



Australian Government

Commonwealth Environmental Water Office

**Commonwealth Environmental Water**

Portfolio Management Plan

# Victorian Rivers in the Murray-Darling Basin

2016–17



Front cover image credit: Goulburn River. Photo by Commonwealth Environmental Water Office

Back cover image credit: Moodie Swamp. Photo by Commonwealth Environmental Water Office

The Commonwealth Environmental Water Office respectfully acknowledges the traditional owners, their Elders past and present, their Nations of the Murray-Darling Basin, and their cultural, social, environmental, spiritual and economic connection to their lands and waters.

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# Commonwealth environmental water portfolio management planning

## Commonwealth environmental water

The Commonwealth Environmental Water Holder is an independent statutory position established by the *Water Act 2007* to manage the Commonwealth environmental water holdings. The Commonwealth Environmental Water Holder leads and is supported by the Commonwealth Environmental Water Office (the Office), a division of the Australian Government Department of the Environment.

Under the *Water Act 2007*, Commonwealth environmental water must be managed to protect or restore environmental assets, so as to give effect to relevant international agreements. The *Water Act 2007* also requires that the Commonwealth Environmental Water Holder perform its functions and exercise its powers consistently with and in a manner that gives effect to the Basin Plan and that Commonwealth environmental water is managed in accordance with the Basin Plan's environmental watering plan.

## Purpose of the document

This document sets out the plans for managing the Commonwealth environmental water portfolio in the Victorian Rivers in the Murray-Darling Basin for 2016–17. Efficient and effective management of Commonwealth environmental water requires the utilisation of all portfolio management options, including water delivery, carryover and trade. To support improved outcomes from water use over time, carryover provides the opportunity to optimise water use across water years and to improve water availability early in a water year, while trade provides further capacity to optimise use over the long-term as well as across catchments.

By taking a multi-year approach to planning, portfolio management tools such as use, carryover and trade can be managed for maximising environmental outcomes. The portfolio management plans support transparent, coordinated and adaptive management of the Commonwealth environmental water portfolio, consistent with Basin Plan obligations including the expected outcomes in the Basin-wide environmental watering strategy and the Basin annual environmental watering priorities.

To learn more about the portfolio management planning approach see *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water 2016–17* (available at: <http://www.environment.gov.au/water/cewo/publications>).

## Delivery partners

Commonwealth environmental water is managed in conjunction with and delivered by a range of partners. In the Victorian Rivers our partners include the Victorian Environmental Water Holder, Murray Darling Basin Authority, Goulburn Broken Catchment Management Authority, North Central Catchment Management Authority, North East Catchment Management Authority, Wimmera Catchment Management Authority, Goulburn Murray Water and Grampians Wimmera Mallee Water.

This portfolio management plan has been developed in consultation with our delivery partners.

## Your input

The management of Commonwealth environmental water relies on considerable advice and assistance from local organisations, state governments and others. Individuals and groups within the Murray-Darling Basin community are encouraged to submit suggestions for the management of Commonwealth environmental water. Please contact the Office via: [ewater@environment.gov.au](mailto:ewater@environment.gov.au).

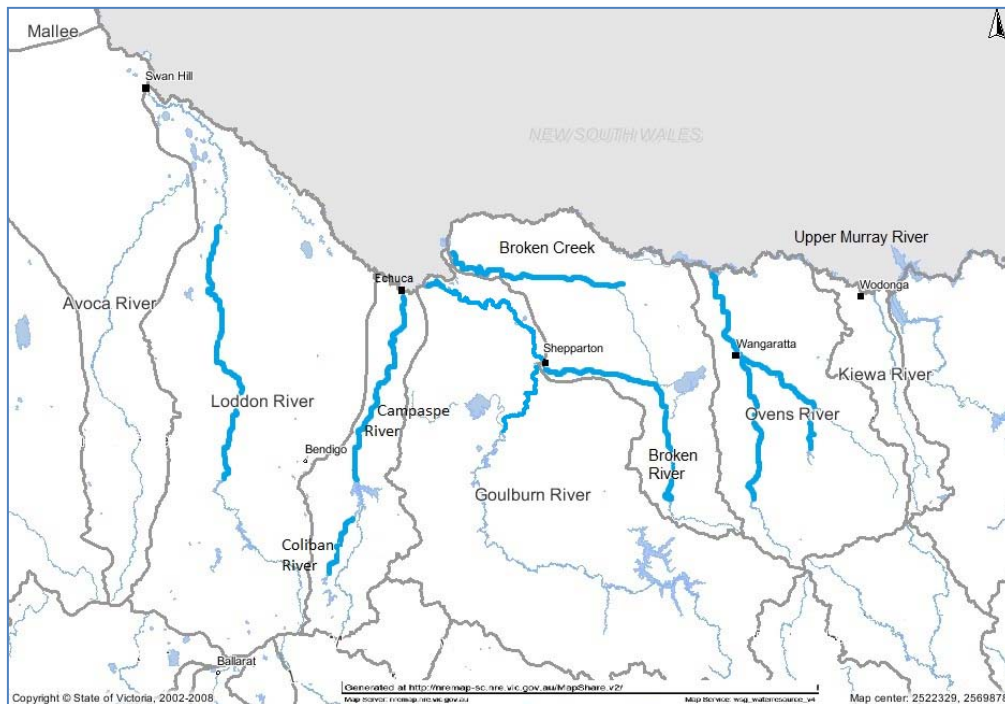
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# Environmental watering in the Victorian Rivers in the Murray-Darling Basin

## 1.1. The Victorian Rivers in the Murray-Darling Basin

The Victorian rivers in the Murray-Darling Basin include the Ovens, Goulburn-Broken, Loddon, Campaspe (Figure 1) and Wimmera catchments. The northern Victorian rivers, particularly the Ovens and Goulburn-Broken, contribute significantly to the water resources of the River Murray, and 11.5 per cent of the Basin's stream flow originates in the Goulburn-Broken (MDBA 2015). Lake Eildon on the Goulburn River is one of the Basin's major water storages. The Wimmera River in central-west Victoria flows into Lakes Hindmarsh and Albacutya terminal wetlands and does not connect to the River Murray. The Victorian Rivers region has a highly developed agricultural sector and a population of almost half a million people (DEPI 2015).



**Figure 1:** Map of the Victorian rivers in the Murray-Darling Basin. The Wimmera catchment is not shown here but is located in central-west Victoria.

Commonwealth environmental water is delivered to the Victorian rivers primarily as in-stream flows via managed releases from storage. Natural cues may be used to inform the use of environmental water in Victorian Rivers, establishing a more natural flow regime and maximising the benefits of environmental water delivery. In lower Broken Creek delivery is via irrigation infrastructure sourced from either the Goulburn system or the Victorian Murray. Commonwealth environmental water use in the Victorian rivers contributes to both enhanced baseflows and freshes. This water can be credited as return flows for further environmental use downstream in the River Murray, with the exception of flows from the Loddon, Ovens and Wimmera rivers.

Goulburn Murray Water is the principal storage and water supply manager in Victorian catchments and responsible for the day to day delivery of water (including environmental water) throughout its river systems and irrigation supply network. Grampians Wimmera Mallee Water is the storage and water supply manager for the Wimmera catchment. The implementation of watering actions within the Victorian Rivers is coordinated by the Victorian Environmental Water Holder and managed by regional waterway managers including the Goulburn-Broken Catchment Management Authority, North Central Catchment Management Authority, North East Catchment Management Authority and Wimmera Catchment Management Authority.



## 1.2. Environmental objectives and outcomes in the Victorian Rivers in the Murray-Darling Basin

The long-term environmental objectives and expected outcomes for the Murray-Darling Basin are described in the Basin Plan's environmental watering plan and the Basin-wide environmental watering strategy. The Basin-wide environmental watering strategy includes quantified environmental outcomes at both a Basin-scale and for each catchment—outcomes relevant for the Victorian Rivers are described in [Attachment A](#).

The Victorian state government is also developing a long-term watering plan for all northern Victorian catchments. The plan will identify the priority environmental assets and ecosystem functions in the catchment, the objectives and targets for these assets and functions, and their watering requirements.

Based on these strategies and plans, and in response to best available knowledge drawing on the results of environmental watering monitoring programmes, the outcomes being targeted by environmental watering in Victorian Rivers are summarised in Table 1. The objectives and targeted outcomes for water-dependent ecosystems will continue to be revised as part of the Commonwealth Environmental Water Office's commitment to adaptive management.

