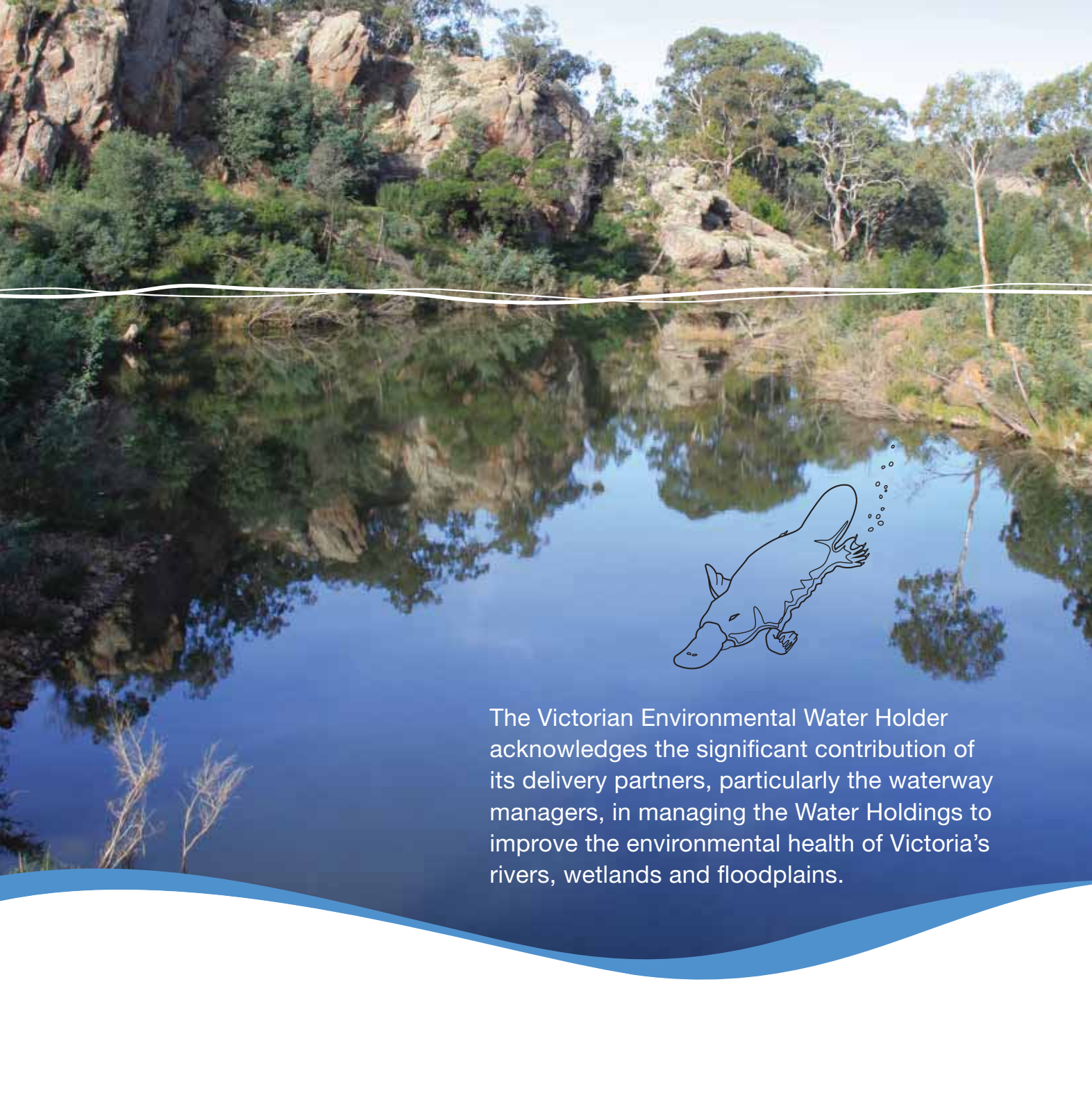
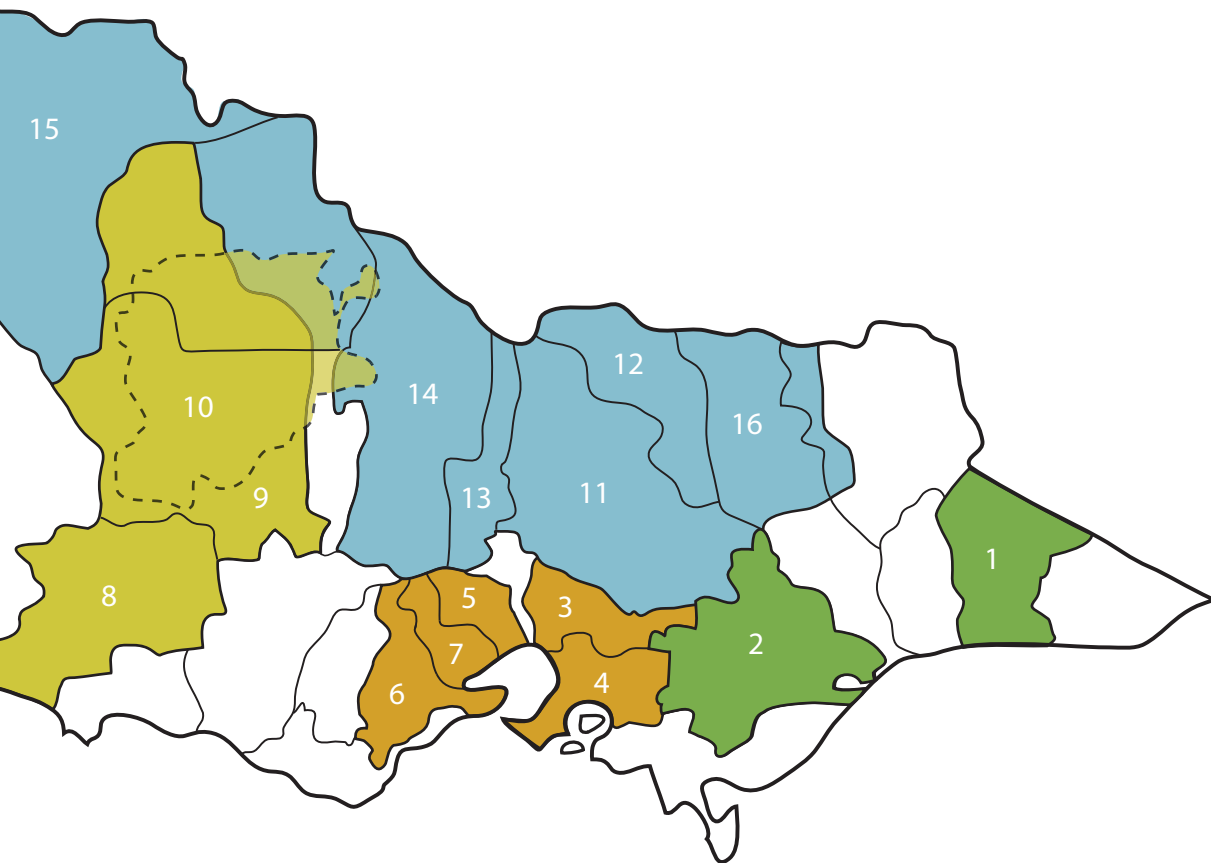






# Reflections

**Environmental watering**  
in Victoria 2012-13



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



-  Gippsland Region
-  Central Region
-  Western Region
-  Northern Region



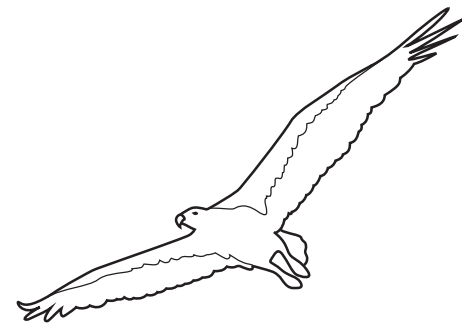


## Systems where environmental water was delivered in 2012-13

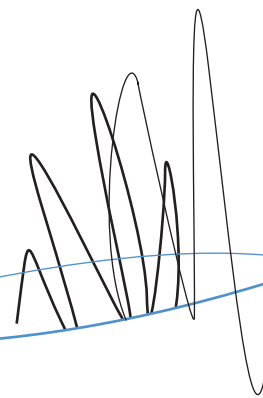
- 1 Snowy
- 2 Latrobe, Thomson and Macalister
- 3 Yarra
- 4 Tarago
- 5 Werribee
- 6 Barwon
- 7 Moorabool
- 8 Glenelg
- 9 Wimmera
- 10 Wimmera-Mallee wetlands
- 11 Goulburn
- 12 Broken
- 13 Campaspe
- 14 Loddon
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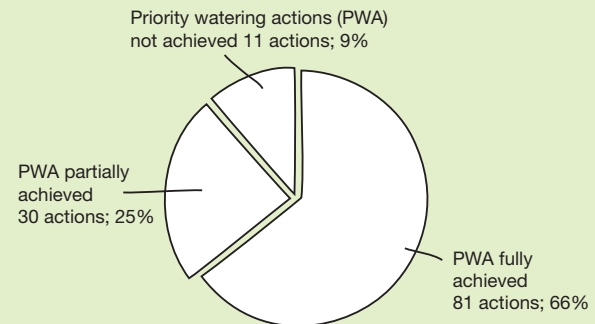
# foreword

Welcome to the second edition of *Reflections – Environmental watering in Victoria 2012-13*, the annual watering booklet produced by the Victorian Environmental Water Holder (VEWH). Inside, you will find the stories of environmental water management, as told by a representative from the relevant catchment management authority or Melbourne Water. Each story highlights the key achievements and learnings, across 19 Victorian systems. *Reflections* provides us with the opportunity to reflect on both the 2012-13 year and environmental watering achievements over the longer term.

In this, our second year of operation, we continued to work closely with our delivery partners to ensure the most efficient use of available environmental water. Our first Stakeholder Information Forum was held, providing an opportunity to discuss environmental water management with partners and other stakeholders that share our state-wide focus. We look forward to continuing to build and foster these relationships, to assist us in understanding linkages between organisations involved in water, land and catchment management, as we continue to strive towards achieving environmental outcomes across Victoria's rivers, wetlands and floodplains.

