rare and threatened fauna species.

The Moira grass has experienced a 96 percent decline over the past 80 years and the large-scale watering activity created a specific regime to enable the grass to grow and set seed.

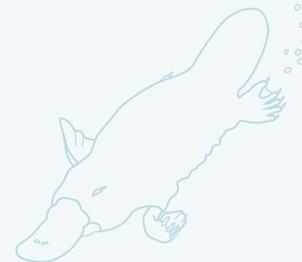
“ To slow the flood’s recession from the forest, we used environmental water from the River Murray to give Moira grass the four-month, half-metre deep, winter/spring drink it needed. ”

Keith Ward, Environmental Water Reserve Officer

Left: Little pied cormorants at Harbours Lake, Barmah Forest, by Keith Ward, Goulburn Broken CMA



sites



Keith Ward, Environmental Water Reserve Officer at Goulburn Broken CMA, explained that the winter floods alone could not provide the depth and duration of flows needed for key vegetation growth and recovery.

“To slow the flood’s recession from the forest, we used environmental water from the River Murray to give Moira grass the four-month, half-metre deep, winter/spring drink it needed.”

The watering was a collaboration between Victorian and interstate partners, and combined water allocations from the VEW, CEWH, New South Wales Office of Water, and the Living Murray program.

“It was a real team effort,” Keith said. “New South Wales closed most of the Millewa Forest’s regulators to make sure Barmah achieved a greater flood depth from the available flows. We would have needed an extra 10,000 ML a day to achieve the same flood depth if the Millewa forest regulators had remained open.”

“The watering also boosted breeding opportunities for little black and little pied cormorants, of which we saw around 700 nests each with three chicks on average,” Keith said.

“We also witnessed a number of eastern great egret nests for only the third occasion they’ve been observed breeding in Barmah in the past 40 years, and this represented the only site in Victoria

where this threatened species was known to breed in the year. There was broad-scale breeding of a large diversity and number of other waterbirds, which without the environmental water to extend the natural flooding events, may not have occurred or ended so successfully.”

Further collaboration also facilitated the trial of a new technique to target golden perch spawning in the River Murray.

“Perch need flow variability to spawn. Rather than adding extra water to create a ‘pulse’, we reduced flows by 400 ML per day for four days to cause a brief dip in river levels – resulting in successful perch spawning which was four times greater than previously observed.”

Additional environmental watering also occurred at Boals Deadwood wetland where there was a risk that a large ibis breeding colony may prematurely abandon their nests full of vulnerable young chicks. Environmental water was used to maintain stable water levels, successfully supporting the fledging of straw-necked and white ibis chicks.

In total, the watering used 363,086 ML of water – with approximately 200,000 ML flowing back to the Murray system, providing significant downstream benefits.

Site	VEWH	VEWH (Barmah-Millewa Environmental Water Allocation)	CEWH ¹	Living Murray ¹	Total
Barmah Forest	10,000	64,200	198,500	82,700	355,400
Boals Deadwood wetland	7,686	–	–	–	7,686

¹ Includes use of Water Holdings in both Victoria and New South Wales.

Gunbower Forest

Watering and works in Gunbower in 2013-14 will help provide a better future for the Murray's 'big fish'.

Environmental water from the VEW, CEWH and the Living Murray program, delivered to Gunbower Creek and Gunbower Forest, supported the recovery of various native fish species.

Anna Chatfield, Gunbower Forest Project Manager at North Central CMA, said almost 20,000 ML was delivered to Gunbower Creek to support large-bodied native fish, such as Murray cod.

“Fish surveys undertaken as part of the Living Murray program over the past nine years have found a lack of recruitment in the large-bodied native fish population in Gunbower Creek. The lack of flows in the winter period and fluctuating irrigation flows in spring are thought to contribute to the lack of recruitment, especially for Murray cod. We can address these issues by working with Goulburn-Murray Water to deliver environmental flows.”

Environmental water was used to provide baseflows over the winter and a high stable flow during spring. The winter baseflows were important to ensure that adult fish remained in good condition ready for spring migration and spawning. The spring

watering is important to allow Murray cod to spawn, protect their nests and for larvae to emerge and drift downstream.