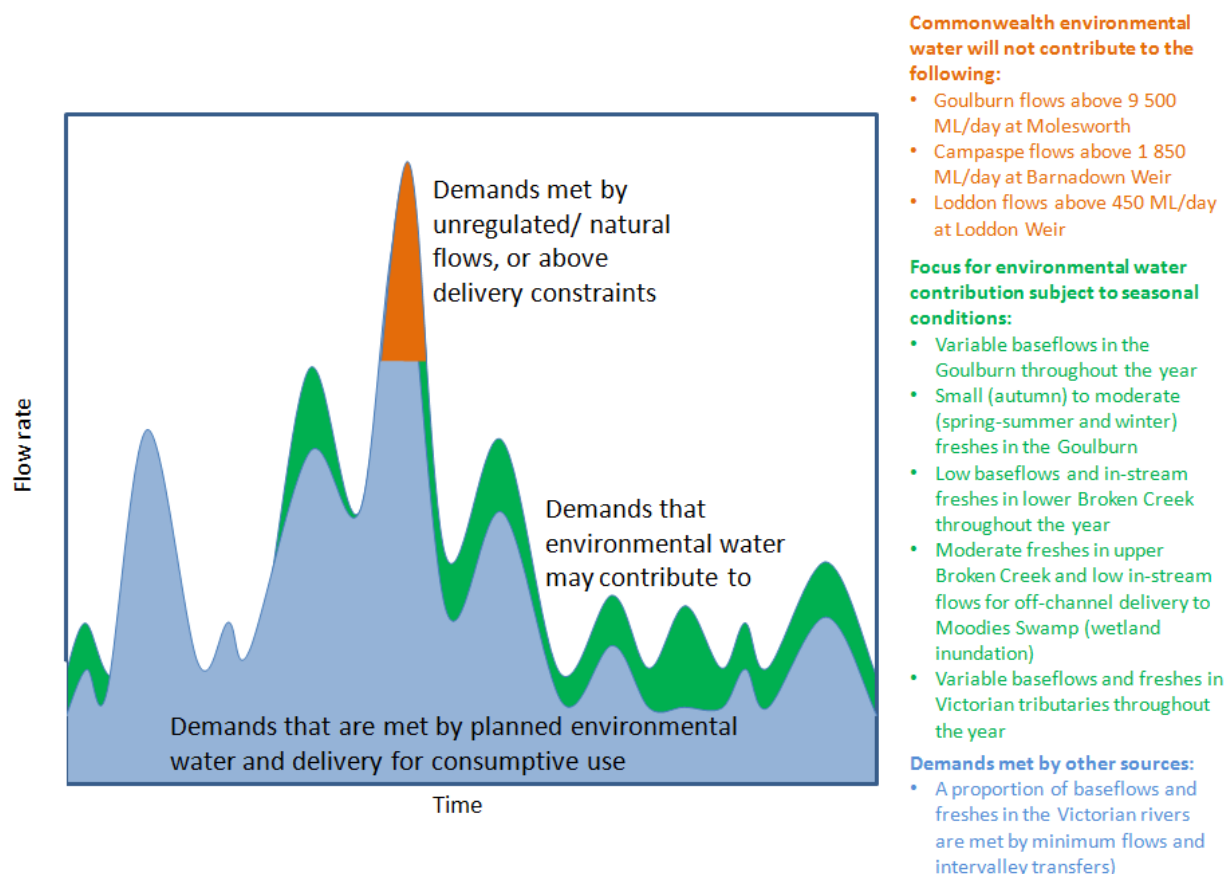
**Table 1:** Summary of outcomes being targeted by environmental watering in the Victorian Rivers in the Murray-Darling Basin

BASIN-WIDE OUTCOMES (Outcomes in red link to the Basin-wide environmental watering strategy MDBA 2014)	EXPECTED OUTCOMES						
	IN-CHANNEL ASSETS				OFF-CHANNEL ASSETS		
	Goulburn River (lower and middle sections)	Upper and lower Broken Creek	Broken River	Campaspe, Loddon, Ovens and Wimmera rivers	Goulburn River wetlands	Lower Broken wetlands	Upper Broken Creek wetlands (Moodie Swamp)
VEGETATION	Maintain and improve riparian and in-channel vegetation cover, extent, condition and diversity.  Increase periods of growth for inundation tolerant vegetation communities that closely fringe or occur within river channels.				Maintain the current extent, condition and diversity of water-dependent vegetation near river channels and on low-lying areas of the floodplain.  Improve condition of black box, river red gum and lignum shrublands.  Improve recruitment of trees within black box and river red gum communities.		
WATERBIRDS	Provide habitat and food sources to support waterbird breeding, survival and recruitment, and maintain condition and current species diversity.						
					Provide opportunities for waterbird breeding, especially brolga in Moodie Swamp		
FISH	Provide flows to support habitat and food sources to promote increased movement, breeding, recruitment and survival of native fish, improve abundance and maintain species richness. Provide native fish passage through fishways.				Provide flow cues to support habitat and food sources and promote increased movement, recruitment and survival of native fish (particularly for floodplain specialists).		
INVERTEBRATES	Provide habitat to support increased microinvertebrate and macroinvertebrate survival, diversity, abundance and condition.						
OTHER VERTEBRATES	Provide habitat and food sources to support survival, maintain condition and provide recruitment opportunities for frogs, turtles, reptiles and mammals						
CONNECTIVITY	Support longitudinal connectivity along Victorian rivers in order to fulfil important environmental functions such as nutrient and sediment transport, organism dispersal and water quality.  Support lateral connectivity through contributing to an increase in the frequency of freshes.				Support lateral connectivity (within constraints) to wetlands and floodplains, by contributing to an increase in the frequency of lowland floodplain flows.		
	Support longitudinal connectivity to the River Murray.						
PROCESSES	Support primary productivity, sediment, nutrient and carbon transport and cycling; biotic dispersal/movement; and channel maintenance.						
WATER QUALITY	Maintain water quality and provide refuge habitat from adverse water quality events (e.g. low DO and hypoxic blackwater), including minimising accumulation of Azolla (aquatic plant) in lower Broken Creek to help maintain DO levels.				Support transport of nutrients and carbon off the floodplain into the river channel and downstream.		
RESILIENCE	Provide drought refuge habitat.						

Information sourced from: Cottingham et al. (2003; 2007; 2010; 2014) GBCMA (2016a-d), NCCMA (2016a-b), WCMA (2016).

### 1.3. Environmental flow requirements

Not all environmental demands can and will be met through the use of held environmental water. Some demands are met by regulated water deliveries for consumptive purposes and intervalley transfers, while others are met by large unregulated/natural flows events or are beyond what can be delivered within operational constraints. Figure 2 shows the broad environmental demands that are in scope for Commonwealth environmental water. Importantly, these are broad, indicative demands and individual watering events may contribute to particular opportunities such as using infrastructure to deliver water to individual wetlands that would otherwise not be possible due to constraints. Also, there may be opportunities for Basin State governments to remove or modify constraints, which will improve the efficiency and/or effectiveness of environmental watering. Further information on delivery constraints are described in [Attachment B](#).



**Figure 2:** Scope of demands that environmental water may contribute to in the Victorian rivers in the Murray-Darling Basin

Based on the above outcomes sought and delivery constraints, specific watering requirements (flow magnitude, duration, timing and frequency) have been identified as being in scope for Commonwealth environmental water. These water requirements are described in Table 3. As with the objectives and targeted outcomes, the environmental water requirements will continue to be reviewed and revised in response to new knowledge.



## 1.4. Monitoring and adaptive management

Operational monitoring is undertaken for all Commonwealth environmental watering actions and involves collecting on-ground data with regard to environmental water delivery such as volumes delivered, impact on the river systems hydrograph, area of inundation and river levels. It can also include observations of environmental outcomes.

Intervention monitoring is also being undertaken in the catchments. It aims to understand the environmental response from Commonwealth environmental watering with respect to targeted objectives and expected outcomes.

Information on the monitoring activities is available at

<http://www.environment.gov.au/water/cewo/catchment/northern-victorian-rivers/monitoring>

Monitoring information is also provided by state governments. The outcomes from these monitoring activities are used to inform portfolio management planning and decision-making.

## 2. Portfolio management in 2016–17

In planning for the management of Commonwealth environmental water, the Commonwealth Environmental Water Office aims to maximise the outcomes achieved from the available water. This includes consideration of the urgency of demands (based on targeted outcomes and watering requirements, watering history and asset condition watering) and the available supply under different resource scenarios. Plans for water delivery, trade and carryover are then made in a multi-year context, with an assessment also undertaken of need for water in future years.

This planning process is outlined in full in Table 3 and summarised in the sections below.

### 2.1. Antecedent and current catchment conditions and the demand for environmental water in 2016–17

Following the breaking of the millennium drought and the record floods in 2010-12, natural flow events and environmental watering actions have resulted in improvements in the condition of many Victorian Rivers in the Murray-Darling Basin and associated wetlands and promoted recovery of environmental values. This recovery has continued under drier conditions in 2015–16 with the provision of environmental water. Environmental water demands in Victorian rivers in 2016–17 are represented in Table 3 and summarised below:

*Goulburn River:* Moderate–High demand. River bank and in-stream vegetation is still recovering following prolonged drought and floods in 2010-2012 and requires frequent wetting to maintain condition and promote recruitment. There is a moderate demand for environmental water to support native fish spawning and recruitment to build on the outcomes of watering in 2013-16. There is a high demand for year round baseflows that provide critical habitat for fish and other biota and to maintain water quality.

*Lower Broken Creek:* High demand. Environmental water is required annually for maintaining dissolved oxygen above tolerable levels for biota and for facilitating native fish passage through fishways. The start to the 2015-16 water year was characterised by a dry winter, high ambient water temperatures; this, coupled with a blue-green algae outbreak in summer/autumn 2016, resulted in low dissolved oxygen levels for extended periods.

*Upper Broken Creek:* Moderate demand. Environmental water, if available, would contribute to maintaining water quality and support condition and reproduction of in-channel vegetation, native fish and macroinvertebrates.

*Broken River:* Moderate demand. Environmental water to contribute to in-stream flows to support vegetation condition, native fish reproduction and condition, macroinvertebrates, disruption of biofilms, channel maintenance, hydrological connectivity and water quality. The priority demand is for small-moderate size freshes in spring as these demands have not been met in several years.

*Goulburn-Broken catchment wetlands:* Moderate to high demand. Following a managed drying phase environmental water in late winter/early spring to promote the growth of EPBC listed flora species and in the case of Moodie Swamp, to encourage brolga breeding.

*Campaspe River:* High demand. Recent monitoring shows the need for continued in-stream watering for the ongoing recovery and protection of aquatic, fringing and riparian vegetation and native fish reproduction and condition.