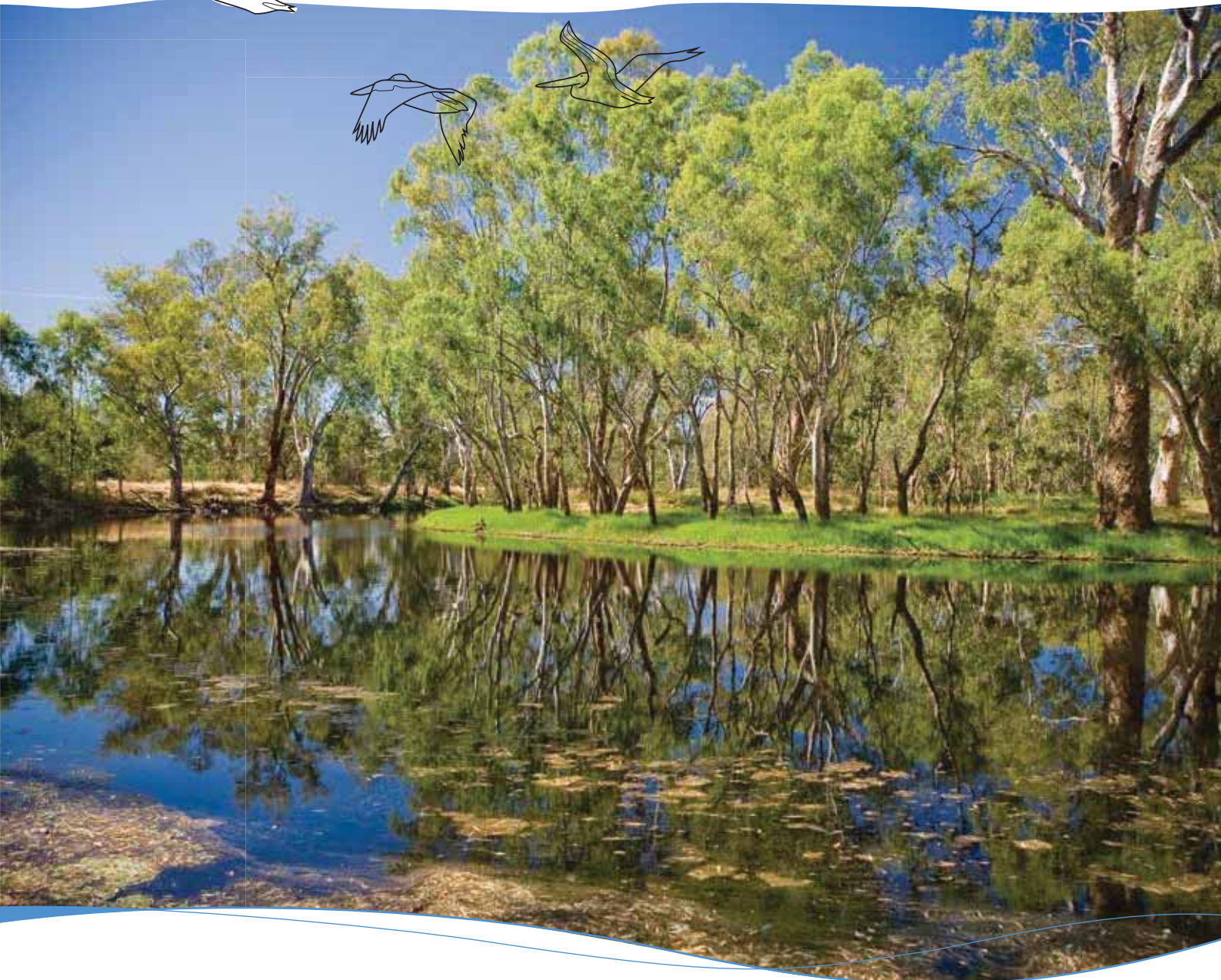
Of the 122 priority watering actions identified in the *Seasonal Watering Plan 2012-13*, 91 percent were fully or partially achieved, through natural (unregulated) river flows, through river operations, or largely as a direct result of managed environmental releases.

Where priority watering actions were able to be met solely from unregulated flows, or through the delivery of consumptive water en route to other water users, less water is required from environmental water entitlements.



I would like to recognise the ongoing time and effort of all our delivery partners, including waterway managers, storage managers and land managers, toward the achievement of priority watering actions and their associated environmental outcomes in waterways. We cannot overstate how important this contribution is. I would also like to thank the Commonwealth Environmental Water Holder and his Office, the Living Murray program staff and the broader community who work with us to improve the environmental condition of our rivers, floodplains and wetlands.

**Denis Flett**  
Chairperson





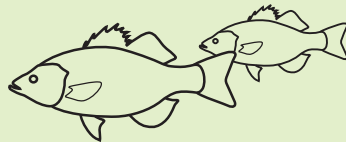
# introduction

## The role of the Victorian Environmental Water Holder

On 1 July 2011, the VEWH was officially established, becoming the first independent statutory body responsible for managing Victoria's environmental water entitlements (Water Holdings). The mission of the VEWH is to manage Victoria's environmental Water Holdings and cooperate with partners to improve the environmental health of rivers, wetlands and floodplains.

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
- commissions targeted projects to demonstrate ecological outcomes of environmental watering at key sites and to improve environmental management
- publicly communicates environmental watering decisions and outcomes.



## The Environmental Water Reserve

The Water Holdings managed by the VEWH are a small but important part of the broader Environmental Water Reserve (EWR). The EWR also includes:

- water set aside for the environment as obligations on water entitlements held by urban and rural water corporations, usually called 'passing flows'
- 'above cap' water provided once limits on consumptive water use have been reached or due to unregulated flows and spills from storages.

Environmental water is essential to sustain the ecosystems of our rivers, wetlands and floodplains. These ecosystems support many important community values.

Planning the use of environmental water involves describing a flow pattern of a particular magnitude, timing and duration. Under the seasonally adaptive approach, environmental flow patterns are planned for different water availability scenarios. This allows waterway managers to manage adaptively to naturally occurring conditions.

## Highlights of environmental watering

In 2012-13, over 430,000 ML of water was delivered to 46 river reaches and 17 wetlands, providing significant benefit to a wide range of water-dependent plants and animals. Ninety-one percent of priority watering actions were fully or partially achieved. Of greater importance than the volume of water delivered, is the environmental outcomes that were able to be achieved.



This year environmental watering actions have resulted in or contributed to the:

- first ever environmental water releases in the Tarago and Werribee systems
- largest environmental water release to date in the Glenelg systems
- spawning of threatened Australian grayling in the Thomson, Macalister, Yarra and Tarago systems
- protection of endangered Murray hardyhead populations in the Mallee and North Central wetlands
- high numbers of waterbirds breeding and feeding in the lower Latrobe, lower Barwon and North Central wetlands, as well as Barmah Forest
- prevention of water quality issues and potential fish kills in the Moorabool, Wimmera and Broken systems
- improved frog populations in the Loddon system and fish populations in Gunbower Creek
- adaptive management of the Goulburn and Campaspe systems and Goulburn Broken wetlands in response to new learnings, additional water and variable seasonal conditions.

Pages 6–51 highlight the achievements and benefits in each system.

## Carryover and trade

The VEWH considers opportunities to carry over or trade water to achieve priority watering actions and environmental outcomes. Carrying over water allows entitlement holders, including the VEWH to retain unused water at the conclusion of the

water year. The carryover amount can be used in subsequent years.

An assessment of water availability and foreseeable demand resulted in a small amount of the VEWH's Water Holdings being available for sale in northern Victoria. Trade revenue contributed to addressing a supply shortfall in the Werribee system. In 2012-13, the VEWH traded the following amounts of water:

- 14,000 ML sold in the Murray system
- 850 ML co-purchased with Melbourne Water for use in the Werribee River.

Any net revenue from water trading earned by the VEWH will be used for direct environmental outcomes in rivers, floodplains and wetlands. This may include purchasing water allocation at a different time or in a different system, addressing key knowledge gaps, or funding small works and measures to improve water use efficiency.

## Demonstrating outcomes from environmental water

To demonstrate the effectiveness of environmental water delivery, a range of monitoring is undertaken by our watering partners.

The VEWH has commissioned short-term monitoring of ecological responses to watering events and specific environmental flow patterns.

This monitoring is a first step to addressing our knowledge gaps and will be shared with delivery partners to inform future use of environmental water.

# Snowy system

**Waterway managers** – New South Wales Office of Water (NSW); East Gippsland Catchment Management Authority (Vic)

**Storage manager** – Snowy Hydro Limited

In 2012-13, the largest annual water allocation was made to the Snowy River to date

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.

Water releases in the Snowy system are managed by the New South Wales Government on behalf of the Victorian and Commonwealth governments. The Victorian Government is working with the New South Wales and Commonwealth governments to

rehabilitate the health of the Snowy River by returning 21 percent of the average annual flow.

During 2012-13, 162,700 ML of water was released to the Snowy River below Jindabyne Dam.

“In September 2012, a large environmental flow was released to the Snowy River. The flow consisted of 79,900 ML and was released over 17 days,” said Simon Williams, NSW Office of Water’s Environmental Water Manager.

Simon said the environmental flow mimicked characteristics of a snow melt that had occurred every year prior to the construction of the Snowy Mountains Scheme.

“A release was made in March 2013, as part of a flood mitigation measure to lower the water levels in Lake Jindabyne. This mitigation measure saw an additional 80,680 ML released to the Snowy River.”



*Images by NSW Office of Water*

*Left to right: Jindabyne Dam spillway delivering a high flow event; Undertaking research in the Snowy River; Simon Williams undertaking monitoring in the Snowy River; Spring release in the Jindabyne Gorge.*

Simon described how managed high flows have initiated the physical reworking of the habitat in the channel of the Snowy River.

“Some localised improvements in habitat condition have occurred as a result of sediment scour in the river bed,” he said.

“Once we have improved the in-stream habitat condition, we should expect some more dramatic responses from aquatic plants and animals. For example, river blackfish were previously common in the Snowy River. We have not recorded river blackfish since we started sampling for them in 2000. They currently live in the tributaries of the Snowy River. In the future if river blackfish are recorded in the Snowy River itself, then we would have achieved one of our environmental objectives. It will be interesting to see if or how this occurs.”

Simon explained that with only 21 percent of the average annual flow, the aim is to make a smaller but healthier river.

“It will take many decades to achieve the various environmental objectives. This is a long-term rehabilitation strategy that will require commitment from the community and government.”

More information on the Snowy system is available in the VEW *Seasonal Watering Plan 2013-14*, or by visiting the East Gippsland CMA website at [www.egcma.vic.gov.au](http://www.egcma.vic.gov.au).

#### Environmental objectives

Developing a smaller but healthier river by improving the physical habitat - removing silt and algae from the river bed, inundating the old river bed and stimulating local-scale fish movement





# latrobe system

**Waterway manager** – West Gippsland Catchment Management Authority (CMA)

**Storage manager** – Southern Rural Water

Environmental water complemented natural flows in the Latrobe wetlands in 2012-13 to maintain habitat for waterbirds

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. The wetlands are made up of Sale Common, Heart Morass and Dowd Morass, and cover an area of over 3500 hectares.

These wetlands 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. There are also diverse

macroinvertebrate communities including damselflies, water beetles, bugs, snails and worms.

West Gippsland CMA Environmental Water Resources Officer, Eleisha Keogh, said the lower Latrobe wetlands were filled in June 2012 by natural overbank flooding, setting them up well for the 2012-13 watering year. Environmental water was then used to complement what was already happening naturally.

“Partial wetting flows were provided to Sale Common and Dowd Morass to avoid complete drying of large areas of these wetlands during autumn. This resulted in an expansion and extension of habitat for wetland plants and wildlife.”

Eleisha said the environmental water was important for maintaining bird populations at the wetlands.

“Observations of the waterbird breeding colony in Dowd Morass suggest that numbers of ibis and royal spoonbill were significantly higher in spring 2012 than 2011,” Eleisha said.

“Maintaining the aquatic habitat was seen as very important given the successful waterbird breeding

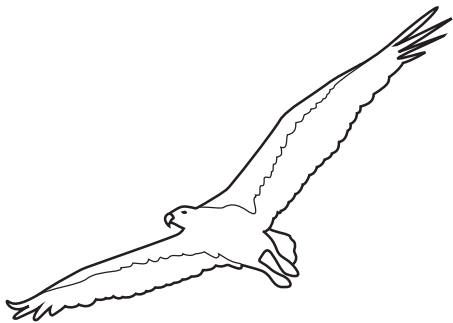


*Left to right: Egret in eastern Heart Morass, by Eleisha Keogh; Sale Common upgraded Latrobe regulator, by West Gippsland CMA; Eleisha Keogh inspecting Dowd Morass, by West Gippsland CMA; (top) Eastern Heart Morass, by Eleisha Keogh.*

season in spring 2012, and the subsequent rapid loss of freshwater-brackish wetland habitat across the region and the State during the 2012-13 summer and autumn seasons.”

Eleisha said the recent upgrade of the Sale Common regulator improves our ability to efficiently deliver water to the wetland.

“The June 2013 watering of Sale Common was during a minor flood event to supplement natural inundation, and the regulator was used to ensure that the wetland filled,” she said.



More information on the Latrobe system is available in the VEWB **Seasonal Watering Plan 2013-14**, or by visiting the West Gippsland CMA website at [www.wgcma.vic.gov.au](http://www.wgcma.vic.gov.au).