“We monitored the creek for larvae during spring and early summer and identified that Murray cod spawned at least three times.”

The Hipwell Road Channel works, completed in early 2014 as part of the Living Murray program, has enabled the targeted inundation of the forest floodplain and wetlands. The works (including a weir, channel and gated regulator) will enable up to 4,700 hectares of the forest to be inundated, including a third of the river red gums and most of the wetlands. More regular flooding of the forest will also help to restore its natural flood regime.

The first operation of the Gunbower Forest works commenced in May 2014, and will continue until early November 2014, providing a range of benefits for the ecology of Gunbower Forest. These include aiding fish movement between Gunbower Creek and Gunbower Forest, enabling the forest's native plants to grow and set seed, and providing suitable feeding areas for its waterbirds.

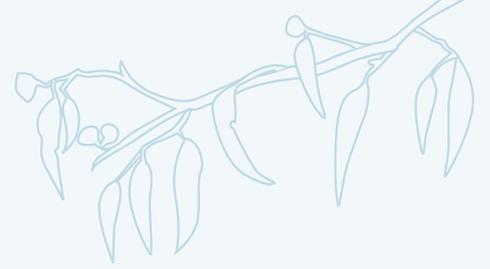
The Gunbower Island Community Reference Group, working with the North Central CMA and its many partner groups, have been influential in planning for and bringing better environmental outcomes to Gunbower Forest.

“It is a really great thing to happen (the watering that is) and for me to have a small input into such a good cause for the forest in so many ways. Let the trees, birds, fish, turtles, vegetation and all our other friends out there enjoy!!”

Trevor Powis, Cohuna resident

*All images by North Central CMA.
Left: Gunbower Forest; Right: Turtle ramp at Hipwell Road Channel; Far right: Gunbower Forest; Top right: Nursery Track at Gunbower Forest.*





Trevor Powis, Cohuna resident and member of the reference group, summed up the positive future of Gunbower Forest.

“It is a really great thing to happen (the watering that is) and for me to have a small input into such a good cause for the forest in so many ways. Let the trees, birds, fish, turtles, vegetation and all our other friends out there enjoy!!”

Sites	Water Source Volume delivered (ML)			
	VEWH	CEWH	Living Murray	Total
Gunbower Forest	9,104	–	10,153	19,257
Gunbower Creek	550	19,026	–	19,576



Hattah Lakes

One of Australia's largest environmental works projects has been completed in the Hattah system, enabling more targeted water delivery to its lakes in 2013-14.

The new pump infrastructure, completed at Messenger's Bend, enabled environmental water to be pumped into the system, beginning in October 2013 and then again in May 2014, targeting regeneration of its river red gum, black box, and other floodplain vegetation communities.

Sharyon Peart, Mallee CMA Chair, said the infrastructure underpinned the effective and efficient delivery of environmental water to this iconic system.

"Through completion of the pumping station and environmental levees and regulators, the Hattah system is able to reap the benefits to support its diverse ecological values."

"In 2013-14, we commenced two watering events at Hattah Lakes – aimed at increasing the diversity, extent and abundance of floodplain vegetation communities, and restoring and maintaining wetlands and floodplain habitat to support fish and water bird communities. The first action targeted river red gum communities and was followed by a top-up event, at the end of the water year, that aimed to inundate the higher elevation black box vegetation communities.

These actions resulted in Lake Bitterang receiving water for the first time in around 20 years – also the first time that environmental water has been used to achieve outcomes at this lake," Ms Peart said.

"The works completed at Hattah are a great example of how environmental works and measures can offer a more feasible and effective way to deliver Murray-Darling Basin Plan environmental outcomes in wetlands and floodplains."

Environmental water for the Hattah Lakes was made available by the VEWH, CEWH and the Living Murray program.

“ Through completion of the pumping station and environmental levees and regulators, the Hattah system is able to reap the benefits to support its diverse ecological values. ”

Sharyon Peart, Mallee CMA Chair

All images by Mallee CMA. Left: Pumps at Hattah Lakes Right: Lake Hattah; Top right: Aerial view of Hattah Lakes.