*Loddon River:* High demand. Following a very dry year in 2015-16 continued in-stream watering for ongoing recovery and protection of native riparian and in-stream vegetation condition, native fish reproduction and condition, platypus breeding and habitat, hydrological connectivity and water quality.

*Ovens River:* High demand. Climatic conditions have been drier than average for the past four years and continued in-stream watering, particularly in conjunction with a bulk water transfer, will contribute to ongoing recovery and protection of targeted fish species. Achieving these ecological needs will also meet broader requirements of a healthy ecosystem, including for frogs, platypus, turtles and waterbirds.

*Wimmera River:* High demand. Should Commonwealth allocations become available (unlikely in 2016–17) environmental water would contribute to in-stream flows to support native fish reproduction and condition, riparian vegetation condition, macroinvertebrate habitat and food, hydrological connectivity and biotic dispersal, and maintaining appropriate water quality.

## Murray-Darling Basin 2016-17 environmental watering priorities

In contributing to these demands, the Commonwealth Environmental Water Office will also be aiming to contribute to the following 2016–17 Basin annual environmental watering priorities relevant for the Victorian Rivers in the Murray-Darling Basin:

- Support viable populations of threatened native fish species by protecting drought refuges and maintaining instream habitats
- Contribute to the long-term recovery of silver perch by improving the viability of existing populations and enhancing conditions for recruitment and dispersal to suitable habitats
- In moderate conditions, contribute to the long-term recovery of threatened species, (including silver perch), through range expansion and the establishment of new populations
- In moderate conditions, support waterbird populations by watering critical breeding and feeding habitats at the important Basin environmental assets for waterbirds
- In moderate conditions, capitalise on opportunities to support waterbird breeding

## 2.2. Water availability in 2016–17

### Forecasts of Commonwealth water allocations

The volume of Commonwealth environmental water likely to be carried over in the Victorian Rivers for use in 2016–17 is estimated to be around 34 GL. Total carryover in the southern-connected Basin is estimated to be between 270-290 GL.

Allocations against Commonwealth water entitlements in the Victorian Rivers in the Murray-Darling Basin are determined by the relevant storage managers and will vary depending on inflows. The following forecasts in Table 2 are based on the best available information including forecasts and historical inflow scenarios.

**Table 2:** Forecasts of Commonwealth water allocations (including carryover) in 2016-17 in the Victorian Rivers as at 30 April 2016.

Entitlement type	Forecasts of Commonwealth water allocations (including carryover) in 2016–17 (GL) <sup>1</sup>					
	Very dry ←————→ Very wet					
	95 percentile	90 percentile	75 percentile	50 percentile	25 percentile	10 percentile
Goulburn <sup>2</sup> -Broken (High/Low Reliability)	142	186	308	308	307	306
Campaspe <sup>2</sup> (High/Low Reliability)	1	2	6	8	7	7
Loddon (High/Low Reliability)	0	<1	3	4	4	4
Ovens (High Reliability)	0.07	0.07	0.07	0.07	0.07	0.07
Wimmera & Glenelg (Bulk Entitlement)	0	0	0	0	0	0
<b>Total – Vic Rivers</b>	<b>143</b>	<b>188</b>	<b>317</b>	<b>319</b>	<b>318</b>	<b>316</b>
<b>Total – Southern-Connected Basin</b>	<b>739</b>	<b>935</b>	<b>1282</b>	<b>1440</b>	<b>1501</b>	<b>1468</b>

Notes:

1. Forecasts for regulated catchments are given to the nearest whole gigalitre except where the entitlement held by the Commonwealth is below 1 GL.
2. Total forecast water available in the southern-connected Basin assumes that in Victoria 100 per cent of water held in spillable accounts becomes available under a median or dry scenario and 50 per cent or less becomes available under wetter scenarios. These figures do not include supplementary, unregulated or ground water accruals in the southern-connected Basin.

Information on actual allocations to Commonwealth environmental water holdings can be found at <http://www.environment.gov.au/water/cewo/portfolio-mgt/holdings-catchment> and is updated monthly.

Commonwealth environmental water is not managed in isolation. When considering the available resource to meet environmental demands, it is necessary to also factor in the resources managed by other entities that is available to contribute to environmental outcomes. Relevant resources include held environmental water, planned environmental water, natural and unregulated flows, conveyance water and consumptive water. Further detail on sources of environmental water in the Victorian Rivers in the Murray Darling Basin is provided in [Attachment C](#).

By combining the forecasts of water held by the Commonwealth with streamflow forecasts, as well as taking into account operational considerations, water resource availability scenarios can be developed ranging from very low to very high. Based on available information moderate to very high resource availability scenarios are in scope for 2016–17 in the Goulburn-Broken system.

In the remaining Victorian tributaries a flexible range of variable baseflows and freshes that Commonwealth environmental water may contribute to is available, allowing for a number of delivery options across all resource availability scenarios (Table 3c). Under drought conditions access to carryover at the start of the water year may be restricted in the Campaspe and Loddon Rivers. Carryover availability relies on a determination from Goulburn Murray Water based on sufficient water resources in storages and under a worst-case scenario restrictions may continue throughout the water year.

### **2.3. Overall purpose of managing environmental water based on supply and demand**

Environmental water needs (demand) and water availability (supply) both influence the overall purpose of Commonwealth environmental water management. Under different combinations, the management purpose can range from 'avoiding damage' to the environment to 'improving' ecological health. This in turn informs the mix of portfolio management options available for maximising outcomes.

Figure 3 shows how current demands and forecasted supply in the Goulburn-Broken system are considered together.

The overall 'purpose' for managing the Commonwealth's water portfolio in the Victorian rivers in the Murray-Darling Basin for 2016–17 is to protect the aquatic and riparian vegetation, maintain water quality, and support native fish and other biota via habitat provision. If overall resource availability increases, deliveries will seek to re-establish and improve the resilience of native in-channel and bank vegetation through elevated baseflows and freshes.

Overall environmental water resource availability	Demand for environmental water				
	Very High – water predominantly needed urgently	High – water predominantly needed this year	Moderate – water predominantly needed this year and/or next	Low – water predominantly not needed this year	Very low - water predominantly not needed this year and next
Very low	Avoid damage to environmental assets		Protect and ensure ecological capacity for recovery		
Low					
Moderate				Maintain ecological health and resilience	
High					
Very high					
	Improve the health and resilience of aquatic ecosystems / build future capacity to support ecological health and resilience				

**Figure 3:** Determining a broad purpose for portfolio management in the Goulburn-Broken system for 2016-17. Note: grey lines represent the likely range in demand and resource availability for the 2016-17 water year.

Further detail on how the overall purpose for portfolio management changes under different supply and demand scenarios is provided in *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water 2016-17* (available at: <http://www.environment.gov.au/water/cewo/publications>).

## 2.4. Water Delivery in 2016-17

Consistent with the demands and purpose described above, the Office is considering supplying environmental water to the following watering actions for 2016-17 (see also Table 3 for supporting information regarding the basis for determining these watering intentions).

### Goulburn River 2016-17 (Table 4 options 1a. – 1f.)

In the Goulburn River, river bank and in-stream vegetation is still recovering following prolonged drought and floods in 2010-2012 and requires frequent wetting to maintain condition and promote recruitment. Environmental watering will be targeted at providing year-round variable baseflows to maintain water quality and provide suitable habitat and food resources to support native fish and macroinvertebrates condition and survival. If additional water is available, freshes in spring and autumn will be delivered to support condition and survival of native vegetation and macroinvertebrates, breeding and movement of native fish, provide channel maintenance and promote the transport of nutrients, carbon, sediment and biota.

### **Lower Broken Creek 2016-17 (Table 4 options 2a. – 2c.)**

Commonwealth environmental water will contribute to variable baseflows to support native fish passage through fishways; provide improved native fish habitat during breeding and migration seasons; improve water quality, in particular maintaining dissolved oxygen levels above tolerable thresholds for biota and managing excessive Azolla growth.

### **Upper Broken Creek and Broken River (Table 4 option 3.)**

Environmental water is required to maintain water quality and support the condition and reproduction of in-channel vegetation, native fish and macroinvertebrates.

### **Broken River (Table 4 options 4a. – 4c.)**

Subject to availability, environmental water may contribute to in-stream flows to support vegetation condition, native fish reproduction and condition, macroinvertebrates, disruption of biofilms, channel maintenance, hydrological connectivity and water quality. The priority demand is for small-moderate size freshes in spring as these demands have not been met in several years.

### **Goulburn-Broken catchment wetlands (Table 4 option 5.)**

Following a managed drying phase environmental water in late winter/early spring to promote the growth of EPBC listed flora species and in the case of Moodie Swamp, to encourage brolga breeding.

### **Campaspe River (Table 4 options 6a. – 6d.)**

Environmental water will contribute to in-stream flows (baseflows and freshes) year-round in support of vegetation growth and survival, native fish reproduction and condition, adult River Red Gums, platypus populations, hydrological connectivity, biotic dispersal and improved water quality including controlling salinity and stratification in deep pools.

### **Loddon River (Table 4 options 7a. – 7e.)**

Environmental water will contribute to in-stream flows (baseflows and freshes) year-round in support of native riparian vegetation condition, native fish reproduction and condition, macroinvertebrates, platypus, water rats, hydrological connectivity and water quality.

### **Ovens River (Table 4 options 8a. – 8b.)**

Where possible delivery from Lake Buffalo (20 ML) will be planned to coincide with a bulk release water transfer to contribute to a fresh to stimulate fish movement, scour biofilms, maintain macroinvertebrate habitat and move sediment. If a bulk release does not occur the 20 ML will be released and contribute to low flows. The 50 ML held in Lake William Hovell on the King River will be used to obtain a small pulse to maintain the natural variability of flows that provide food resources and habitat for macroinvertebrates and to maintain water quality.