Environmental objectives	
Providing feeding, breeding and sheltering habitat for a range of wetland species, particularly for waterbirds; maintaining the diversity of wetland habitats across the system	
Water source (entitlement)	Volume delivered in megalitres (ML)
Latrobe River Environmental Entitlement 2011 <sup>1</sup>	• n/a <sup>2</sup>

1 Entitlement name change in 2013 to ‘Lower Latrobe Wetlands Environmental Entitlement 2010’.

2 This entitlement provides access to unregulated flows, with use dependent on suitable river heights, as specified in the entitlement.



# thomson system

**Waterway manager** – West Gippsland Catchment Management Authority (CMA)

**Storage managers** – Melbourne Water; Southern Rural Water

## Environmental water releases successfully targeted spawning of the threatened Australian grayling in the Thomson

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 fresh water flows to the lower Latrobe wetlands.

The Thomson 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 species are migratory fish,

including Australian bass, tupong, short and long-finned eels, and the threatened Australian grayling.

West Gippsland CMA Environmental Water Resources Officer, David Stork, explains that as with previous years, the environmental water release targeted the spawning of Australian grayling. Due to the species' short lifespan of two to three years, regular spawning is critical for its long-term sustainability.

"This year we monitored fish movement and sampled for larvae. We found that during the environmental water release, grayling migrated downstream and spawned in the lower reaches of the river."

"This monitoring provides us with the best evidence to date that the environmental flow releases are achieving their objectives."

Fish populations weren't the only beneficiaries of environmental water delivered to the Thomson River in 2012-13. Many people took advantage of the extra paddling opportunities provided by the environmental water release.



*Left: Thomson River by West Gippsland CMA  
Right: Horseshoe Bend Tunnel by West Gippsland CMA  
Far right: Canoe in Thomson River flow release by Jake Marler*



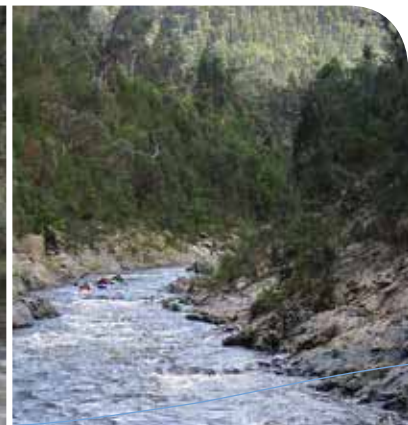
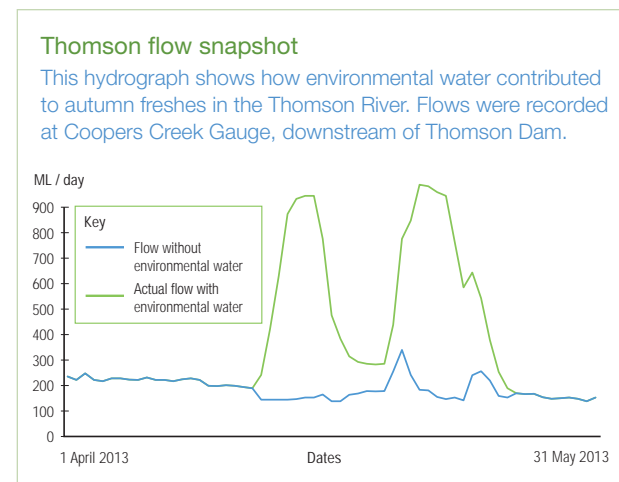


“An online poll undertaken by AdventurePro found that 280 people paddled the Thomson River canoe trail during the environmental flow release,” David said.

“As part of our risk management process we notify individuals and parties registered with the CMA, such as canoe groups, about planned environmental water releases. Through this process more and more people are becoming aware and taking advantage of the recreational opportunities that the increased flow provides.”

More information on the Thomson system is available in the VEWH **Seasonal Watering Plan 2013-14**, or by visiting the West Gippsland CMA website at [www.wgcma.vic.gov.au](http://www.wgcma.vic.gov.au).

Environmental objectives	
Protecting and enhancing the self-sustaining population of Australian grayling; maintaining the diversity and condition of aquatic habitat; and stimulating fish migration and spawning	
Water source (entitlement)	Volume delivered in megalitres (ML)
Bulk Entitlement (Thomson River - Environment) Order 2005	• 10,936



# macalister system

**Waterway manager** – West Gippsland Catchment Management Authority (CMA)

**Storage manager** – Southern Rural Water

Environmental flow releases and wetter conditions have contributed to increased Australian grayling populations in the Macalister system

The Macalister River 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 (MID) near the township of Maffra – the largest irrigation area south of the Dividing Range. The Macalister River features two major structures – Glenmaggie Weir and Maffra Weir which supply the MID.

The Macalister River joins with the Thomson River between Maffra and Sale, making it the third river

that contributes fresh water to the lower Latrobe wetlands. Like the Thomson River, the lower Macalister River is home to a diverse range of native fish populations.

In 2012-13, wetter conditions prevailed during winter, however spring and summer saw a return of dry conditions.

West Gippsland CMA Environmental Water Resources Officer, David Stork, said improving populations of the threatened Australian grayling in the Macalister River is a key target of the region's River Health Strategy.

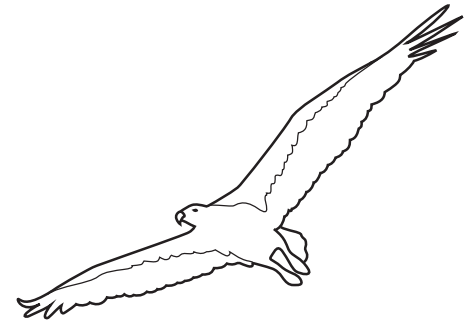
"The strategy really targets actions aimed at the protection and enhancement of self-sustaining populations of Australian grayling," he said.

This is implemented through an environmental flow pattern aimed at improving in-stream habitat and promoting spawning and migration.

Monitoring is used to track the movement of a small subset of individuals and improve understanding of environmental flow effects on the rest of the population.



*Images by West Gippsland CMA.  
Left to right: Upper Macalister River;  
Macalister River; David Stork.*



“Autumn freshes and baseflows were successfully delivered in 2012-13 to create favourable conditions for Australian grayling to breed,” David said.

“Our fish monitoring subsequently tracked the downstream migration of grayling during the autumn fresh; a response strongly linked to spawning activity.”

More information on the Macalister system is available in the VEWH **Seasonal Watering Plan 2013-14**, or by visiting the West Gippsland CMA website at [www.wgcma.vic.gov.au](http://www.wgcma.vic.gov.au).

#### Environmental objectives

Protecting and enhancing the self-sustaining population of Australian grayling; maintaining the diversity and condition of aquatic habitat; and stimulating fish migration and spawning

#### Water source (entitlement)

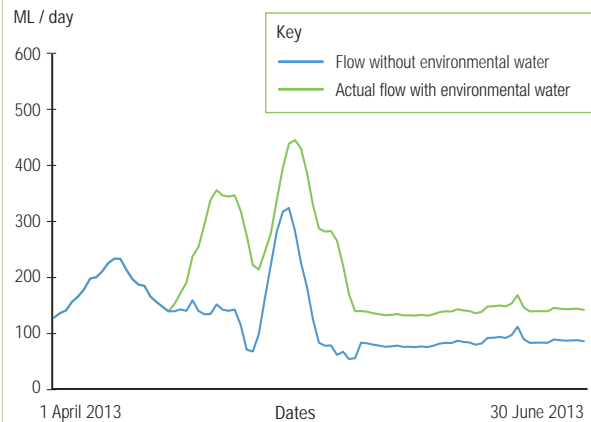
Macalister River Environmental Entitlement 2010

#### Volume delivered in megalitres (ML)

• 10,811

#### Macalister flow snapshot

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





# Yarra system

## Waterway and storage manager – Melbourne Water

### Barrier removal and environmental water releases have assisted spawning of Australian grayling in the Yarra system in 2012-13

Covering over 400,000 hectares and supplying around 70 percent of Melbourne's drinking water, the Yarra River catchment is the largest within the Port Phillip and Westernport region. The Yarra River supports many important environmental values, including platypus and a number of nationally significant fish species such as the Australian grayling and the Macquarie perch. The Yarra River is a highly valued focal point for the community, from the Yarra Valley through to the centre of Melbourne.

The Dights Falls fishway was completed by Melbourne Water in late 2012, removing a significant barrier to fish migration. The vertical slot fishway is a gradually sloped concrete ramp, divided to create a series of pools which fish can use to move past the weir. The fishway is expected to improve fish numbers and diversity above the weir.

Melbourne Water Senior Environmental Water Planner, Helen Clarke, said that the completion of the fishway refocussed management on the protection of the Australian grayling in addition to Macquarie perch. In May 2013, delivery of the largest environmental watering event in the Yarra River to date, was targeted to Australian grayling spawning.

"Monitoring of the environmental watering event revealed that grayling did spawn, showing that the river does have an existing population on which to expand," Helen said.

"The upgrade of the fishway has also given us confidence that juvenile Australian grayling will be able to migrate back into the freshwater reaches of the system. Ongoing monitoring of the fishway will help to confirm this."

*Images by Melbourne Water*

*Left to right: Yarra River at O'Shannessy Gate looking downstream; Upper Yarra valves; Yarra River in Melbourne (by VEWH); (top image) Yarra River downstream of Upper Yarra Reservoir Park*



Helen said monitoring of physical conditions during various environmental watering events also revealed some positive results for fish and macroinvertebrate habitat availability.

“We observed that successful sediment scour in the upper-most reach of the Yarra River resulted from targeted releases. This provides us with confidence that the recommended flow event is effective in increasing habitat availability” she said.

“Water quality monitoring in the lower Yarra confirmed that providing summer fresh flows is effective in maintaining water quality levels in Dights Falls, which is important for protecting migratory native fish as they move back into the Yarra system.”

#### Environmental objectives

Supporting water-dependent plant and animal species including flood-tolerant sedges, river blackfish, galaxias and Australian smelt; supporting breeding events of Macquarie perch and Australian grayling; maintaining and improving fish diversity; and improving vegetation condition

#### Water source (entitlement)

#### Volume delivered in megalitres (ML)

Yarra River Environmental Entitlement 2006

• 12,589



More information on the Yarra system is available in the VEW *Seasonal Watering Plan 2013-14*, or by visiting the Melbourne Water website at [www.melbournewater.com.au](http://www.melbournewater.com.au).



# tarago system

## Waterway and storage manager – Melbourne Water

2012-13 marked the first ever delivery of environmental water to the Tarago River following the creation of the environmental entitlement in 2009

The Tarago system covers an area of over 95,000 hectares 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.

The Tarago system is home to many native fish species such as the threatened Australian grayling and river blackfish, along with one of Australia's most iconic marsupials, the platypus. Threatened vegetation such as long pin-bells, tree geebung, and swamp bush-pea can be found along stretches of the river.

Melbourne Water Senior Environmental Water Planner, Helen Clarke, said the first releases of environmental water in the Tarago resulted in successful breeding of the threatened Australian grayling.

"The first environmental water event was provided in 2012 to support the migration of juvenile Australian grayling into the river from the sea," Helen said.

"Successful spawning of the Australian grayling was then detected in April and May 2013 during another release of environmental water for this purpose."

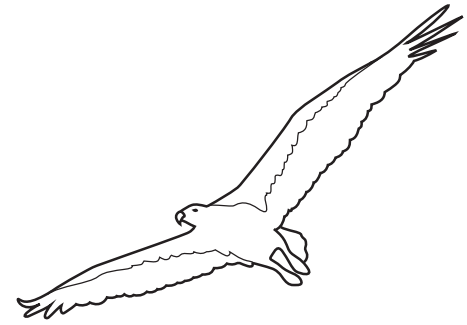
Helen explained that the research that supports the planning for environmental water is frequently updated to allow the best decisions to be made.