Water source
Volume delivered (ML)

VEWH	CEWH	Living Murray	TOTAL
25,349	4,633	67,306	97,288



Lindsay Wallpolla Islands (including Mulcra Island)

A partnership approach has helped deliver flows to one of north-west Victoria's most picturesque landscapes in 2013-14.

During 2013-14, an environmental watering event at Mulcra Island was conducted to commission water delivery structures and deliver much-needed flows through the island's main creek system, the Potterwalkagee Creek.

Raising of the adjacent River Murray weir pool, in cooperation with the New South Wales Office of Water, South Australia Water and the Murray-Darling Basin Authority, provided flows through Mulcra Island's creeks and wetlands, delivering a total of 3,475 ML of environmental water from the Living Murray program.

Sharyon Peart, Mallee CMA Chair, said the watering had connected the river channel, floodplain and wetlands, and generated a strong response from floodplain and aquatic vegetation.

"The newly completed infrastructure allowed us to take advantage of high natural flows in the Murray system and deliver water more efficiently to higher elevation vegetation communities, including river red gum, and some areas of fringing black box and lignum."

Improvements to the condition of trees and understory vegetation on Mulcra Island has been observed in recent years, with the diversity of species also increasing.

While natural flows continued through the Lindsay Island system throughout 2013-14, no environmental watering was undertaken, to enable the construction of infrastructure for environmental water delivery in the upper Lindsay River.

Similarly, Wallpolla Island did not receive any environmental water, initiating a drying event at Wallpolla Horseshoe wetland to allow for the management of pest fish.

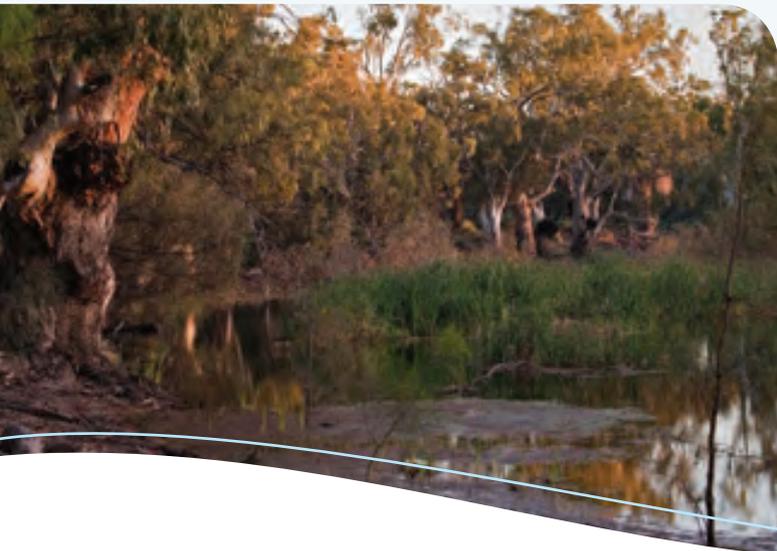
"We are now seeing some really positive environmental responses at Lindsay, Mulcra and Wallpolla islands, which shows what can be achieved through working together."

Site	Volume delivered (ML) – Living Murray water only
Mulcra Island	3,745

“ We are now seeing some really positive environmental responses at Lindsay, Mulcra and Wallpolla islands, which shows what can be achieved through working together. ”

Sharyon Peart, Mallee CMA Chair

Images by Mallee CMA. Left to right: Wallpolla Island; Mulcra Island; Lower Potterwalkagee regulator at Mulcra Island.





Environmental objectives for all Living Murray icon sites

Environmental management objectives have been identified for all of the icon sites and involve (broadly): restoring the extent and distribution of healthy wetland and floodplain vegetation communities; providing feeding and breeding habitat for water birds, including colonial nesting species; providing successful breeding and recruitment of native fish; and providing habitat for native frogs, turtles and crayfish.

Further information on the Living Murray icon sites is available in the VEWH Seasonal Watering Plan 2014-15, or by visiting the Murray-Darling Basin Authority (www.mdba.gov.au) or the Goulburn Broken (www.gbcma.vic.gov.au), Mallee (www.mcma.vic.gov.au) or North Central (www.nccma.vic.gov.au) catchment management authorities.