### **Wimmera River (Table 4 option 9.)**

Should Commonwealth allocations become available (unlikely in 2016–17) there is a high demand for environmental water to contribute to in-stream flows to support native fish reproduction and condition, riparian vegetation condition, macroinvertebrate habitat and food, hydrological connectivity and biotic dispersal, and maintaining appropriate water quality. Larger pulses may be used to provide additional water to the terminal wetlands (Lakes Albacutya and Hindmarsh) when coupled with natural flows. This may also lead to waterbird outcomes and support Australia's objectives under the Ramsar Convention on Wetlands of International Importance and international migratory bird agreements.



### **Local and expert feedback**

Stakeholder feedback incorporated into this plan includes minor revisions to asset demands and relative urgency for delivery, and some additional issues related to constraints.

In addition to feedback from delivery partners and other stakeholders, key findings and recommendations from the first year (2014-15) of Long-Term intervention monitoring in the Goulburn include:

- Environmental flow delivery can proceed with confidence that it is not having major adverse effects on the banks of the Goulburn River. This conclusion is based upon small environmental flow events in 2014-15 and further monitoring of larger freshes is planned for 2015-16.
- Benefits to bankside vegetation may be greater if the first extended spring flow is delivered earlier. This would allow plants to grow in response to bank wetting before air temperatures increase significantly over summer. The Office will investigate the feasibility of delivering the fresh earlier, in consideration of delivery constraints.
- Record spawning in 2014-15 aside, adjusting the timing of the second spring fresh will be important for determining how closely golden perch spawning is tied to water temperature.
- Future data collection will improve the understanding of the importance of antecedent flows on native fish spawning and whether spawning responses translate to population recruitment in the Goulburn River.
- Larger flow events, currently in planning frameworks, but constrained because of third party risks, may be required in the future to increase production of macroinvertebrates and mobilise carbon and nutrients from backwaters and the floodplain to boost primary productivity.

### **2.5. Trading water in 2016–17**

Planning for water trade considers supply and demand within the catchment, and across the Basin. As part of the planning process, the Commonwealth Environmental Water Office undertakes a Basin-wide analysis to identify opportunities to use allocation trade to better match differing demands across catchments (see *Commonwealth Environmental Water Portfolio Management: Basin-wide analysis 2016–17* available at: <http://www.environment.gov.au/water/cewo/publications>).

Where the need arises to adjust the availability of allocations in any valley in the southern-connected Basin, it should be noted that the transfer of allocations from other southern connected catchments would be explored as the preferred and more efficient option to allocation purchase or sale, consistent with the rules identified in state water resource plans that apply to all water users.

Potential trading options in line with this approach will be considered throughout the 2016-17 water year. The Commonwealth Environmental Water Office is also investigating the potential for purchases to augment water for the environment in a number of catchments in the Northern Murray-Darling Basin to meet high environmental water demands (particularly in the Macquarie Marshes, Lower Balonne/Narran Lakes and Border Rivers). Further information will be provided to the market ahead of any trade of Commonwealth environmental water at: <http://www.environment.gov.au/water/cewo/trade/current-trading-actions>.

For more information on the rules and procedures governing the trade of Commonwealth environmental water, see the *Commonwealth environmental water Trading Framework* available at: <http://www.environment.gov.au/water/cewo/publications/water-trading-framework-dec2014>.

## 2.6. Carrying over water for use in 2017–18

The volume of water carried over for use in 2017–18 will depend upon resource availability and demand throughout the year. A minimum carryover target of 23 GL in the Goulburn, as well as small volumes (estimated to be <1 GL each) in the Campaspe and Loddon catchments, is being planned to meet early season water requirements and as a risk management strategy should low inflows result in low allocations. As documented in Table 3a-c, potential demands in 2017–18 include:

- Variable baseflows in the Goulburn River to maintain water quality and provide habitat and food resources for native fish and macroinvertebrates
- Freshes in the Goulburn River primarily in support of in-channel native vegetation condition and reproduction
- Year round baseflows in Lower Broken Creek to maintain water quality and provide habitat and food resources for native fish and macroinvertebrates
- Spring-autumn baseflows in Lower Broken Creek to manage excessive Azolla growth and maintain adequate dissolved oxygen levels
- Variable baseflows and freshes in the Campaspe and Loddon rivers in support of native riparian vegetation condition, native fish reproduction and condition, macroinvertebrates, platypus, hydrological connectivity and water quality.

Carryover volumes will be adjusted throughout the year as the season unfolds in response to both current and future demands and the water available to meet these demands.

Given the connected nature of southern Murray-Darling Basin catchments and the varying carryover, account and use limits, carryover is considered at a broader scale than just the Victorian rivers in the Murray-Darling Basin. More information on how the Commonwealth makes decisions on carryover is here: <http://www.environment.gov.au/water/cewo/portfolio-mgt/carryover>

**Table 3a:** Environmental demands, priority for watering in 2016–17 and outlook for coming years in the Goulburn-Broken - **MODERATE WATER RESOURCE AVAILABILITY IN 2016–17**

Environmental assets	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)			2016-17			Implications for future demands		
	Flow/volume	Required frequency (maximum dry interval)	2013-14 moderate	2014-15 drying	2015-16 drying	Predominant urgency of environmental demand for water	Purpose under <u>moderate</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016-17	2018-19 Range of likely demand	Met in 2017–18 Not met in 2017–18
Goulburn River (mid and lower)	Baseflow 540–940 ML/day at McCoys Bridge <sup>1</sup> to maintain water quality and provide habitat and food resources for native fish & macroinvertebrates	Year round				High	Protect	High potential for partial contribution to baseflow requirements in conjunction with other contributors (minimum releases, Intervalley Transfer and other environmental water holders)	High	High	
	Winter fresh (Jun-Aug) Up to 15 000 ML/day at Murchison & McCoys Bridge <sup>2</sup> with 14 days above 6 600 ML/day <sup>1</sup> to support native vegetation, provide channel maintenance and promote the transport of nutrients, carbon, sediment & biota	1-2 events per year (1 year)			Partially met (5 days above 6 600 ML/day)	High – annual requirement and only partially met in 2015-16.	Protect	Low potential – is subject to unregulated flow conditions in the Goulburn and Murray as it is unlikely there will be sufficient allocation in 2016-17 to undertake a regulated action	Moderate	Moderate	
	Spring fresh (Sep-Nov) Up to 15 000 ML/day at Murchison/McCoys Bridge <sup>2</sup> with 14 days above 5 600 ML/day <sup>1</sup> primarily in support of in-channel native vegetation condition and reproduction	1-2 events per year (1 year)		Partially met (8 days above 5 600 ML/day)	Partially met (11 days above 5 600 ML/day)	High	Protect	High priority - to continue recovery of bank vegetation	High	High	
	Spring/summer fresh (Oct-Dec) 7 000–15 000 ML/day at Murchison & McCoys Bridge <sup>2</sup> for 2 days <sup>3</sup> to promote movement and breeding of native fish	2 in 3 years <sup>4</sup>			2 <sup>nd</sup> spring fresh cancelled due to low resource availability	Moderate	Maintain	Moderate potential – to support native fish breeding, noting that 2 successful golden perch breeding events have been achieved in 2013-14 and 2014-15	Moderate-High	Moderate	
	Summer/autumn fresh (Feb-Apr) Up to 5 600 ML/day at Murchison & McCoys Bridge for 2-4 days <sup>3</sup> to support in-channel native vegetation and promote the transport of nutrients, carbon, sediment and biota	1-2 events per year (1 year)			Partially – duration met, but magnitude peaked at only ~4,000 ML/day	High	Maintain	High potential - to continue recovery of bank vegetation	Moderate-High	Moderate	
										High	

Environmental assets	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)			2016-17			Implications for future demands	
	Flow/volume	Required frequency (maximum dry interval)	2013-14	2014-15	2015-16	Predominant urgency of environmental demand for water	Purpose under <u>moderate</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017-18 if watering occurred as planned in 2016-17	2018-19 Range of likely demand
			moderate	drying	drying					Met in 2017-18 Not met in 2017-18
Lower Broken Creek	Winter/autumn baseflow (40 ML/day at Rices Weir) <sup>5</sup> to support native fish movement	Continuous mid August – mid May				High	Protect	High potential for partial contribution to baseflow requirements in conjunction with consumptive deliveries and intervalley transfer	High	High
	Spring/autumn baseflow (120-250 ML/day at Rices Weir) <sup>5</sup> to manage excessive Azolla growth and maintain adequate dissolved oxygen levels	Continuous Aug-May				High	Protect	High potential - as above	High	High
	Spring/summer baseflow (250 ML/day at Rices Weir) <sup>5</sup> to provide improved habitat and migration opportunities for native fish	Continuous Aug-Nov			Only met 55 per cent of the time due to high irrigation demand	Moderate	Maintain	High potential – as above	Moderate	Moderate
Upper Broken Creek	Fresh (up to 200 ML/day for 1-2 days in winter/spring and/or summer/autumn) <sup>6</sup> to maintain water quality and support condition and reproduction of in-channel vegetation, native fish and macroinvertebrates	1 in 2 years	Partial – has received some e-water flows resulting from e-water deliveries en route to Moodie Swamp, and one creek fresh in 2014-15 following bushfire impact on water quality			Moderate	Maintain	High potential, subject to assessment of 3 <sup>rd</sup> party risks	Low	Low
										Moderate
Broken River	Winter/spring baseflow 80-200 ML/day at d/s Back Creek Junction <sup>7</sup> to maintain water quality and support native fish and macroinvertebrates condition and survival	Continuous (Jun-Nov)	Late winter-spring only	Late winter-spring only		Moderate	Maintain	Low potential – no watering demands identified for 2016-17	Moderate	Moderate
										High
	Small fresh 270-500 ML/day for 2-8 days in winter/spring and summer/autumn <sup>7</sup> year to support native in-channel vegetation and native fish by providing suitable habitat	1-4 per year (1 year)	Winter only	Winter only		Moderate	Maintain	Low potential – no watering demands identified for 2016-17	Moderate	Moderate
										High
	Large fresh 2600-4500 ML/day for 1 day in winter/spring <sup>7</sup> to support native in-channel vegetation and native fish, and provide channel maintenance	1 in 1 year (3 years)				Moderate	Maintain	Low potential – no watering demands identified for 2016-17	Moderate	Moderate
										High