*Images by Melbourne Water*

*Left to right: Drouin West Road; Fishway on the Tarago River at Drouin West; Helen Clarke; (top) Platypus found on the Bunyip River during Melbourne Water's annual platypus survey*





“A review of the Tarago environmental flow study was undertaken in early 2013. This allowed us to incorporate new research into the spawning and migration requirements of Australian grayling in the Tarago system in recent years,” Helen said.

“This research and the update of the environmental flow study has allowed us to refine the environmental flow recommendations and ensure the efficient use of environmental water in the system.”

More information on the Tarago system is available in the VEWB *Seasonal Watering Plan 2013-14*, or by visiting the Melbourne Water website at [www.melbournewater.com.au](http://www.melbournewater.com.au).

#### Environmental objectives

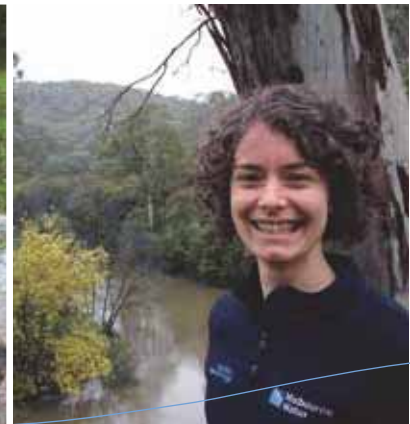
Maintaining and improving habitat for aquatic species; maintaining habitat connectivity; promoting flood-tolerant vegetation; and assisting spawning and migration for native fish including Australian grayling

#### Water source (entitlement)

Tarago and Bunyip Rivers  
Environmental Entitlement 2009

#### Volume delivered in megalitres (ML)

- 2,176



# Werribee system

**Waterway manager** – Melbourne Water

**Storage manager** – Southern Rural Water

In 2012-13, the first environmental water releases into the Werribee system from Merrimu and Melton reservoirs attracted community members keen to witness the events

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 Lerderderg River is a major tributary that joins the river at Bacchus Marsh. Some upper tributaries 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.

The Werribee River provides water for urban users in Melton and Bacchus Marsh, irrigation districts at Bacchus Marsh and Werribee and private diverters west of Werribee. The estuarine reaches are valued for recreational fishing and the lower freshwater reaches pass through the Werribee Tourist Precinct, which attracts many visitors from Melbourne and beyond.

During winter 2012, environmental water deliveries provided much needed flows to Coimadai Creek (below Lake Merrimu to Melton Reservoir), the lower Werribee Diversion Weir and the estuary. This was facilitated through the joint purchase of allocation by Melbourne Water and the VEWH, increasing the water available to meet priority watering actions in the system.

Melbourne Water Environmental Water Planner, Bill Moulden, said communities in outer western Melbourne place a high intrinsic value on the Werribee River.

“It’s good to see such great community support and interest in what we’re trying to achieve by providing environmental flows to improve the health of the Werribee River,” Bill said.

*Images by Melbourne Water*

*Left to right: Werribee River; Merrimu release;*

*Local community members watching the*

*Merrimu release*





“Both Coimadai Creek and the lower Werribee River are used extensively for recreational purposes. People really value these waterways, particularly as this area has such a dry climate.”

Environmental releases into Coimadai Creek during 2012-13 also resulted in unexpected but welcome benefits for macroinvertebrates and frogs.

“We observed an increase in frog activity following the release of environmental water at a high flow rate, which inundated areas of frog habitat,” Bill said.

“These unexpected outcomes will broaden our focus on fish and vegetation to include macroinvertebrates

and frogs when planning future environmental water releases in the creek.”

More information on the Werribee system is available in the VEWB *Seasonal Watering Plan 2013-14*, or by visiting the Melbourne Water website at [www.melbournewater.com.au](http://www.melbournewater.com.au).

### Environmental objectives

Providing suitable habitat to encourage self-sustaining fish populations in the river and estuary; promoting the maintenance of diverse macroinvertebrate populations; providing suitable habitat for water-dependent species such as platypus; and improving the extent and condition of in-stream vegetation

### Water source (entitlement)

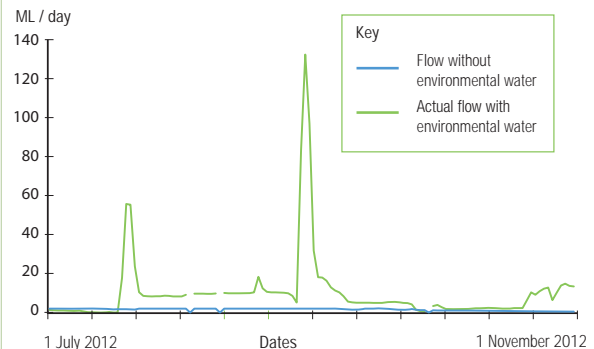
Werribee River Environmental Entitlement 2011

### Volume delivered in megalitres (ML)

- 2,149

### Werribee flow snapshot

This hydrograph shows how environmental water contributed to winter/spring high flows and freshes in Coimadai Creek. Flows were recorded below Lake Merrimu.



# barwon system

**Waterway manager** – Corangamite Catchment Management Authority (CMA)

**Storage manager** – N/A

Large numbers of birds flocked to the lower Barwon wetlands to feed and breed in response to inflows from the Barwon River

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, and are also part of the Lake Connewarre State Game Reserve. The wetlands are a popular area for recreational activities for the communities surrounding Geelong and the Bellarine Peninsula.

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

Corangamite CMA Environmental Water Reserve Officer, Jayden Woolley, said large numbers of birds were observed feeding in shallow water and exposed mud banks as the water level dropped in the wetlands over the summer months.

"One of the most significant outcomes that we were able to achieve was to mimic a natural wetting and drying cycle at Hospital Swamps in 2012-13," Jayden said.



*Images by Corangamite CMA*

*Left to right: Reedy Lake; Reedy Lake; Jayden Woolley*

*Image by Andrew Attewell*

*Top right: Yarra pygmy perch*



“The abundant birdlife across the wetlands clearly demonstrates the important function a wetting and drying cycle plays in providing habitat for birds and all other life dependant on the wetland system.”

Much was learned in 2012-13 from addressing key knowledge gaps and involving stakeholders in planning for environmental water regimes.

“Since the creation of the lower Barwon Environmental Entitlement in 2011, a series of investigations, including stakeholder consultation, have been undertaken to identify the most appropriate watering regime for Reedy Lake and Hospital Swamps,” Jayden said.

“This has been undertaken to identify the key environmental, social and economic issues at play at this internationally significant Ramsar listed wetland complex. It will help to inform future environmental water management at the site.”

More information on the Barwon River is available in the VEW **Seasonal Watering Plan 2013-14**, or by visiting the Corangamite CMA website at [www.ccma.vic.gov.au](http://www.ccma.vic.gov.au).

Environmental objectives	
Maintaining a high diversity of plant communities to support waterbirds, fish and other animals dependent on the wetlands	
Water source (entitlement)	Volume delivered in megalitres (ML)
Barwon River Environmental Entitlement 2011	• n/a <sup>1</sup>

*1 This entitlement provides access to unregulated flows, with use dependent on suitable river heights, as specified in the entitlement*



# moorabool system

**Waterway manager** – Corangamite Catchment Management Authority (CMA)

**Storage manager** – Central Highlands Water

Environmental water releases were important in maintaining water quality for the Moorabool River over a dry summer

The Moorabool is an important river for the major urban areas of Geelong and Ballarat, providing water for urban water supply, recreational and agricultural purposes in the region. Despite years of drought, the Moorabool River still retains many environmental values, including native fish of high conservation value and areas of significant remnant vegetation. The river is home to populations of native aquatic species, such as platypus and native fish, including tupong, river blackfish, southern pygmy perch, Australian smelt and the short-finned eel.

“Maintaining flow, and incorporating variability in flows, was the most important factor influencing environmental water management in the Moorabool system in 2012-13,” said Corangamite CMA Environmental Water Reserve Officer, Mark Schultz.

“Without environmental water releases from Lal Lal Reservoir between March and June 2013, flows would have completely stopped, resulting in rapidly deteriorating water quality and posing a serious risk to native fish and other biota that rely on the river.”

“The timing of Barwon Water’s releases for consumptive use over the summer also played a key role in maintaining flow in the Moorabool River.”

Consistent monitoring over the course of the summer allowed environmental flows to be adjusted to maintain water quality. Results from the CMA’s water quality monitoring indicated that the environmental water releases were sufficient to maintain water quality over the driest periods of the summer.

“The CMA’s Waterwatch program has several monitoring sites along the Moorabool at which community volunteers conduct regular water quality and macroinvertebrate monitoring,” Mark said.

*Images by Corangamite CMA*

*Left to right: Moorabool River from Coopers Crossing; Downstream of Sharpes Road Bridge; Upstream of Hunts Bridge*



“This data, along with information we already collect, gave us some indication of the flows and temperature ranges at which water quality was maintained. This will help us with planning in the future – although we also want to do some further work in this area.”

“The cooperation of Central Highlands Water—who delivered our planned environmental flows as required—was also crucial to the successful delivery of environmental water in 2012-13.”

Mark said the results of the environmental watering program were presented to a community meeting in Meredith in April 2013.

“The Moorabool River has important social and recreational values. Its confined valley produces spectacular scenery and it includes parks, picnic sites, lookouts, swimming holes, fishing and camping spots and historic bridges,” he said.

“The community is interested in the results of the environmental watering program, and understands the link between social and recreational values and maintaining an environmentally healthy Moorabool River.”

More information on the Moorabool River is available in the VEW *Seasonal Watering Plan 2013-14*, or by visiting the Corangamite CMA website at [www.ccma.vic.gov.au](http://www.ccma.vic.gov.au).

## Environmental objectives

Maintaining water quality to support self-sustaining fish populations, diverse macroinvertebrate populations and in-stream and riparian vegetation communities

## Water source (entitlement)

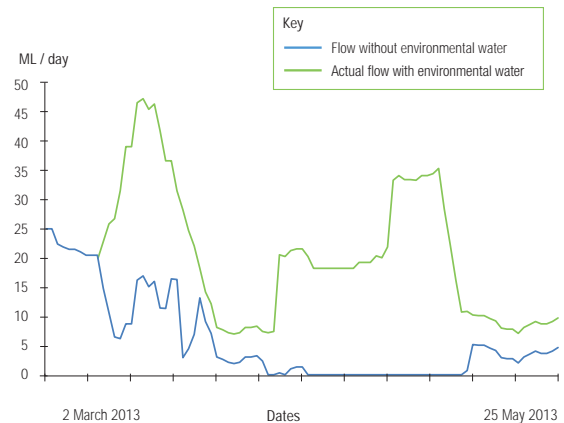
Moorabool River Environmental Entitlement 2010

## Volume delivered in megalitres (ML)

- 2,399

## Moorabool flow snapshot

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





# glenelg system

**Waterway manager** – Glenelg Hopkins Catchment Management Authority (CMA)

**Storage manager** – Grampians-Wimmera-Mallee Water

The Glenelg River made history in 2012-13 when it received the largest and longest environmental water release since the system was first dammed in 1953

The Glenelg River, in south-west Victoria, starts in the Grampians Ranges and runs for over 500 kilometres, 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. The Glenelg River is a central feature of the Lower Glenelg National Park and is a popular place for recreational activities. One reach is listed as a heritage river 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.

Glenelg-Hopkins CMA Water Resources Planner, Bryce Morden, said the environmental water release has had a significant impact on improving fish populations in the Glenelg River.

“Monitoring of fish communities has identified continued recovery of several species since the end of the drought,” Bryce said.

“For example, river blackfish continue to recover as a result of improved in-stream conditions with populations up by 150 percent in areas targeted by integrated river health works and environmental flows, which is a great result.”