The Living Murray program is one of Australia's most significant long-term river restoration programs. It aims to achieve a healthy, working River Murray system for the benefit of all Australians. Four sites in Victoria have been identified as 'icon sites' for restoration under the Living Murray program. These sites include: Barmah Forest, Hattah Lakes, Lindsay-Wallpolla Islands (including Mulcra Island) and Gunbower Forest.

The Living Murray is a joint initiative funded by the New South Wales, Victorian, South Australian, Australian Capital Territory and Commonwealth governments, coordinated by the Murray-Darling Basin Authority.



Ovens system

Waterway manager: North East Catchment Management Authority (CMA)

Storage manager: Goulburn-Murray Water

Environmental watering in the Ovens River in 2013-14 showed how small amounts of water can be managed cleverly with positive results.

Between April and May 2014, 70 ML of Commonwealth environmental water was added to approximately 5,000 ML of water released from Lake Buffalo. This water release – known as ‘drawdown’ water – occurred at the end of the irrigation season for dam operation and maintenance purposes.



Euan Hind, Environmental Water Resource Officer at North East CMA, said that working with key partners to combine environmental flows with the drawdown, provided multiple advantages for the Ovens system.

“North East CMA worked with Goulburn-Murray Water and the Commonwealth Environmental Water Office to design a pattern for the release that replicated a natural pulse or ‘fresh’ in river flow.”

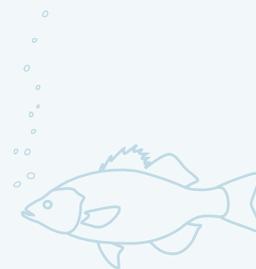
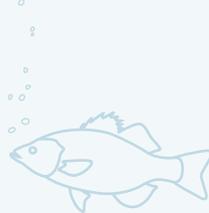
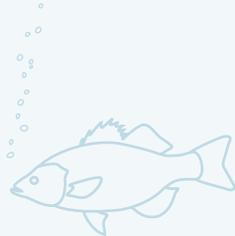
“Delivery of the fresh helped to maintain the natural variability of flows and was specifically aimed at enhancing conditions for native fish,” said Euan.

“The release also contributed to a number of important ecological outcomes. It connected habitat, allowing fish to move between them and scoured biofilms, which are slimy films of bacteria and

“North East CMA worked with Goulburn-Murray Water and the Commonwealth Environmental Water Office to design a pattern for the release that replicated a natural pulse or ‘fresh’ in river flow.”

Euan Hind, Environmental Water Resource Officer

All images by North East CMA. Left to right: Lake Buffalo spillway at Ovens River; Confluence of Ovens and King rivers; Billabong at Ovens River.



organic matter, from river beds. It also helped to refresh in-stream habitats for water-dependent macroinvertebrates that are important to river health and a key food source for native fish.”

In April 2014, Macquarie perch made a return to the Ovens River, through fish translocation. The translocation program is aimed at re-establishing a sustainable population of Macquarie perch in the Ovens River and the managed environmental flows were timed and designed to support the translocated fish, as well as other native fish. The program will be complemented by a fish study assessing Macquarie perch movement.

“This study will provide important information in establishing Macquarie perch movement patterns and the flows required to support its population.”

Environmental flow management this year also complemented a number of other river health restoration activities aimed at increasing native fish numbers, including the development of ‘fish hotels’. The fish hotels are box structures in the river placed to enhance fish spawning opportunities.

Euan indicated that overall the condition of the Ovens system is relatively good due to its close-to-natural flow regime.

Further information on the Ovens system is available in the **VEWH Seasonal Watering Plan 2014-15**, or by visiting the North East CMA website at www.necma.vic.gov.au.

The Ovens River rises in the Great Dividing Range near Mount Hotham and flows approximately 150 kilometres to join the River Murray in the backwaters of Lake Mulwala. Only two small water storages have been constructed – Lake Buffalo on the Buffalo River and Lake William Hovell on the King River. The Ovens River is considered to be home to one of Victoria’s best Murray cod populations and also supports populations of golden perch and fly-specked hardyhead. It is a particularly important system for some key species of threatened native fish, including Macquarie perch and trout cod.