Environmental assets	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)			2016-17			Implications for future demands		
	Flow/volume	Required frequency (maximum dry interval)	2013-14	2014-15	2015-16	Predominant urgency of environmental demand for water	Purpose under <u>moderate</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017-18 if watering occurred as planned in 2016-17	2018-19 Range of likely demand	Met in 2017-18
			moderate	drying	drying						Not met in 2017-18
Goulburn-Broken catchment wetlands	Infrastructure delivery to semipermanent wetlands <sup>8</sup> (for Goulburn River wetlands, equivalent to >20 000 ML/day at Shepparton) <sup>9</sup> in support of native vegetation and provision of drought refuge for waterbirds	1 in 1-2 years (4.5 years)	Water delivered to some wetlands only <sup>10</sup>	Water delivered to Moodie Swamp <sup>11</sup>	Water delivered to all wetlands <sup>12</sup>	Moderate	Maintain	It is anticipated that demands in the Goulburn-Broken wetlands will be met by other water holders	Moderate	Moderate	
		Moodie Swamp max. dry interval is 1 year				High	Maintain	Moderate potential subject to available allocation	Moderate	Moderate	
	Approximate total demand 12 000 ML per year for infrastructure delivery										
<div>1. Sourced from GBCMA (2016a) and Cottingham et al. (2007)</div> <div>2. Flows above 10,000 ML/day at McCoys Bridge or Murchison would be subject to natural flow cues</div> <div>3. Adapted from GBCMA (2016a) and Cottingham et al. (2007)</div> <div>4. The required frequency of short-duration freshes targeting breeding of native fish such as golden perch remains undocumented in the literature. The frequency estimated here is based on a number of sources including flow recommendations for spring freshes (1-2 per year) and analysis of the modelled natural flow record</div> <div>5. Sourced from GBCMA (2016b)</div> <div>6. Sourced from GBCMA (2016c)</div> <div>7. Adapted from GBCMA (2016c) and based on advice from Goulburn-Broken CMA</div> <div>8. Environmental water delivery via infrastructure is possibly for only nine wetlands including Moodie Swamp on upper Broken Creek</div> <div>9. Sourced from GBCMA (2016c, 2016d)</div> <div>10. Water delivered to Kinnaird Swamp and Black Swamp (Victorian environmental water), Moodie Swamp (Commonwealth Environmental Water Holder)</div> <div>11. Water delivered to Moodie Swamp from October – December 2014 (250ML VEWH/ 250 ML CEWH)</div> <div>12. Water delivered to Kinnaird’s Wetland, Black Swamp, Doctors Swamp, Reedy Swamp (Spring 2015) and Moodie Swamp (Autumn 2016)</div>							Carryover potential	Low to moderate proportion of available allocations expected to be carried into 2016-17.	Potential carryover will depend upon resource availability and demands		
							Trade potential	Potential for purchases to augment water for the environment in a number of catchments in the northern Murray-Darling Basin to meet high environmental water demands. Further information will be provided to the market ahead of any trade of Commonwealth environmental water. Transfer of allocations between catchments in the southern-connected Basin would be explored as the preferred option to allocation purchase or sale, consistent with the rules identified in state water resource plans that apply to all water users.			

Key - events in previous years

means demand was met by Commonwealth environmental water or any other source

means demand was partially met by Commonwealth environmental water or any other source (may be used to indicate infrastructure assisted delivery)

means water not provided (or not required)

Note that not all demands require water every year; drying phases are important for floodplains and temporary wetlands or streams

Key - potential watering in 2016-17

means a high priority for Commonwealth environmental watering (full or partial contribution, and subject to seasonal and operational considerations)

means a secondary priority for Commonwealth environmental watering, likely to be met via other means (other water holders, or natural flows)

means a low priority for Commonwealth environmental watering

Key - urgency of environmental demands

means critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage

means high demand for water i.e. needed in that particular year

means moderate demand for water i.e. water needed that particular year and/or next

means low demand for water i.e. water generally not needed that particular year

means very low demand for water i.e. water generally not needed that particular year or the following year

Note that demand is considered at a generalised scale; there may be specific requirements that are more or less urgent within the flow regime

**Table 3b:** Environmental demands, priority for watering in 2016–17 and outlook for coming years in the Goulburn-Broken – **VERY HIGH WATER RESOURCE AVAILABILITY IN 2016–17**

Environmental assets	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)			2016-17			Implications for future demands	
						Predominant urgency of environmental demand for water	Purpose under <u>very high</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016-17	2018–19 Range of likely demand
	Flow/volume	Required frequency (maximum dry interval)	2013–14 moderate	2014–15 drying	2015–16 drying					Met in 2017–18 Not met in 2017–18
Goulburn River (mid and lower)	Baseflow  540–940 ML/day at McCoys Bridge <sup>1</sup> to maintain water quality and provide habitat and food resources for native fish & macroinvertebrates	Year round				High	Protect	High potential for partial contribution to baseflow requirements in conjunction with other contributors (minimum releases, intervalley transfer and other environmental water holders)	High	High
	Winter fresh (Jun-Aug)  Up to 15 000 ML/day at Murchison & McCoys Bridge <sup>2</sup> with 14 days above 6 600 ML/day <sup>1</sup> to support native vegetation, provide channel maintenance and promote the transport of nutrients, carbon, sediment & biota	1-2 events per year (1 year)			Partially met (for 5 days above 6 600 ML/day)	High – annual requirement and only partially met in 2015-16.	Protect	Low potential – is subject to unregulated flow conditions in the Goulburn and Murray as there is unlikely to be sufficient allocation in 2016-17 to undertake a regulated action	High	Moderate
	Spring fresh (Sep-Nov)  Up to 15 000 ML/day at Murchison/McCoys Bridge <sup>2</sup> with 14 days above 5 600 ML/day <sup>1</sup> primarily in support of in-channel native vegetation condition and reproduction	1-2 events per year (1 year)		Partially met (for 7-9 days only)	Partially met (for 11 days above 5 600 ML/day)	High	Protect	High potential – to continue recovery of bank vegetation	High	High
	Spring/summer fresh (Oct-Dec)  7 000–15 000 ML/day <sup>2</sup> at Murchison & McCoys Bridge <sup>2</sup> for 2 days <sup>3</sup> to promote movement and breeding of native fish	2 in 3 years <sup>4</sup>			2nd spring fresh cancelled due to low resource availability	Moderate	Maintain	Moderate potential – to support native fish breeding, noting that 2 successful golden perch breeding events have been achieved in 2013-14 and 2014-15	Moderate-High	Moderate
	Summer/autumn fresh (Feb-Apr)  Up to 5 600 ML/day at Murchison & McCoys Bridge for 2-4 days <sup>3</sup> to support in-channel native vegetation and promote the transport of nutrients, carbon, sediment and biota	1-2 events per year (1 year)			Partially – duration met, but magnitude peaked at only ~4 000 ML/day	Moderate	Maintain	High potential – to continue recovery of bank vegetation	Moderate-High	Moderate
										High



Environmental assets	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)			2016-17			Implications for future demands		
	Flow/volume	Required frequency (maximum dry interval)	2013-14	2014-15	2015-16	Predominant urgency of environmental demand for water	Purpose under <u>very high</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017-18 if watering occurred as planned in 2016-17	2018-19 Range of likely demand	Met in 2017-18
			moderate	drying	drying						Not met in 2017-18
Lower Broken Creek	Winter-autumn baseflow (40 ML/day at Rices Weir) <sup>5</sup> to support native fish movement	Continuous mid August – May				High	Protect	High potential for partial contribution to baseflow requirements in conjunction with consumptive deliveries and intervalley transfer	High	High	
										High	
	Spring-autumn baseflow (120-250 ML/day at Rices Weir) <sup>5</sup> to manage excessive Azolla growth and maintain adequate dissolved oxygen levels	Continuous Aug-May				High	Protect	Moderate-high potential, dependant on unregulated flow conditions, which may meet the demand	High	High	
										High	
	Spring-summer baseflow (250 ML/day at Rices Weir) <sup>5</sup> to provide improved habitat and migration opportunities for native fish	Continuous Aug-Nov			Only met 55 per cent of the time due to high irrigation demand	Moderate	Maintain	Moderate-high potential, dependant on unregulated flow conditions, which may meet the demand	Moderate	Moderate	
										Moderate	
Upper Broken Creek	Fresh (up to 200 ML/day for 1-2 days in winter/spring and/or summer/autumn) <sup>6</sup> to maintain water quality and support condition and reproduction of in-channel vegetation, native fish and macroinvertebrates	1 in 2 years	Partial – has received some e-water flows resulting from e-water deliveries en route to Moodie Swamp			Moderate	Maintain	Moderate-high potential, dependant on unregulated flow conditions and subject to assessment of 3 <sup>rd</sup> party risks	Low	Low	
										Moderate	
Broken River	Winter/spring baseflow 80-200 ML/day at d/s Back Creek Junction <sup>7</sup> to maintain water quality and support native fish and macroinvertebrates condition and survival	Continuous (Jun-Nov)	Late winter-spring only	Late winter-spring only		Moderate	Maintain	Low potential – no watering demands identified for 2016-17	Moderate	Moderate	
										High	
	Small fresh 270-500 ML/day for 2-8 days in winter/spring and summer/autumn <sup>7</sup> to support native in-channel vegetation and native fish by providing suitable habitat	1-4 per year (1 year)	Winter only	Winter only		Moderate	Maintain	Low potential – no watering demands identified for 2016-17	Moderate	Moderate	
										High	
	Large fresh 2600-4500 ML/day for 1 day in winter/spring <sup>7</sup> to support native in-channel vegetation and native fish, and provide channel maintenance	1 in 1 year (3 years)				Moderate	Maintain	Low potential – no watering demands identified for 2016-17	Moderate	Moderate	
										High	
Goulburn-Broken catchment	Infrastructure delivery to semi-permanent wetlands <sup>8</sup> (for Goulburn River	1 in 1-2 years (4.5 years)	Water delivered to some	Water delivered to	Water delivered to all	Moderate	Maintain	It is anticipated that demands in the Goulburn-Broken wetlands will be met by other	Moderate	Moderate	