“Anglers along the Glenelg River are also reporting one of the most successful years in several decades.”

Bryce said estuary perch were collected far into the freshwater reaches for the second year in a row.

*Left: Glenelg River at Fulham Reserve summer fresh, by Bryce Morden*

*Right: Glenelg River near Nelson, by Jarred Obst*

*Far right: Glenelg River at Major Mitchell's crossing, by Bryce Morden*







“Estuary perch had not been observed in the Glenelg River as far upstream as Harrow since the 1960s,” he said.

“Their return is thought to be a result of improved conditions associated with environmental watering and river health works.”

Casterton Angling Club member, Brian Murrell (who is also part of the ‘Friends of the Glenelg River’ group) has been fishing in the Glenelg River since the 1960s. Before 2006, he hadn’t seen estuary perch so far upstream. Now anglers have been catching them consistently.

“The river was drying up fairly consistently during the summer and now there’s constant flow coming down right through the year, which allows the species to migrate and breed,” Brian said.

More information on the Glenelg River is available in the VEW **Seasonal Watering Plan 2013-14**, or by visiting the Glenelg-Hopkins CMA website at [www.ghcma.vic.gov.au](http://www.ghcma.vic.gov.au).

*The Glenelg Hopkins CMA was awarded the Australian Riverprize in 2013, recognising their significant efforts in integrated catchment management in the Glenelg River, including environmental water management.*

#### Environmental objectives

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

#### Water source (entitlement)

Wimmera Glenelg Rivers  
Environmental Entitlement 2010

#### Volume delivered in megalitres (ML)

• 19,386



# Wimmera system

**Waterway manager** – Wimmera Catchment Management Authority (CMA)

**Storage manager** – Grampians-Wimmera-Mallee Water

Environmental water provided a lifeline to the Wimmera system in 2012-13 during the driest spring, summer and autumn on record

The Wimmera system (which includes the Wimmera and MacKenzie rivers and the Burnt, Mt William and Bungalally creeks) lies in western Victoria. It begins in the Pyrenees and flows into Lake Hindmarsh before overflowing into Lake Albacutya, which is a Ramsar-listed wetland. The Wimmera system is home to Victoria's only self-sustaining population of freshwater catfish, and a wide range of significant plant species.

The Wimmera River boasts a wide range of environmental and social values. It is a popular spot

for recreational activities such as boating, fishing and camping, and contains many sites of Indigenous cultural heritage. The lower reach of the Wimmera River downstream of Polkemmet (near Horsham), is listed as a heritage river.

Environmental releases to the Wimmera River from Lake Lonsdale and Taylor's Lake were continuous throughout 2012-13 apart from a planned 'cease-to-flow' event in early summer and two days in October 2012 when operational maintenance occurred.

Wimmera CMA Project Manager, Mark Toomey, said without the release of environmental water during this period, the system would have been in dire straits.

"Without the release of this water the river would not have flowed for most of this extremely dry period," Mark said.

"Recent history indicates there would have been catastrophic increases in salinity and water quality problems that could have led to large-scale fish kills."



*Left: Pelicans at Lake Hindmarsh, by Jonathon Starks*

*Right: Wood ducks on the Wimmera River, by Jonathon Starks*

*Far right: Wimmera River at Glenorchy,  
by Mark Toomey*

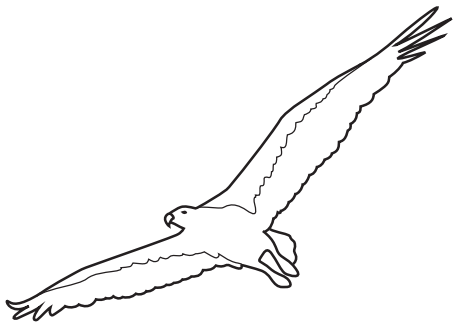
Mark said the delivery of environmental water was also important for the continued recovery of the freshwater catfish – an iconic species of the Wimmera system.

“Recreational anglers were finding that there were a lot more freshwater catfish around in the lower reaches of the river, which is a good indication of the continued recovery of the species following the many years of drought experienced over the last decade,” Mark said.

“Monitoring of fish breeding in the lower MacKenzie River and Burnt Creek also indicated that this area is very important as a nursery for endemic fish such as southern pygmy perch and mountain galaxia.”

“As a result we will now place a high priority on maintaining appropriate flows in these reaches to provide suitable habitat and resources to protect these important fish species.”

More information on the Wimmera River is available in the VEW *Seasonal Watering Plan 2013-14*, or by visiting the Wimmera CMA website at [www.wcma.vic.gov.au](http://www.wcma.vic.gov.au).



#### Environmental objectives

Continuing recovery after prolonged drought; maintaining water quality in the lower reaches of the Wimmera River; supporting the health of Wimmera bottlebrush communities; providing suitable habitat for platypus and high-value fish populations in the MacKenzie River; and maintaining vegetation condition in Burnt Creek

#### Water source (entitlement)

Wimmera Glenelg Rivers  
Environmental Entitlement 2010

#### Volume delivered in megalitres (ML)

- 30,730



# Wimmera mallee wetlands

**Waterway managers** – Wimmera, Mallee and North Central catchment management authorities (CMAs)

**Storage manager** – Grampians-Wimmera-Mallee Water

Environmental water was delivered to a number of wetlands connected to the Wimmera-Mallee pipeline in 2012-13, providing an important water source for native fauna and fringing wetland vegetation in a predominantly dry landscape

The wetlands selected for connection to the Wimmera-Mallee pipeline vary in size and are home to a large variety of native waterbirds. These waterbird species include brolgas, egrets, blue-billed ducks, freckled ducks, Caspian terns and glossy ibis. They also provide a valuable source of water for other native animals such as the threatened growling grass frog. Important vegetation communities are present in the wetlands, such as spiny lignum and cane grass. Many of the wetlands also provide social and recreational values important to local communities, including canoeing and bird watching.

In 2012-13, environmental water was delivered to six wetlands in the Wimmera-Mallee wetland system. This water delivery aimed to improve the condition of vegetation communities, and the health of animals that use these wetlands.

In the Wimmera, water was delivered to Sawpit Swamp, near the junction of the Wimmera River and Yarriambiack Creek.

Wimmera CMA Planning and Project Officer, Greg Fletcher, described how a new investigation of vegetation in wetlands will help environmental water planning, especially in dry years.

“A study of nine wetlands has identified a number of threatened plant species, including ridged water-milfoil that will inform our environmental water priorities in the future,” Greg said.

“Providing water for wetlands across the landscape is important for local fauna too. Despite the hot and dry summer and autumn, the environmental water provided respite and generated a chorus of frog calls within a few days of the tap being turned on.”



*Images by Mallee CMA*

*Left to right: Bull Swamp; Barbers Swamp; White-faced heron*



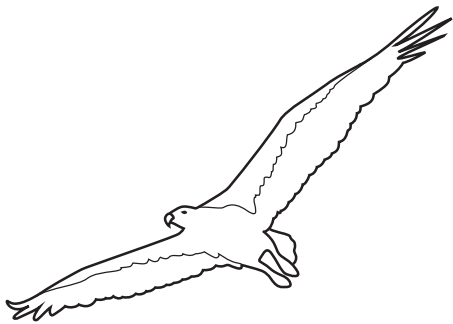
In the Mallee, five wetlands received environmental water, including Barbers Swamp, Moreton Plains, Beulah Weir Pool, Bull Swamp and Roselyn Wetland. The Birchip Landcare Group installed a motion sensor camera at Roselyn Wetland, which enabled additional monitoring of birdlife after environmental flows.

“The birdlife is just amazing – white-faced herons, wedge-tailed eagles, eastern rosellas and an array of ducks were recorded along with the Australian painted snipe, plumed whistling duck and nankeen night heron,” said Birchip Landcare Group Vice President, Keith Barber.

“This was a great way of monitoring how the birdlife in the area was responding to the delivery of environmental water to the wetland.”

No environmental water was delivered to Wimmera-Mallee pipeline wetlands in the North Central region in 2012-13.

More information on the Wimmera-Mallee wetlands is available in the VEW *Seasonal Watering Plan 2013-14*, or by visiting the Wimmera ([www.wcma.vic.gov.au](http://www.wcma.vic.gov.au)), Mallee ([www.malleecma.vic.gov.au](http://www.malleecma.vic.gov.au)) or North Central ([www.nccma.vic.gov.au](http://www.nccma.vic.gov.au)) catchment management authority websites.



#### Environmental objectives

Providing habitat for waterbirds, reptiles and frogs; maintaining the condition of fringing wetland vegetation; and ensuring animal species have habitat and water

#### Water source (entitlement)

#### Volume delivered in megalitres (ML)

Wimmera Glenelg Rivers  
Environmental Entitlement 2010

• 160

#### Wetland

#### Volume delivered (ML)

Moreton Plains

• 22

Roselyn Wetland

• 19

Bull Swamp

• 42

Barbers Swamp

• 15

Beulah Weir Pool

• 50

Sawpit Swamp

• 11



# Goulburn system

**Waterway manager** – Goulburn Broken Catchment Management Authority (CMA)

**Storage manager** – Goulburn-Murray Water

Important lessons were learnt in the delivery of environmental water in the Goulburn River in 2012-13, with new knowledge and adaptive management helping to inform management

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 because of its significant environmental, recreational and cultural values. 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. It also contains many important cultural heritage sites, provides water for agriculture and supports recreational activities such as fishing and canoeing.

Goulburn Broken CMA Environmental Water Flow Coordinator, Geoff Earl, said environmental water management in the Goulburn River continues to focus on recovery of the system after a tumultuous decade of drought followed by floods.

"In 2012-13, conditions were dry, particularly during the spring and summer. However, environmental water releases allowed most priority environmental watering actions to be met."

Geoff said the environmental flows provided to the Goulburn were targeted at improving habitat, migration and breeding opportunities for fish, providing habitat for macroinvertebrates and encouraging the recovery of bank vegetation.

"Importantly, vegetation lost from the lower riverbank during the 2010-11 floods started to return in 2012-13," he said.

Bank instability, including slumping and notching, was an issue in 2012-13 requiring adaptive management to limit damage to the river bank.



*Images by Goulburn Broken CMA*

*Left to right: Goulburn River at McCoys Bridge; Carp Muster (initiative to catch pest carp and protect native fish)*

*Bird images by Keith Ward*

*Purple swamphen; Scarlet robin*

Geoff said incorporating greater variability in the delivery of environmental flows, was an effective approach to managing the risk of bank instability.

“The March 2013 fresh was delivered at a lower flow than the November 2012 fresh to avoid the notched bank level,” he said.

“An expert review into bank vegetation, notching and slumping confirmed the importance of variable flows in limiting bank notching.”

“The continued recruitment of bank vegetation will also improve bank stability over the next few years, and recruiting remains a priority for flow management.”

Water source (entitlement)	Volume delivered in megalitres (ML)
Environmental Entitlement (Goulburn System - NVIRP Stage 1) 2012	• 3,953
Environmental Entitlement (Goulburn System - Living Murray) 2007	• 50,344
Parks Victoria donation*	• 33
Commonwealth Environmental Water Holdings	• 201,097

*\*Parks Victoria donated a small amount of water from entitlements held in the Goulburn system. This water was used to contribute to flows in the Goulburn River in late 2012-13.*

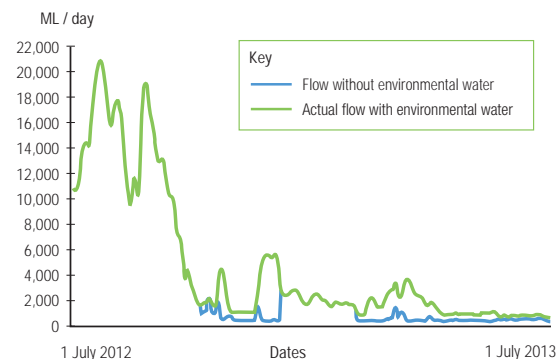
More information on the Goulburn River is available in the VEWB **Seasonal Watering Plan 2013-14**, or by visiting the Goulburn Broken CMA website at [www.gbcma.vic.gov.au](http://www.gbcma.vic.gov.au).