Environmental objectives

Maintaining adequate habitat for native fish; maintaining sufficient flows for native fish passage between pools; scouring biofilm from the river bed; and maintaining short-term fluctuations in discharge to move sediment and maintain macroinvertebrate habitat.

Site	Volume delivered (ML) – CEWH water only
Ovens River	70



glossary

Adaptive management – *An iterative process of decision making, based on continuous learning, with the aim of reducing uncertainty over time.*

Basalt soil – *Soil containing a dark fine-grained volcanic rock composition.*

Baseflows – *A relatively stable, sustained and low flow in a river.*

Biodiversity – *The variety or abundance of species (plant and animal) in a particular habitat or environment.*

Biofilms – *Slimy films of bacteria, other microbes and organic materials that cover underwater surfaces including rocks and snags.*

Biota – *The animal or plant life of a particular region, habitat or geological period.*

Brackish herbland – *Vegetation that is moderately salty, as a result of the mixing of seawater with fresh water.*

Carryover – *Allows entitlement holders to retain ownership of unused water into the following season (according to specified rules).*

Catchment management authority – *Statutory authority established to manage river health, regional and catchment planning, and waterways, floodplains, salinity and water quality management.*

Cease-to-flow – *The period in which there is no discernible flow in a river with partial or total drying of the river channel.*

Commonwealth Environmental Water Office (part of the Department of Environment) – *Manages the water entitlements recovered by the Australian Government through a combination of investments in water-saving infrastructure, water purchases and other water recovery programs, held by the Commonwealth Environmental Water Holder (CEWH).*

Confluence – *The point where a tributary joins a larger river, called the main stem, or where two streams meet to become the source of a river of a new name.*

Drawdown – *Water released from a body of water (for example, reservoir) at the end of the irrigation season for dam operation and maintenance purposes.*

Environmental water entitlement – *An entitlement to water to achieve environmental objectives in waterways (could be an environmental entitlement, environmental bulk entitlement, water share, section 51 licence or supply agreement).*

Estuary – *A partially enclosed body of water along the coast where freshwater from rivers and streams meets and mixes with salt water from the ocean.*

Fish hotels – *Box structures of logs placed in a river designed to enhance fish spawning opportunities.*

Fish ladder – *A series of pools built like steps to enable fish to travel through a particular waterway, dam or waterfall.*

Fledging – *The care of a young bird until it is able to fly.*

Flow component – *Components of a river system's flow regime that can be described by magnitude, timing, frequency and duration (for example, cease-to-flow and overbank flows).*

Freshes – *Small or short duration peak flow events which exceed the baseflow and last for one or several days.*

Groundwater – *Water held underground in the soil or in pores and crevices in rock.*

Headwater – *A tributary stream of a river close to or forming part of its source.*

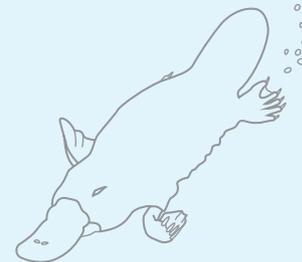
Heritage rivers – *Heritage rivers are listed under the **Heritage Rivers Act 1992**, and are particular parts of rivers and river catchment areas in Victoria which have significant nature conservation, recreation, scenic or cultural heritage attributes.*

Hydrodynamic model – *An assessment model to predict the influence of a given flow on various factors, including salinity, temperature and water level.*

Hydrology – *The study concerned with the properties of the water and its movement in relation to land.*

Irrigation releases – *Release of water for irrigation purposes.*

Juvenile – *Animals and plants not yet fully mature.*



Land manager – Agency or authority responsible for the conservation of natural and cultural heritage on public land, including parks and reserves (includes Parks Victoria and DEPI).

Macroinvertebrates – Those animals that have no backbone and can be seen with the naked eye; includes worms, snails, mites, bugs, beetles, dragonflies and freshwater crayfish.

Managed releases – Release of water from the Water Holdings which is stored in major reservoirs; used for priority watering actions to achieve environmental outcomes.