Environmental al assets	Indicative demand (for <u>all sources of water</u> in the system)		Watering history (from all sources of water)			2016-17			Implications for future demands		
	Flow/volume	Required frequency (maximum dry interval)	2013–14	2014–15	2015–16	Predominant urgency of environmental demand for water	Purpose under <u>very high</u> resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2017–18 if watering occurred as planned in 2016-17	2018–19 Range of likely demand	Met in 2017–18
			moderate	drying	drying						Not met in 2017–18
wetlands	wetlands, equivalent to >20 000 ML/day at Shepparton) <sup>9</sup> in support of native vegetation and provision of drought refuge for waterbirds		wetlands only <sup>10</sup>	Moodie Swamp <sup>11</sup>	wetlands <sup>12</sup>			water holders.			High
	Approximate total demand 12 000 ML per year for infrastructure delivery	Moodie Swamp max. dry interval is 1 year				High	Maintain	Moderate potential subject to available allocation	Moderate		Moderate
											High
<div>1. Sourced from GBCMA (2016a) and Cottingham et al. (2007)</div> <div>2. Flows above 10,000 ML/day at McCoys Bridge or Murchison would be subject to natural flow cues</div> <div>3. Adapted from GBCMA (2016a) and Cottingham et al. (2007)</div> <div>4. The required frequency of short-duration freshes targeting breeding of native fish such as golden perch remains undocumented in the literature. The frequency estimated here is based on a number of sources including flow recommendations for spring freshes (1-2 per year), analysis of the modelled natural flow record</div> <div>5. Sourced from GBCMA (2016b)</div> <div>6. Sourced from GBCMA (2016c)</div> <div>7. Adapted from GBCMA (2016c) and based on advice from Goulburn-Broken CMA</div> <div>8. Environmental water delivery via infrastructure is possibly for only nine wetlands including Moodie Swamp on upper Broken Creek</div> <div>9. Sourced from GBCMA (2016c, 2016d)</div> <div>10. Water delivered to Kinnaird Swamp and Black Swamp (Victorian environmental water), Moodie Swamp (Commonwealth Environmental Water Holder)</div> <div>11. Water delivered to Moodie Swamp from October – December 2014 (250ML VEWH/ 250 ML CEWH)</div> <div>12. Water delivered to Kinnaird’s Wetland, Black Swamp, Doctors Swamp, Reedy Swamp (Spring 2015) and Moodie Swamp (Autumn 2016)</div>							Carryover potential	Low to moderate proportion of available allocations expected to be carried into 2017–18.	Potential carryover will depend upon resource availability and demands		
<div><b>Key - events in previous years</b></div> <div><div></div> means demand was met by Commonwealth environmental water or any other source</div> <div><div></div> means demand was partially met by Commonwealth environmental water or any other source (may be used to indicate infrastructure assisted delivery)</div> <div><div></div> means water not provided (or not required)</div> <div>Note that not all demands require water every year; drying phases are important for floodplains and temporary wetlands or streams</div> <div><b>Key - potential watering in 2016-17</b></div> <div><div></div> means a high priority for Commonwealth environmental watering (full or partial contribution, and subject to seasonal and operational considerations)</div> <div><div></div> means a secondary priority for Commonwealth environmental watering, likely to be met via other means (other water holders, or natural flows)</div> <div><div></div> means a low priority for Commonwealth environmental watering</div> <div><b>Key - urgency of environmental demands</b></div> <div><div></div> means critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage</div> <div><div></div> means high demand for water i.e. needed in that particular year</div> <div><div></div> means moderate demand for water i.e. water needed that particular year and/or next</div> <div><div></div> means low demand for water i.e. water generally not needed that particular year</div> <div><div></div> means very low demand for water i.e. water generally not needed that particular year or the following year</div> <div>Note that demand is considered at a generalised scale; there may be specific requirements that are more or less urgent within the flow regime</div>							Trade potential	Potential for purchases to augment water for the environment in a number of catchments in the northern Murray-Darling Basin to meet high environmental water demands. Further information will be provided to the market ahead of any trade of Commonwealth environmental water. Transfer of allocations between catchments in the southern-connected Basin would be explored as the preferred option to allocation purchase or sale, consistent with the rules identified in state water resource plans that apply to all water users.			

**Table 3c:** Long-Term Plan for the Victorian Rivers in the Murray-Darling Basin reflected in long-term commitments by the Commonwealth Environmental Water Holder – under all resource availability scenarios

Environmental Asset	Indicative demand		Watering history (from all sources of water)			Potential Commonwealth environmental water contribution 2016-17 to 2018-19	Purpose and Expected Outcomes
	Flow/volume	Required Frequency	2013–14	2014–15	2015–16		
			(moderate)	(drying)	(drying)		
<b>Campaspe River</b>	Up to the total Commonwealth environmental water entitlement of 6 913 ML (6 517 HRWS <sup>1</sup> and 396 LRWS <sup>2</sup> ) per year <sup>3</sup> to contribute to in-stream flows at Barnadown Weir, to reach 2 and 4, for example <sup>4</sup> : <ul style="list-style-type: none"> <li>Summer/autumn low flows: 10–50 ML/day</li> <li>Winter/spring fresh (small): 1 000–1 800 ML/day for up to days</li> <li>Winter/spring fresh (large): up to 1,600 ML/day for 2-7 days (2 consecutive years, twice per decade)</li> <li>Winter/spring low flows: 50–200 ML/day</li> <li>Summer/autumn freshes: 50-200 ML/day for 1-3 days</li> </ul>	Annually as per agreed hydrographs with the Victorian Environmental Water Holder and Catchment Management Authorities <sup>8</sup>				A high potential to contribute	Under drought and dry scenarios the purpose is to ‘protect’, moving towards ‘improving’ and ‘enhancing’ the river and its environment and as conditions improve.  Commonwealth environmental water will contribute to maintaining: pool habitat to maintain fish populations; connectivity to protect in-stream and fringing vegetation; platypus breeding populations; macroinvertebrate populations; and emergent littoral macrophytes.  Potential watering actions will also facilitate the dispersal and movement of plant propagules, micro and macroinvertebrates, fish, frogs, turtles and platypus as well as carbon and nutrient recycling.
<b>Loddon River</b>	Up to the total Commonwealth environmental water entitlement of 3 883 ML (3 356 HRWS <sup>1</sup> and 527 LRWS <sup>2</sup> ) per year <sup>3</sup> to contribute to in-stream flows in reach 4 between Loddon and Kerang Weir for example <sup>5</sup> : <ul style="list-style-type: none"> <li>Summer/autumn low flows (continuous Dec-May): 25–50 ML/day</li> <li>Summer/autumn freshes (Dec-May): 50-100 ML/day for 3–4 days</li> <li>Winter/spring high flow - Not expected in a drought scenario. Other - (Sept-Oct): 450–750 ML/day with a 7-10 day peak</li> <li>Autumn high flow - Not expected in a drought scenario. Other - (April-May): 400 ML/day with a 6 day peak</li> <li>Winter/spring low flow (continuous June-Nov): 50-100 ML/day (during non-irrigation season)</li> <li>In drought-scenario maintain minimum passing flows as agreed with Goulburn Murray Water</li> </ul>				All priority flows delivered – some modified to take account of dry conditions	A high potential to contribute to flows in reach 4	Depending on the timing and volume of flows, Commonwealth environmental water will contribute to: maintaining adequate depth in pools for macroinvertebrates, fish, aquatic plants and fauna; improved local movement of fish and platypus; flushing of sediment from hard surfaces; and growth of fringing emergent macrophytes. In a drought scenario maintain continuous flow through the reach to maintain water quality.
<b>Ovens River</b>	Up to the total Commonwealth environmental water entitlement of 70 ML per year <sup>3</sup> (50 ML from Lake William Hovell and 20 ML from Lake Buffalo) to contribute to in-stream flows within the Ovens, Kings and Buffalo rivers, for example <sup>6</sup> : <ul style="list-style-type: none"> <li>Pulsed summer-autumn fresh when the bulk water transfer from Lake Buffalo is available (February – May)</li> <li>Variability in baseflows if bulk water transfer not available (Nov-May)</li> </ul>					A moderate-high potential to contribute to operational water releases or to variability in baseflows, depending on the timing of the call by Goulburn Murray Water of the likelihood of a bulk water transfer.	When released with the bulk water drawdown, Commonwealth environmental water will contribute to maintaining the movement of native fish, natural connectivity between pools and riffles and with the River Murray, microinvertebrate habitat and scouring of bio-film from beds. When contributing to low flows, Commonwealth environmental water will help to maintain native fish habitat and connectivity sufficient for fish passage between pools.
<b>Wimmera System</b>	Up to the total Commonwealth entitlement of 28 000 ML (LRWS <sup>2</sup> ) per year <sup>3</sup> to contribute toward in-stream flows within the Wimmera River (baseflow and freshes), subject to environmental need, delivery constraints and water availability <sup>7</sup> .					If Commonwealth environmental water becomes available, consideration will be given to watering the terminal wetlands, however, this will occur very rarely as it requires significant volumes of water that are only available under very wet conditions where unregulated conditions would largely fill the lakes.  More likely, when available, Commonwealth environmental water may be used to assist the Victorian Environmental Water Holder in meeting objectives in the greater Wimmera system via a combination of partial allocations and/or carryover from previous years.	When available. Commonwealth water will aim to support native fish reproduction and condition, riparian vegetation condition, macroinvertebrate habitat and food, hydrological connectivity and biotic dispersal, and maintaining appropriate water quality.  Larger pulses may be used to provide additional water to the terminal wetlands (Lakes Hindmarsh and Albacutya) when coupled with natural flows and may lead to waterbird outcomes that support Australia’s objectives under The Ramsar Convention on Wetlands and other international migratory bird agreement. This may include waterbird reproduction and recruitment and an increase in local and landscape waterbird survival and diversity.