### Environmental objectives

Providing appropriate habitats within the river for spawning, recruitment and migration of fish species, such as golden perch; enhancing the extent and diversity of aquatic vegetation; maintaining the diversity of riparian vegetation; and improving the abundance and species diversity of macroinvertebrate communities

### Goulburn flow snapshot

This hydrograph shows how environmental water contributed to spring, summer and autumn 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

Improving conditions for native fish was the focus of environmental watering in the lower Broken Creek in 2012-13

The lower Broken Creek, flows north-west from the Broken River into the River Murray, just downstream of Barmah Forest. It supports threatened plant and animal species, including six native fish species of state and national conservation significance. The lower Broken Creek supports valuable riparian vegetation and is also a popular area for recreational fishing and walking.

Goulburn Broken CMA Environmental Water Flow Coordinator, Geoff Earl, said environmental water releases in 2012-13 were aimed at maintaining and improving native fish populations.

“From September to December 2012, Commonwealth environmental water, consumptive water en route and unregulated flows contributed to achieving the environmental flow target of around 250 ML per day, to increase large-bodied native fish habitat during the migration and breeding season,” Geoff said.

“This was the first year this watering action has been able to be provided.”

“Flows were then progressively reduced from 250 to 150 ML per day, from January to May 2013, to maintain water quality.”

Geoff said the environmental watering needs of the lower Broken Creek vary throughout the year in response to changes in water quality, which pose a threat to fish populations.

“Adaptive decision making is very important with environmental water management in the Broken Creek,” Geoff said.

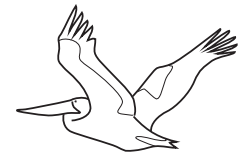


*Images by Goulburn Broken CMA*

*Left to right: Broken Creek at Cemetery Bridge, looking downstream; Broken Creek at James Bridge, looking downstream.*

*Image by Keith Ward*

*Far right: Yellow-billed spoonbill*



“Flows are managed to maintain appropriate water quality, and manage the growth of azolla (an aquatic fern that can form large mats on the surface of the water).”

“Low dissolved oxygen, including that resulting from excessive azolla growth, dramatically reduces the amount of suitable habitat for fish and potentially leads to fish deaths.”

“There was no significant azolla growth during 2012-13 and therefore no flows were required to manage this. Dissolved oxygen was also kept at better levels than in previous years.”

In addition to environmental water delivery to the lower Broken Creek, 51 ML of Commonwealth environmental water was delivered to the upper Broken Creek in March 2013. The summer/autumn pulse provided natural flow variability, wetted vegetation at the channel edge, and assisted in maintaining fish habitat, and improving water quality.

More information on the Broken system is available in the VEWB **Seasonal Watering Plan 2013-14**, or by visiting the Goulburn Broken CMA website at [www.gbcma.vic.gov.au](http://www.gbcma.vic.gov.au).

#### Environmental objectives

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

#### Water source (entitlement)

#### Volume in megalitres (ML)

Commonwealth Environmental Water Holdings

• 41,230



# Campaspe system

**Waterway manager** – North Central Catchment Management Authority (CMA)

**Storage managers** – Goulburn-Murray Water, Coliban Water

Active and adaptive environmental water management assisted in the continued recovery of the Campaspe River in 2012-13

The Campaspe River, which flows to its confluence with the River Murray at Echuca, lies in north-central Victoria. The Campaspe River provides irrigation water to an agriculturally diverse catchment, including dryland, dairy and intensive horticultural farming. The river system has high environmental values because of its banks of river red gums and its healthy native fish populations, including Murray cod, golden perch and silver perch. It also supports a diverse range of significant bird species, such as the threatened brown tree creeper.

North Central CMA Environmental Flows Project Manager, Darren White, said environmental watering in the Campaspe is all about adaptive management.

“Through a combination of storage spills and managed environmental flow releases, we were able to achieve a number of priority watering actions in 2012-13,” Darren said.

“Winter baseflows were interspersed with winter high flows from managed releases and storage spills, achieving the important winter flow regime, with the exception of bankfull flows, for the first time in 10 years. These flows provided connectivity and promoted the movement of fish throughout the river system,” Darren said.

Summer baseflows were also maintained, with a summer fresh event provided in the lower reaches of the Campaspe River.

Darren said the creation of an environmental entitlement for the Campaspe will mark a new era in environmental water management for this important Victorian river.

“The establishment of the new Campaspe Environmental Entitlement will mean a fundamental



*Images by North Central CMA  
Left to right: Campaspe River from English's Bridge;  
Doaks Reserve; Bachhouse Lane*

shift in flow management for the Campaspe River from 2013-14 onwards,” he said.

“The focus will then be on providing winter baseflows and high flow events, if not provided naturally. These are the flows that have been most affected by storages and river regulation, making them a high priority for environmental water delivery to restore a more natural flow regime.”

More information on the Campaspe River is available in the VEW **Seasonal Watering Plan 2013-14**, or by visiting the North Central CMA website at [www.nccma.vic.gov.au](http://www.nccma.vic.gov.au).

Water source (entitlement)	Volume delivered in megalitres (ML)
Goulburn-Murray Water Connections Project water*	• 6,660
Environmental Entitlement (Campaspe River - Living Murray Initiative) 2005	• 3,406
Commonwealth Environmental Water Holdings	• 6,821

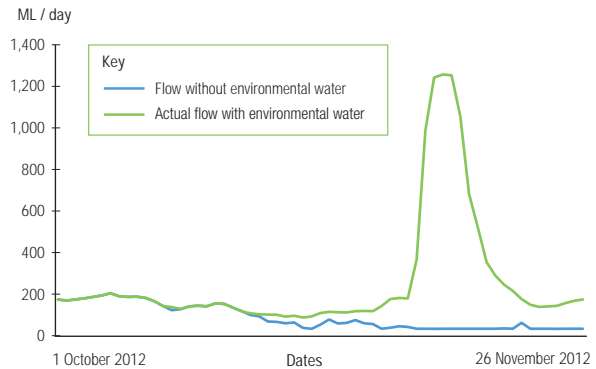
*\*Use of environmental water recovered in the Campaspe under the Goulburn-Murray Water Connections Project in 2012-13 was facilitated through an allocation bank account and water use registration, until the environmental entitlement was granted at the end of 2012-13.*

### 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; and enhancing river red gum recruitment

### Campaspe flow snapshot

This hydrograph shows how environmental water contributed to a spring fresh in the Campaspe River. Flows were recorded downstream of Waranga Western Channel/Campaspe Siphon.





# Loddon system

**Waterway manager** – North Central Catchment Management Authority (CMA)

**Storage manager** – Goulburn-Murray Water

The unmistakable call of hundreds of frogs is one indicator that environmental flows are doing some good for the previously highly-stressed Loddon River

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.

North Central CMA Environmental Water Reserve Officer, Phil Slessar, said an increase in frog calls is a good indicator of the benefits that environmental water brings to the river.

"After a natural bankfull in August 2012 and then a spring fresh released in November, we observed large numbers of frog calls in and around the river," Phil said.

"This is evidence that with the release of environmental water, we're providing improved habitat for frog species such as pobblebunks, and spotted marsh frogs to breed."

"We also noticed an increase in waterbirds and a clear improvement in the condition of red gum and black box canopies."

Local landholder, Paul Haw, is an advocate for the health of the Loddon River. Paul has witnessed a positive change in the health of the Loddon system since the introduction of environmental flows.

"It has been really beneficial for the red gums along the river and has helped to establish reeds and rushes which is important."

"Some of the wetlands around the Loddon have been spectacular with the number of birds they've attracted and the improvement in health of river red gums."

For the first time, the Loddon River downstream of Loddon Weir received all planned priority watering actions, with a natural bankfull flow in August 2012.



*Images by North Central CMA*

*Left to right: Durham Ox Bridge downstream; Whites Lane; Loddon environmental flows information day at Durham Ox*

“We were really pleased that we could achieve all of our planned watering actions in that stretch of the river for the first time,” Phil said.

“The great outcomes that we’re seeing here in terms of improved vegetation condition, increased bird numbers and frog activity is really a result of not only this year’s efforts, but an ongoing effort to improve the health of this location.”

In addition to environmental water delivery to the Loddon River, a spring fresh was delivered to Pyramid Creek, a tributary of the Loddon River. A total of 525 ML of environmental water was used to account for losses associated with the delivery of consumptive water en route in this event. The fresh improved habitat availability and provided connectivity and migration cues for a range of native fish species, including Murray cod and golden perch.

More information on Loddon River is available in the VEW *Seasonal Watering Plan 2013-14*, or by visiting the North Central CMA website at [www.nccma.vic.gov.au](http://www.nccma.vic.gov.au).

### Environmental objectives

Continuing to build resilience; maintaining channel form; maintaining in-stream and riparian vegetation; reducing encroachment of terrestrial vegetation; and maintaining water quality

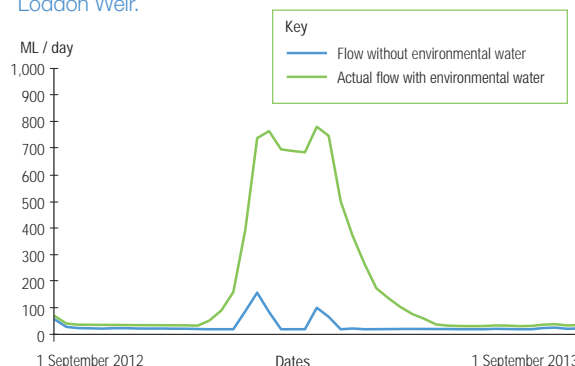
### Water source (entitlement)

### Volume delivered in megalitres (ML)

Goulburn River Environmental Entitlement 2010	• 1,886
Environmental Entitlement (Goulburn system – NVIRP Stage 1) 2012	• 765
Bulk Entitlement (Loddon River – Environmental Reserve) 2005	• 4,759
Commonwealth Environmental Water Holdings	• 2,746
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	• 525

### 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** – Goulburn Broken, Mallee and North Central catchment management authorities (CMAs)

**Storage managers** – Goulburn-Murray Water and Lower Murray Water

## Mallee wetlands

Environmental water was received in four priority wetland sites in 2012-13 in the Mallee region, including Sandilong Creek, Robertson Wetland, Brickworks Billabong and Cardross Lakes. Wetlands situated higher in the floodplain were the focus for the 2012-13 environmental watering program, as most lower elevation wetlands received water from naturally high Murray flows in 2010 and 2011.

Delivery of environmental water was targeted to support existing refuges for the endangered Murray hardyhead. Mallee CMA Coordinator Waterways,

Louise Searle, said environmental water is making more sites available and improving vegetation for this species.

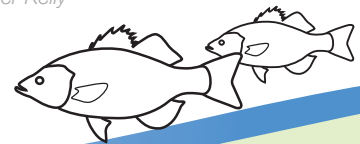
“The environmental water received at the large Cardross Lakes site was able to encourage vegetation growth and make the site more suitable to sustain this population,” Louise said.

“At Brickworks Billabong, the addition of environmental water to the already high natural flows allowed the site to respond more quickly, particularly the aquatic vegetation. This site is naturally connected to the River Murray so we are preparing it for a future translocation of fish.”

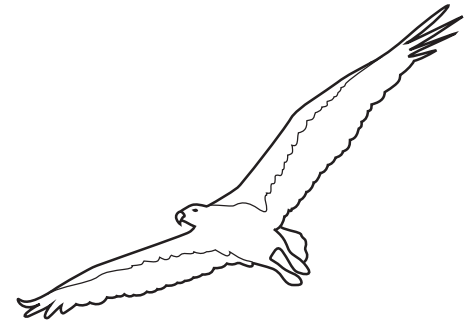
Louise said the positive response of plant and animal life at wetlands after environmental watering was magnificent.