Megalitre (ML) – One million (1,000,000) litres.

Passing flow – Water released out of storages to operate river and distribution systems (to deliver water to end users), provide for riparian rights and maintain environmental values and other community benefits.

Priority watering actions – Flow components that have been identified as priorities for a particular system in a particular year.

Pulse – A gradual build in the flow of water, typically to replicate optimal conditions for water species such as fish to travel and spawn.

Ramsar-listed wetland – A wetland listed as internationally significant under the Convention on Wetlands signed in Ramsar, Iran in 1971.

Reach – A stretch or section of a river, generally defined in an environmental flows study.

Recruitment – When plants or animals survive to settlement or maturity stage.

Remnant pools – Small pools of water that have emerged after larger areas of water have subsided or dried.

Remnant vegetation – Patches of native trees, shrubs and grasses still remaining following disturbance.

Riparian vegetation – Vegetation located in the area of land that adjoins, regularly influences or is influenced by a river.

Rookery – A breeding colony, for example a collection of nests in a small, close group of trees.

Salt wedge – The transition zone of salt water and freshwater environments which occurs when a freshwater river flows directly into salt water.

Seagrass – Grass-like plants that live in or close to the sea.

Spawning – The process of species releasing the eggs and sperm to reproduce.

Storage manager – Appointed by the Minister for Water to operate major water storages in a particular river basin to deliver to entitlement holders.

Terrestrial vegetation – Land-based plants.

The Living Murray program – An intergovernmental program, which holds an average of 500,000 ML of environmental water per year, for use at six icon sites along the River Murray.

Threatened species – A native species that is facing threats to their survival and may be at risk of extinction in the near future.

Translocation – The movement of living organisms from one area to another area where they are given free release.

Tributary – Smaller river or creek that flows into a larger river.

Victorian Environmental Water Holder (VEWH)

– An independent statutory body responsible for holding and managing Victorian environmental water entitlements and allocations (Victorian Water Holdings).

Waterways – Includes rivers, wetlands, creeks, floodplains and estuaries.

Water entitlement – The right to a volume of water that can (usually) be stored in reservoirs and taken and used under specific conditions.

Water Holdings – Environmental water entitlements held by the Victorian Environmental Water Holder.

Water trade – The process of buying or selling or exchanging water allocation or entitlements.

Waterway manager – Agency or authority responsible for the environmental management of catchments and waterways (includes catchment management authorities and Melbourne Water).

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Acknowledgment of Country

The Victorian Environmental Water Holder acknowledges Aboriginal Traditional Owners within Victoria, their rich culture and their spiritual connection to Country. The contribution and interests of Aboriginal People and organisations in the management of land and natural resources is also recognised and acknowledged.

Summary of environmental water delivery 2013-14

			VEWH (ML)	CEWH (ML)	Living Murray (ML)	Other source (ML) ¹	Total volume used (ML)
Gippsland Region							
Snowy system ²			-	-	-	190,600	190,600
Latrobe system	Latrobe wetlands	Sale Common	-	-	-	-	N/A³
		Heart Morass					
		Dowd Morass					
Latrobe River		3,748	-	-	-	3,748	
Thomson system			10,754	-	-	-	10,754
Macalister system			12,849	-	-	-	12,849
Gippsland Region total			27,351	-	-	190,600	217,951
Central Region							
Yarra system	Yarra River		16,826	-	-	-	16,826
	Yering Backswamp		9	-	-	-	9
Tarago system			1,784	-	-	-	1,784
Werribee system			461	-	-	-	461
Maribyrnong system ⁴			200	-	-	-	200
Moorabool system			2,500	-	-	-	2,500
Barwon system	Reedy Lake		-	-	-	-	N/A⁵
	Hospital Swamps						
Central Region total			21,780	-	-	-	21,780
Western Region							
Glenelg system			10,207	-	-	-	10,207
Wimmera system			19,532	-	-	-	19,532
Wimmera-Mallee wetlands ⁶	Mallee CMA		218.9	-	-	15.6 ⁷	234.5
	North Central CMA		12.7	-	-	-	12.7
	Wimmera CMA		33.1	-	-	-	33.1
Western Region total			30,003.7	-	-	15.6	30,019.3