1. High Reliability Water Shares 2. Low Reliability Water Shares 3. Plus any additional Commonwealth environmental water, including carryover, as it becomes available. 4. Sourced from NCCMA (2016a) and advice from the Victorian Environmental Water Holder  
5. Sourced from NCCMA (2016b) 6. Sourced from NECMA (2016) 7. Sourced from WCMA (2016) 8. The Commonwealth and Victorian Environmental Water Holders have agreed to 5 year watering schedules (2014-15 to 2018-19) for the Campaspe, Loddon and Ovens Rivers.

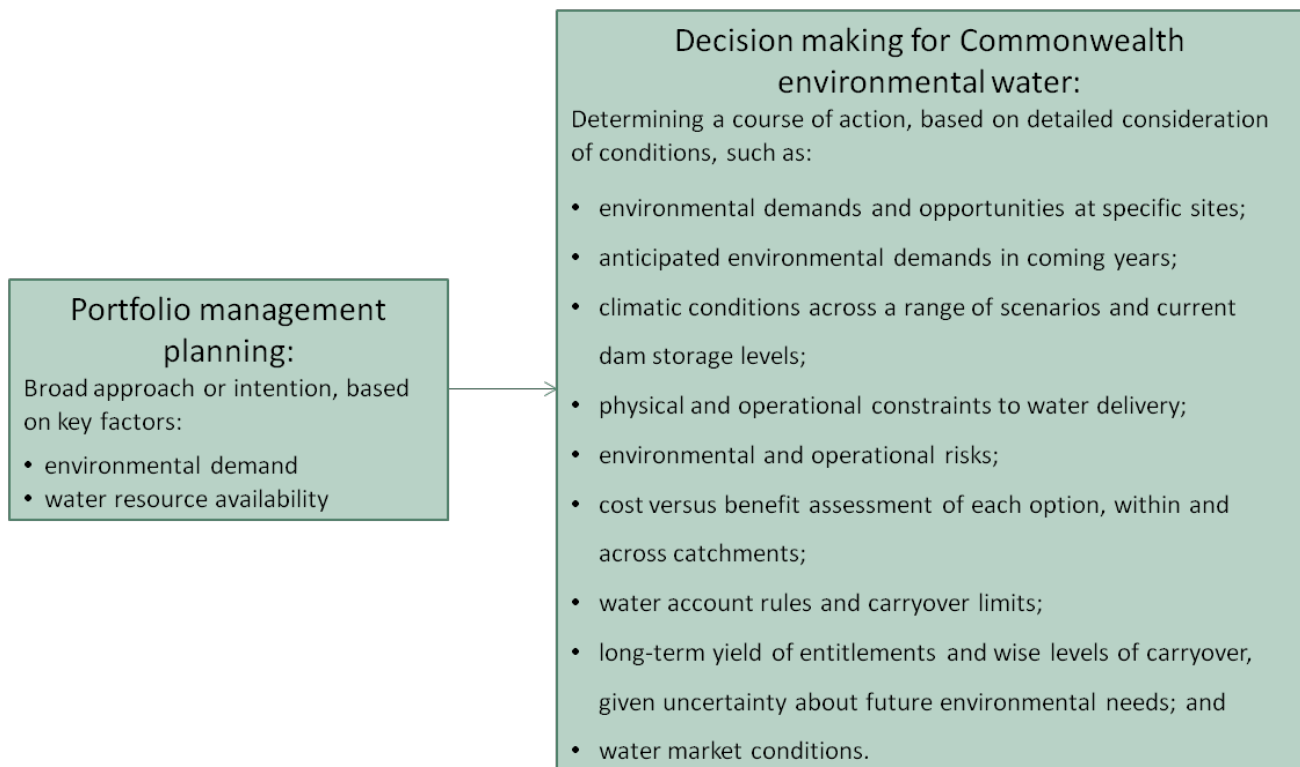
## 3. Next steps

### 3.1. From planning to decision making

It is important to distinguish between planning and operational decision making (Figure 4).

Planning allows the Office to manage the environmental water portfolio in a holistic manner and develop a broad approach or intention based on the key drivers (demand and supply)

Decision making throughout each year builds on the intention by considering in more detail the specific prevailing factors and additional factors such as costs, risks, and constraints to water delivery and market conditions.



**Figure 4:** Planning and decision making for Commonwealth environmental water use

### 3.2. Further information

For further information on how the Office plans for water use, carryover and trade, please visit our web site <http://www.environment.gov.au/water/cewo>

- Water use: [www.environment.gov.au/topics/water/commonwealth-environmental-water-office/assessment-framework](http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/assessment-framework)
- Carryover: <http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/portfolio-management/carryover>
- Trade: *Discussion Paper – Trade of Commonwealth Environmental Water and Commonwealth Environmental Water Trading Framework*: <http://www.environment.gov.au/water/cewo/trade/trading-framework>

# Bibliography

Cottingham, P., Crook, D., Hillman, T., Roberts, J., and Stewardson, M. (2010) Objectives flow freshes in the lower Goulburn river 2010/11. Report prepared for the Goulburn-Broken Catchment Management Authority.

Cottingham, P., Brown, P., Lyon, J., Pettigrove, V., Roberts, J., Vietz, G., and Woodman, A. (2014) Mid Goulburn River FLOWS study, Final report: flow recommendations. Prepared for the Goulburn-Broken Catchment Management Authority, December 2014.

Cottingham, P., Stewardson, M., Crook, D., Hillman, T., Oliver, R., Roberts, J., and Rutherford, I. (2007) Evaluation of summer inter-valley water transfers from the Goulburn River, prepared for the Goulburn-Broken CMA.

Cottingham, P., Stewardson, M., Crook, D., Hillman, T., Roberts, J., and Rutherford, I. (2003) Environmental flow recommendations for the Goulburn River below Lake Eildon. CRC Freshwater Ecology and CRC Catchment Hydrology, Technical Report 01/2003.

(DEPI) Department of Environment and Primary Industries (2015), *Victoria and the Murray-Darling Basin*, <http://www.depi.vic.gov.au/water/rural-water-and-irrigation/murray-darling-basin>

(GBCMA) – see Goulburn Broken Catchment Management Authority

Goulburn-Broken Catchment Management Authority (2016a) Goulburn River Seasonal Watering Proposal 2016-17.

Goulburn-Broken Catchment Management Authority (2016b) Lower Broken Creek Seasonal Watering Proposal 2016-17.

Goulburn-Broken Catchment Management Authority (2016c) Broken River Seasonal Watering Proposal 2016-17.

Goulburn-Broken Catchment Management Authority (2016d) Goulburn Broken Catchment Wetlands Seasonal Watering Proposal 2016-17.

(MDBA) – see Murray Darling Basin Authority

Murray-Darling Basin Authority (MDBA) (2013a), *Preliminary Overview of Constraints to Environmental Water Delivery in the Murray-Darling Basin*

Murray-Darling Basin Authority (MDBA) (2013b), *Constraints Management Strategy*

Murray-Darling Basin Authority (2014), *Basin-wide environmental watering strategy*.

Murray Darling Basin Authority (2015), *Goulburn-Broken*, <http://www.mdba.gov.au/about-basin/how-river-runs/goulburn-broken>

(NCCMA) – see North Central Catchment Management Authority

North Central Catchment Management Authority (2016a). *Seasonal Watering Proposal for the Campaspe River System Downstream of Lake Eppalock 2016–17*. North Central Catchment Management Authority, Huntly, Victoria.

North Central Catchment Management Authority (2016b). *Seasonal Watering Proposal for the Loddon River System 2016–17*. North Central Catchment Management Authority, Huntly, Victoria.

(NECMA) North East Catchment Management Authority (2016). *2016-17 Ovens River System Seasonal Watering Proposal*. North East Catchment Management Authority, Wodonga, Victoria.

(VEWH) Victorian Environmental Water Holder (2015), *Seasonal Watering Plan 2015–16*. Victorian Environmental Water Holder, Melbourne, Victoria.

(WCMA) Wimmera Catchment Management Authority (2016). *Seasonal Watering Proposal for the Wimmera River System 2016--17*. Wimmera Catchment Management Authority. Victoria.