*Images by Mallee CMA  
Left to right: Robertson Wetland,  
Sandilong Creek 'Catch a Carp' day,  
and Waterway Manager Peter Kelly  
surveys the wetlands.*



# floodplains

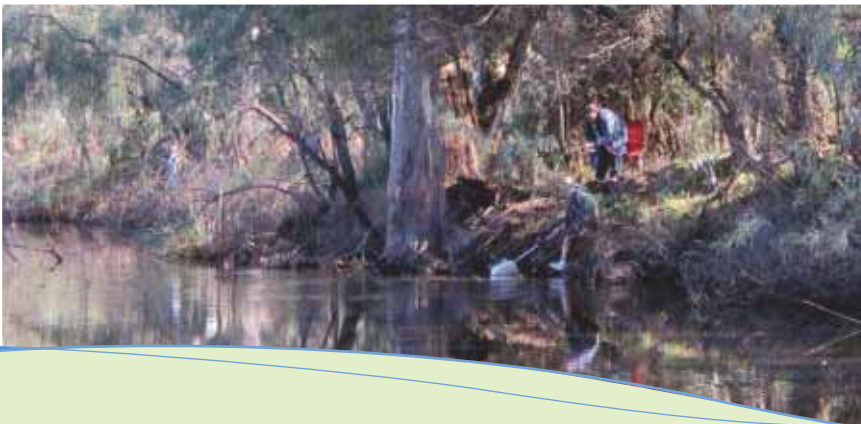


“We were really pleased with the outcome at Robertson Wetland, which hadn’t seen water since 1993, and the breeding activity we observed,” Louise said.

The other recipient site, Sandilong Creek, has benefited from environmental water since 2010. “We have seen a marked improvement in riparian health and a reduction in the spread of cumbungi (a semi-aquatic plant that can out-compete other native plants),” Louise explained.

“The Riverside Golf Course, which Sandilong Creek runs through, also held a ‘Catch a Carp’ day upon the completion of the environmental water release, which was very well attended and demonstrated the public support for the health of the river.”

Water source (entitlement)	Volume delivered to all northern wetlands in megalitres (ML)
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	• 5,343
Mallee wetlands	Volume delivered in megalitres (ML)
Sandilong Creek	• 150
Robertson Wetland	• 850
Brickworks Billabong	• 73
Cardross Lakes	• 1,027





# North Central wetlands

Thousands of waterbirds flocked to wetlands in the north central Victorian region in 2012-13 following a combination of natural flows and delivery of environmental water. Round Lake, McDonalds Swamp and Richardson’s Lagoon all received environmental water.

Following major flooding in the region during January and February 2011, most of the wetlands held water throughout 2011-12 and some into 2012-13. As a result, most of the wetlands did not require environmental water and were left to naturally draw down.

North Central CMA Environmental Water Reserve Officer, Bree Bisset, said the environmental water received at the three sites, McDonalds Swamp, Round Lake and Richardson’s Lagoon in 2012-13, was of benefit to waterbirds. Monitoring at McDonalds Swamp and Richardson’s Lagoon counted almost 5,000 waterbirds at McDonalds, including blue billed ducks, hardhead, glossy ibis, royal spoonbills, musk ducks and pied cormorants.

“The data suggests that the drying phase is important for promoting waterbird numbers. For example, at Lake Cullen, which was not provided with environmental water in 2012-13, over 5,500 individual birds were observed, including 42 freckled ducks, a species considered rare in this region.”

Bree said surveys undertaken at Round Lake established that Murray hardyhead breeding had occurred.

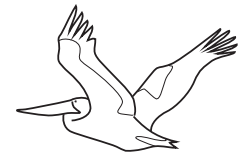
“Our surveys indicated that Murray hardyhead of multiple age classes were present at Round Lake, demonstrating that they have continued to breed as a result of effective environmental water management, which is a great result for this critically threatened fish,” Bree explained.

“We also witnessed a significant improvement in river red gum health at McDonalds Swamp, with the establishment of river red gum saplings, indicating that environmental water management is assisting with the re-establishment of the species at this wetland.”



North Central wetlands	Volume delivered (ML)
Richardson’s Lagoon	• 1,257
McDonalds Swamp	• 1,044
Round Lake	• 418

Images left to right: McDonalds Swamp by North Central CMA. Pink-eared ducks at Reedy Swamp by Keith Ward; Brolga family at Moodies Swamp by Goulburn Broken CMA



## Goulburn Broken wetlands

Wetlands in the Goulburn Broken region responded well to a drying phase in 2012-13. After above average and unseasonal rainfalls between 2010 and 2012 many wetlands in the region then experienced prolonged inundation, which can have a negative impact on wetland health.

Goulburn Broken CMA Environmental Water Reserve Coordinator, Simon Casanelia, said “Prolonged inundation can alter wetland vegetation communities by favouring species adapted to these conditions, reducing the diversity and structure of habitat.”

A partnership with Parks Victoria and Goulburn-Murray Water enabled the draw down and ultimate drying of Doctors Swamp and Reedy Swamp. However, Reedy Swamp was only dry for approximately two months before it filled again after an unseasonal rainfall event in February 2013.

“The drying phase resulted in the eradication of carp at Reedy Swamp, which were affecting the wetland habitat. We also saw improved health of river red gums stressed by prolonged inundation at Doctors Swamp,” Simon said.

Simon said fluctuation in weather patterns continues to be a challenge for adaptive environmental water management in the Goulburn Broken region.

More information on the northern wetlands and floodplains is available in the VEWB **Seasonal Watering Plan 2013-14**, or by visiting the Mallee ([www.malleecma.vic.gov.au](http://www.malleecma.vic.gov.au)), North Central ([www.nccma.vic.gov.au](http://www.nccma.vic.gov.au)) or Goulburn Broken ([www.gbcma.vic.gov.au](http://www.gbcma.vic.gov.au)) catchment management authority websites.



# the living murray icon sites

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

**Storage managers** – Goulburn-Murray Water; River Murray Water; South Australian Water Corporation; State Water Corporation (NSW)

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.





Through the Living Murray program, environmental objectives had been identified for all the icon sites. These broadly involved: restoring the extent and distribution of healthy wetland and floodplain vegetation communities; providing feeding and breeding habitat for waterbirds, including colonial nesting species; providing successful breeding and recruitment of native fish; and providing habitat for native frogs, turtles and crayfish.

*Opposite page left to right: White ibis chicks in Boals Deadwoods, by Keith Ward; River red gums near Barmah Lake during floods, by Keith Ward. This page: (top) Aerial view of Hattah Lakes, by Anna Chatfield. Aerial view of Fisherman's Bend, by Keith Ward*





## Barmah Forest

A critical top-up of environmental water helped to save thousands of fledgling ibis in Barmah Forest during 2012-13.

A total of 2,950 ML was supplied to Boals Deadwood wetland in Barmah Forest where colonial waterbirds had initiated nesting following earlier natural flooding between June to October 2012.

Goulburn Broken CMA Living Murray Project Manager, Keith Ward, said environmental water was provided to maintain adequate water depth around the nesting colony to ensure that the birds successfully completed their nesting attempt.

“The colonial nesting waterbirds were predominantly Australian white ibis, although some straw-necked ibis and a small number of royal spoonbill were also nesting,” Keith said.

“The nests are typically one to one and a half metres from the ground and must be surrounded by flooding for the parent birds to remain. This is presumably due to the decreased risk of predation that could otherwise occur from predators such as pigs and foxes which tend not to enter areas that are deeply flooded.”

Keith said environmental water was managed to maintain flooding at nesting sites until the bulk of the breeding attempt had successfully concluded.

“Natural flood regimes would have frequently resulted in successful nesting outcomes, but river regulation now truncates the frequency, depth and duration of flooding. This commonly causes nesting sites to prematurely dry which results in nest abandonment,” he said.

“This was the developing situation in spring 2012 until we intervened with environmental water.”

Keith said an estimated 2,200 birds, 90 percent being Australian white ibis with the remainder being straw-necked ibis and about 20 royal spoonbill, are estimated to have successfully fledged in Barmah Forest.

“Without intervention, it is almost certain that the colonies would have prematurely abandoned the nesting attempt at chick stage, effectively leaving thousands of young waterbirds to die,” he said.

“The flooding also resulted in providing feeding



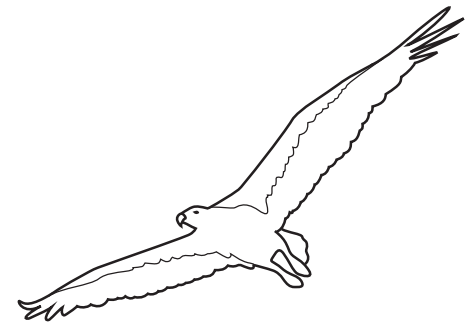
*Images by Keith Ward*

*Left to right: Little Rushy Swamp; White ibis chicks in Barmah Forest; Spotted marsh frog near Barmah Lake during floods; Keith Ward undertaking monitoring; (top) Spiny mudgrass at Little Rushy Swamp*

habitat for four threatened waterbird species that were observed in the wetlands, including the endangered Australasian bittern and little bittern, and the vulnerable royal spoonbill and white-bellied sea-eagle.”

In addition to this delivery, a small volume (12,000 litres) of VEWB water was extracted by CSIRO for use in an experiment exploring the tolerance of Giant rush seedlings to different flood conditions. The results of this project are expected to assist in understanding watering regimes that will be effective in managing the extent of giant rush in Barmah Forest.

More information on Barmah Forest is available in the VEWB *Seasonal Watering Plan 2013-14*, or by visiting the Goulburn Broken CMA website at [www.gbcma.vic.gov.au](http://www.gbcma.vic.gov.au).



Water source (entitlement)	Volume delivered in megalitres (ML)
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 (Living Murray)	<ul style="list-style-type: none"> <li>• 2,950</li> </ul>



## Hattah Lakes

No environmental water was delivered at the Hattah Lakes during 2012-13 due to the continued construction of large-scale environmental structural works.

The structural works, funded by the Living Murray program, includes the construction of a permanent pumping station near the junction of the River Murray and Chalka Creek to deliver water to the lakes. It also includes the construction of three new regulators and three levee banks to hold environmental water within the lakes and on the surrounding floodplain.

These works will enable the delivery of water to the lakes to achieve environmental benefits that would normally require a natural flood with high and extended river flows. The works will make it possible to achieve the environmental outcomes of a natural flood using significantly less water and during normal river operations.

Mallee CMA Coordinator Waterways, Louise Searle, said the works will be commissioned in 2013-14.

“We’re really looking forward to having the flexibility to deliver larger volumes of environmental water to this important lakes system,” Louise said.

“The works will ensure that we’re delivering environmental water as efficiently and effectively as possible.”

More information on the Hattah Lakes is available in the VEW **Seasonal Watering Plan 2013-14**, or at [www.malleecma.vic.gov.au](http://www.malleecma.vic.gov.au).

*Mallee CMA was awarded the Banksia Sustainability Award for Water and the Premier’s Sustainability Award in 2013 for its work towards improving the health of the Hattah Lakes.*

*Images by Mallee CMA. Below left to right: Messengers Regulator at Chalka Creek pump site, Hattah; Chalka Creek pumps*





## Lindsay-Wallpolla Islands (including Mulcra Island)

A drying regime was carried out at Lindsay, Wallpolla, and Mulcra Islands during 2012-13 while construction of environmental works continued at Mulcra Island.

The Lindsay, Wallpolla and Mulcra Islands are influenced by River Murray flows downstream of the Darling River junction. With the exception of parts of Mullaroo and Wallpolla creeks, which are permanently inundated, the wetlands have not received complete inundation in the last decade, with only minor wetting of some sites since 2005.