Summary of environmental water delivery 2013-14

			VEWH (ML)	CEWH (ML)	Living Murray (ML)	Other source (ML) ¹	Total volume used (ML)	
Northern Region								
Goulburn system			33,349	215,000	64,000	-	312,349	
Broken system			-	38,594	-	-	38,594	
Campaspe system			6,280	6,517	1,768	-	14,565	
Loddon system			6,593	2,775	-	-	9,368	
Northern wetlands and floodplains	Goulburn Broken wetlands	Kinnairds Wetland	180	-	-	-	180	
		Moodies Swamp	-	121	-	-	121	
		Black Swamp	50	-	-	-	50	
	Mallee wetlands	Bridge Creek	200	200	-	-	400	
		Bullock Swamp	266	266	-	-	532	
		Burra Creek South	300	300	-	-	600	
		Heywoods Lake	5,000	-	-	-	5,000	
		J1 Creek	209	209	-	-	418	
		Karadoc Swamp	200	200	-	-	400	
		Liparoo East	236	236	-	-	472	
		Psyche Lagoon	400	400	-	-	800	
		Robertson Wetlands	601	-	-	-	601	
		Butlers Creek	207	-	-	-	207	
		Sandilong Creek	142	-	-	-	142	
		Brickworks Billabong	174	174	-	-	348	
		Cardross Lakes	506	506	-	-	1,012	
		Woorlong Wetland	176	176	-	-	352	
		North Central wetlands	Lake Elizabeth	1,455	-	-	-	1,455
			Round Lake	509	-	-	-	509
			Hird Swamp	3,343	-	-	-	3,343
	McDonalds Swamp		1,240	-	-	-	1,240	
	Lake Yando		151	-	-	-	151	
	Lake Meran	1,849	-	-	-	1,849		

Summary of environmental water delivery 2013-14

			VEWH (ML)	CEWH (ML)	Living Murray (ML)	Other source (ML) ¹	Total volume used (ML)
Northern Region continued							
The Living Murray icon sites	Barmah Forest	Boals Deadwood	7,686	-	-	-	7,686
		Barmah Forest	74,200	98,500	15,000	167,700 ⁹	355,400
	Gunbower Creek and Forest	Gunbower Creek ⁸	550	19,026	-	-	19,576
		Gunbower Forest	9,104	-	10,153	-	19,257
	Hattah Lakes	Hattah Lakes	25,349	4,633	67,306	-	97,288
	Lindsay-Wallpolla and Mulcra Islands	Mulcra Island	-	-	3,745	-	3,745
Ovens system ¹⁰			-	70	-	-	70
Northern Region total			180,505	387,903	161,972	167,700	898,080
TOTAL WATER USE			259,640	387,903	161,972	358,316	1,167,830

¹ Other source refers to water that is either delivered outside of Victoria, or delivered in Victoria but not accounted for under the environmental Water Holdings. The VEWB/CEWH/Living Murray columns only account for environmental water delivered through Victorian accounts.

² Environmental water delivery occurred in New South Wales reaches of the Snowy River. The delivery was aimed to achieve outcomes in the New South Wales reaches of the River, however provided some downstream benefits to the Victorian reaches.

³ Use of the Holdings in the Latrobe system are based on the river height at the Swing Bridge, rather than a volumetric entitlement.

⁴ In 2013-14, water allocations purchased by Melbourne Water and the VEWB contributed to the delivery of 200 ML of environmental water to meet objectives in the Maribyrnong system, where no permanent Water Holdings are currently held.

⁵ Use of the Holdings in the Barwon system are based on the river height in the Barwon River, rather than a volumetric entitlement.

⁶ Refer to page 33 for a list of the wetlands watered.

⁷ Water delivered to the Wimmera Mallee wetlands in supply system 5 was accounted for against GWMWater accounts.

⁸ Return flows contributed to delivery at these sites.

⁹ Water also delivered from CEWH, Living Murray and New South Wales Office of Water Water Holdings held in New South Wales.

¹⁰ The VEWB has no Water Holdings in the Ovens system.



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