Mallee CMA Coordinator Waterways, Louise Searle, said in 2010-11, natural flows in excess of 90,000 ML per day in the River Murray downstream of the Darling anabranch inundated the lower-lying parts of the site, and provided strong flows through the anabranches and creeks.

“Given the wet couple of years we’ve had, it was not necessary to deliver environmental water at Lindsay-Wallpolla Islands in 2012-13,” she said.

*Images by Mallee CMA*

*Clockwise from top: Black box on Lindsay Island; Regulator on Potterwakagee Creek, Mulcra Island; Mullaroo Creek mouth at Murray on Lindsay Island*

“This situation will change when the construction of environmental works is complete, as they will help manage flows through the anabranches and allow wider inundation of wetlands and floodplain communities.”

The environmental works being constructed at Mulcra Island under the Living Murray program will be commissioned in 2013-14.

More information about the Lindsay-Wallpolla Islands is available in the VEW *Seasonal Watering Plan 2013-14*, or at [www.malleecma.vic.gov.au](http://www.malleecma.vic.gov.au).





# Gunbower Forest

While Gunbower Forest itself did not require environmental water in 2012-13, flows provided to Gunbower Creek helped to maintain habitat for the iconic Murray cod.

“Gunbower Forest was still holding water from flooding in previous years in 2012-13, so environmental water wasn’t required during this period,” said North Central CMA Environmental Water Project Officer, Kathryn Stanislawski.

“However, we did deliver some environmental flows to Gunbower Creek, aimed at maintaining habitat for native fish populations within the creek.”

Kathryn said the potential for recovery of native fish is high in the Gunbower system.

“Gunbower Creek contains a diverse and significant population of native fish species, and environmental watering improves habitat quality. This then maintains a source of fish for the recolonisation of surrounding waterways,” she said.

Kathryn said fish monitoring results were presented to the community as part of Gunbower Week – a week-long community event aimed at sharing knowledge about Gunbower Forest.

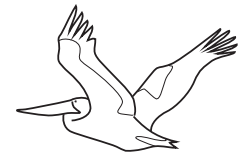
“During Gunbower Week we held a fish forum where our fish ecologist presented information about the Gunbower Island fish populations and the results of our annual fish monitoring program,” she said.

“Initial monitoring results show that there are better populations of some large-bodied fish, including Murray cod, than in the previous two years as a result of environmental watering.”

“We think it’s important to share this information with the community who place a high value on Gunbower Creek and the iconic fish species it supports.”

Water source (entitlement)	Volume delivered in megalitres (ML)
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 (VEWH unregulated)	• 6,301
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 (Living Murray unregulated)	• 5,452
Commonwealth Environmental Water Holdings	• 2,159





More information on Gunbower Forest is available in the VEWB **Seasonal Watering Plan 2013-14**, or by visiting the North Central CMA website at [www.nccma.vic.gov.au](http://www.nccma.vic.gov.au).

*Opposite page images by North Central CMA  
Left to right: Clayton Sharpe with a Murray River turtle;  
Kathryn Stanislawski measures a Murray cod; Gunbower Creek  
Image this page by Anna Chatfield, Little Gunbower Creek at  
Gunbower Forest*



# Ovens system

**Waterway manager** – North East Catchment Management Authority (CMA)

**Storage manager** – Goulburn-Murray Water

Environmental water held by the Commonwealth Environmental Water Holder complemented the variability of natural flows in the Ovens River in 2012-13

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. The Ovens is one of the least regulated systems in the Murray-Darling Basin. 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. It is also home to the threatened Macquarie perch and the trout cod.

North East CMA Environmental Water Resource Officer, Catherine McInerney, said the 20 ML of environmental water released in 2012-13 was designed to replicate a natural pulse in river flow.

“This release was aimed at connecting habitat, allowing fish to move between habitats and rejuvenating biofilms – which are slimy films of bacteria, other microbes and organic materials that cover underwater surfaces including rocks and snags.”

“The fresh helped to maintain the natural variability and connectivity of flows that provide food resources and habitat for macroinvertebrates and provide water of sufficient depth to allow fish movement between habitats.”



*Images by North East CMA*

*Left to right: Ovens River at Nimmo Bridge, Myrtleford; Lower Ovens; Catherine McInerney; (top) Buffalo River downstream at Osbournes Bridge, Nug Nug*

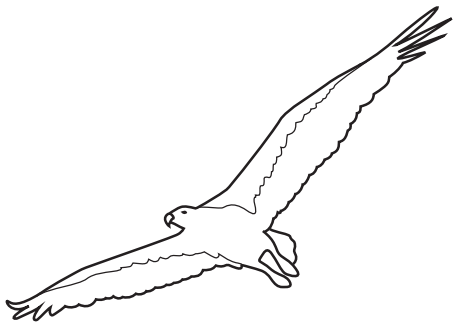


Catherine said the Ovens system is unique among rivers in the Murray-Darling Basin because it still has a relatively natural flow pattern.

“The condition of the Ovens system is relatively good due to the fact that it still has a close to natural flow pattern, which is something that we’re aiming to preserve,” she said.

“This is not only done through environmental water entitlements, but through the preservation of flows through the Upper Ovens Water Management Plan, local management plans and through good relationships and continued liaison with water corporations and government departments.”

Environmental objectives	
Maintaining natural flow variability and connectivity; providing food and habitat for macroinvertebrates; and providing water of sufficient depth to allow fish movement between habitats	
Water source (entitlement)	Volume delivered in megalitres (ML)
Commonwealth Environmental Water Holdings	<ul style="list-style-type: none"><li>• 20</li></ul>



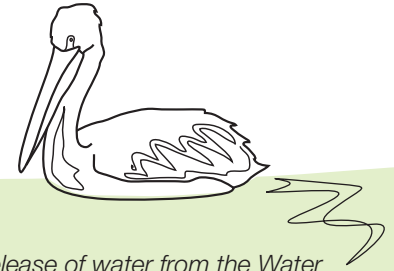
More information on the Ovens system is available by visiting the North East CMA website at [www.necma.vic.gov.au](http://www.necma.vic.gov.au)

*NB: The VEWB has no Water Holdings in the Ovens system*





# glossary



**Bankfull flows** – Flows of sufficient size to reach the top of the river bank with little flow spilling onto the floodplain.

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

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

**Confluence** – The point where two rivers join.

**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.

**Fledgling waterbirds** – Young waterbirds about to leave their nests.

**Flow components** – Components of a river system's flow regime that can be described by timing, seasonality, frequency and duration (for example, freshes, base flows and cease to flow).

**Freshes** – Small or short duration peak flow events. These are flows that exceed the base flow and last for at least several days.

**Heritage rivers** – 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.

**Macroinvertebrates** – Animals that have no backbone and can be seen with the naked eye; they include 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 flows** – 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.

**Ramsar-listed wetland** – A wetland on the Ramsar list due to its international significance in terms of the biodiversity and uniqueness of its ecology, botany (plants), zoology (animals), limnology or hydrology (movement, distribution, and quality of water).

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

**Terrestrial vegetation** – Land-based plants.

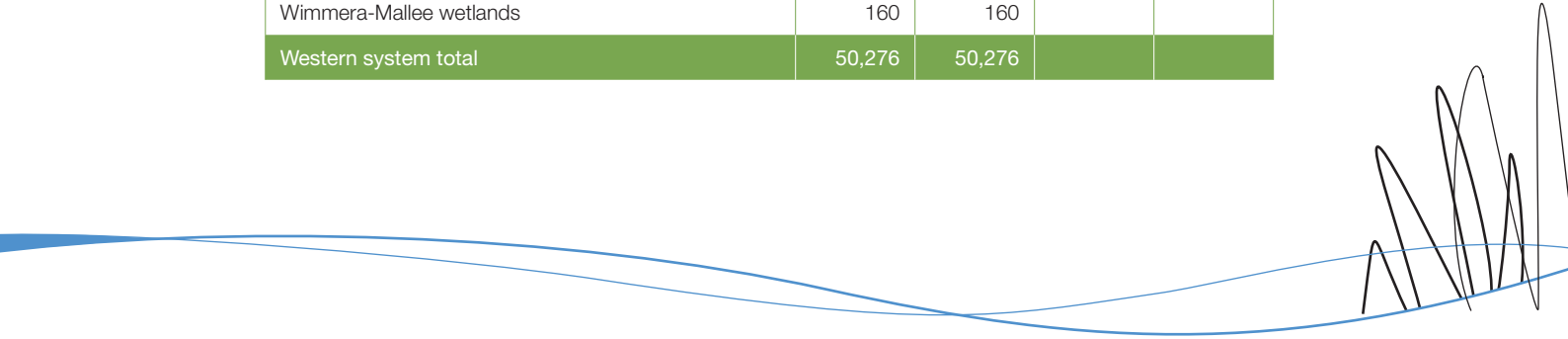
**Tributary** – Smaller river or creek that flows into a larger river.

**Unregulated flows** – Natural stream flows that cannot be captured in major reservoirs or storages.

**Water Holdings** – The environmental water entitlements and allocations held by the VEWH.

**Summary of environmental water delivery 2012–13**

System / site		Total volume used (ML)	Environmental water source		
			VEWH (ML)	CEWH (ML)	TLM <sup>1</sup> (ML)
Southern systems					
Snowy system		162,700 <sup>2</sup>			
Latrobe system	Sale Common	N/A <sup>3</sup>			
	Heart Morass				
	Dowd Morass				
Thomson system		10,936	10,936		
Macalister system		10,811	10,811		
Yarra system		12,589	12,589		
Tarago system		2,176	2,176		
Werribee system		2,149	2,149 <sup>4</sup>		
Barwon system	Reedy Lake	N/A <sup>3</sup>			
	Hospital Swamps				
Moorabool system		2,399	2,399		
Southern system total (excluding Snowy)		41,060	41,060		
Western systems					
Glenelg system		19,386	19,386		
Wimmera system		30,730	30,730		
Wimmera-Mallee wetlands		160	160		
Western system total		50,276	50,276		



## Summary of environmental water delivery 2012–13 (continued)

System / site		Total volume used (ML)	Environmental water source		
			VEWH (ML)	CEWH (ML)	TLM <sup>1</sup> (ML)
Northern systems					
Goulburn system		255,427	3,986 <sup>5</sup>	201,097	50,344
Broken system		41,230		41,230	
Campaspe system		16,887	6,660 <sup>6</sup>	6,821	3,406
Loddon system (excluding Pyramid Creek)		10,155	7,409	2,746	
Pyramid Creek		525	525		
Mallee wetlands	Cardross Lakes	1,027	1,027		
	Robertson Wetlands	850	850		
	Sandilong Creek	150	150		
	Brickworks Billabong	73	73		
North central wetlands	Round Lake	418	418		
	McDonalds Swamp	1,044	1,044		
	Richardson's Lagoon	1,257	1,257		
Barmah Forest		2,950	0.01		2,950
Gunbower Creek		13,912	6,301	2,159 <sup>7</sup>	5,452
Ovens River		20		20	
Northern system total		345,925	29,700	254,073	62,152
TOTAL WATER USE		437,261	121,036	254,073	62,152

1 The Living Murray. This water is held in trust by VEWH.

2 Water delivered to the Snowy River was sourced from water savings projects and entitlements held in Victoria and New South Wales. Allocations against these entitlements are pooled and prioritised for use annually.

3 Use of these entitlements is dependent on suitable river heights, as specified in both the Latrobe and Barwon environmental entitlements, rather than a volumetric entitlement.

4 Includes water shares purchased by Melbourne Water and VEWH (850 ML).

5 Includes a 33 ML donation from Parks Victoria.

6 Sourced from water made available under Goulburn-Murray Water's Connections Project.

7 Return flows from the Goulburn system were reused for this delivery.

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# environmental health

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