# Attachment A – Expected outcomes from the Basin-wide environmental watering strategy

## Goulburn-Broken

Expected outcomes from the Basin-wide environmental watering strategy (MDBA 2014) that are relevant to the Goulburn-Broken are described below.

### RIVER FLOWS AND CONNECTIVITY

Baseflows are at least 60 per cent of the natural level

Contributing to a 30 per cent overall increase in flows in the River Murray

A 30–60 per cent increase in the frequency of freshes, bankfull and lowland floodplain flows

### VEGETATION

Maintain current extent of forest and woodland vegetation and non woody vegetation and water-dependent vegetation near river channels and on low-lying areas of the floodplain

Improved condition of black box and river red gum

Improved recruitment of trees within black box and river red gum communities

#### Vegetation extent

Area of river red gum (ha)	Area of black box (ha)	Area of coolibah (ha)	Shrublands	Non-woody water dependent vegetation
19 800	500			Closely fringing or occurring within the Broken Ck, Broken and Goulburn river s

#### Black box condition

Vegetation condition score		Percent of vegetation assessed (within the managed floodplain)
0 – 6	>6 – 10	
28 per cent	72 per cent	77 per cent

#### River red gum condition

Vegetation condition score					Percent of vegetation assessed (within the managed floodplain)
0 – 2	>2 – 4	>4 – 6	>6 – 8	>8 – 10	
1 per cent	2 per cent	7 per cent	34 per cent	55 per cent	89 per cent

### WATERBIRDS

Current species diversity is maintained

A 20–25 per cent increase in Basin-wide abundance of waterbirds by 2024

A 30–40 per cent increase in nests and broods (Basin-wide) for other waterbirds

Up to 50 per cent more breeding events (Basin-wide) for colonial nesting waterbird species

#### Important Basin environmental assets for waterbirds in the Goulburn-Broken

Environmental asset	Total abundance and diversity	Drought refuge	Colonial waterbird breeding	Shorebird abundance	In scope for C'th watering
Corop wetlands	*	*			No
Winton wetlands		*			No
Waranga Basin		*			No



## FISH

No loss of native species

Improved population structure of key species through regular recruitment, including

- short-lived species with distribution and abundance at pre-2007 levels and breeding success every 1–2 years
- moderate to long-lived with a spread of age classes and annual recruitment in at least 80 per cent of years

Increased movement of key species

Expanded distribution of key species and populations

**Key species for the Goulburn-Broken include:**

Species	Specific outcomes	In-scope for C'th water in the Goulburn-Broken?
Flathead galaxias ( <i>Galaxias rostratus</i> )	Improved core range in additional locations, including the Goulburn	No
Golden Perch ( <i>Macquaria ambigua</i> )	A 10–15 per cent increase of mature fish abundance (of legal take size) in key populations	Yes
Macquarie perch ( <i>Macquaria australasica</i> )	Establishment of at least four additional riverine populations (candidate sites include mid-Goulburn River)	Yes
Murray cod ( <i>Maccullochella peelii peelii</i> )	A 10–15 per cent increase of mature fish abundance (of legal take size) in key populations	Yes
Silver perch ( <i>Bidyanus bidyanus</i> )	Expanded population within the Goulburn River Expanded population upstream of Lake Mulwala and into the Ovens River, and increased range up the lower Goulburn River Improved core range in at least two additional locations (candidate site includes Broken Ck)	Yes – lower Goulburn River. Fish may also migrate into lower Broken Creek
Trout cod ( <i>Maccullochella macquariensis</i> )	Establishment of at least two additional populations (candidate sites include the mid-Goulburn River) Note: mid-Goulburn populations - attempts to re-establish have commenced	Establishment of new populations is dependent on complimentary activities Environmental water will however target existing populations in the lower Goulburn River to increase abundance and potentially also range
Two-spined blackfish ( <i>Gadopsis bispinosus</i> )	Expand the range of at least two current populations (candidate sites include the upper Goulburn tributaries)	Yes – mid Goulburn River

## Important Basin environmental assets for native fish in the Goulburn-Broken

Environmental asset	Key movement corridors	High Biodiversity	Site of other Significance	Key site of hydrodynamic diversity	Threatened species	Dry period / drought refuge	In-scope for C <sup>th</sup> water
Lower Goulburn River	*	*	*	*	*	*	*
Broken River	*	*	*		*	*	*
Broken Creek					*	*	*

## Campaspe

Expected outcomes from the Basin-wide environmental watering strategy (MDBA 2014) that are relevant to the Campaspe are described below.

### RIVER FLOWS AND CONNECTIVITY

Baseflows are at least 60 per cent of the natural level

Contributing to a 30 per cent overall increase in flows in the River Murray

A 10-20 per cent increase in the frequency of freshes and bankfull

### VEGETATION

Maintain the current extent of forest and woodland vegetation and non-woody vegetation

No decline in the condition of black box and river red gum

Improved recruitment of trees within black box and river red gum communities

#### Vegetation extent

Area of river red gum (ha)	Area of black box (ha)	Area of coolibah (ha)	Shrublands	Non-woody water dependent vegetation
1 900	<100			Closely fringing or occurring within the Campaspe River

### WATERBIRDS

Maintain current species diversity

Increase Basin-wide abundance of waterbirds by 20–25 per cent by 2024

A 30–40 per cent increase in nests and broods (Basin-wide) for other waterbirds

Up to 50 per cent more breeding events (Basin-wide) for colonial nesting waterbird species

### FISH

No loss of native species

Improved population structure of key species through regular recruitment, including

- short-lived species with distribution and abundance at pre-2007 levels and breeding success every 1–2 years
- moderate to long-lived with a spread of age classes and annual recruitment in at least 80 per cent of years

Increased movements of key species

Expanded distribution of key species and populations

#### Key species for the Campaspe include:

Species	Specific outcomes	In-scope for C'th e-water in the Campaspe?
Golden Perch ( <i>Macquaria ambigua</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Murray cod ( <i>Maccullochella peelii peelii</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
River blackfish ( <i>Gadopsis marmoratus</i> )	Establish 1–3 additional populations (candidate sites include downstream of the Campaspe Rivers)	Yes
Silver perch ( <i>Bidyanus bidyanus</i> )	Improve core range in at least two additional locations – (candidate sites include Campaspe Rivers)	Yes

## Loddon River

Expected outcomes from the Basin-wide environmental watering strategy (MDBA 2014) that are relevant to the Loddon are described below.

### RIVER FLOWS AND CONNECTIVITY

Baseflows are at least 60 per cent of the natural level

Contributing to a 30 per cent overall increase in flows in the River Murray

A 10–20 per cent increase in the frequency of freshes and bankfull

### VEGETATION

Maintain the current extent of forest and woodland vegetation and non-woody vegetation

No decline in the condition of black box and river red gum

Improved recruitment of trees within black box and river red gum communities

#### Vegetation extent

Area of river red gum (ha)	Area of black box (ha)	Area of coolibah (ha)*	Shrublands	Non-woody water dependent vegetation
2 200	700			Closely fringing or occurring within the Loddon River

### WATERBIRDS

Maintain current species diversity

Increase Basin-wide abundance of waterbirds by 20–25 per cent by 2024

A 30–40 per cent increase in nests and broods (Basin-wide) for other waterbirds

Up to 50 per cent more breeding events (Basin-wide) for colonial nesting waterbird species

### FISH

No loss of native species

Improved population structure of key species through regular recruitment, including

- short-lived species with distribution and abundance at pre-2007 levels and breeding success every 1–2 years
- moderate to long-lived with a spread of age classes and annual recruitment in at least 80 per cent of years

Increased movements of key species

Expanded distribution of key species and populations

**Key species for the Loddon include:**

Species	Specific outcomes	In-scope for C'th e-water in the Loddon?
Freshwater catfish ( <i>Tandanus tandanus</i> )	Improve core range in at least three additional locations (candidate sites include the Loddon River)	Yes
Golden Perch ( <i>Macquaria ambigua</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Murray cod ( <i>Maccullochella peelii peelii</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
River blackfish ( <i>Gadopsis marmoratus</i> )	Establish 1–3 additional populations (candidate sites include downstream of the Loddon)	Yes
Silver perch ( <i>Bidyanus bidyanus</i> )	Improve core range in at least two additional locations – (candidate sites include the lower Loddon)	Yes

## Wimmera

Expected outcomes from the Basin-wide environmental watering strategy (MDBA 2014) that are relevant to the Wimmera are described below.

### RIVER FLOWS AND CONNECTIVITY

Baseflows are at least 60 per cent of the natural level

A 10–20 per cent increase in the frequency of freshes and bankfull

### VEGETATION

Maintain the current extent of forest and woodland vegetation and non-woody vegetation

Improve condition of black box and river red gum

Improved recruitment of trees within black box and river red gum communities

#### Vegetation extent

Area of river red gum (ha)	Area of black box (ha)	Area of coolibah (ha)	Shrublands	Non-woody water dependent vegetation
6 500	3 100			Closely fringing or occurring within the Wimmera River

#### Black box condition

Vegetation condition score		Percent of vegetation assessed (within the managed floodplain)
0 – 6	>6 – 10	
42 per cent	58 per cent	26 per cent

#### River red gum condition

Vegetation condition score					Percent of vegetation assessed (within the managed floodplain)
0 – 2	>2 – 4	>4 – 6	>6 – 8	>8 – 10	
3 per cent	5 per cent	18 per cent	60 per cent	13 per cent	20 per cent

### WATERBIRDS

Maintain current species diversity

Increase Basin-wide abundance of waterbirds by 20–25 per cent by 2024

A 30–40 per cent increase in nests and broods (Basin-wide) for other waterbirds

Up to 50 per cent more breeding events (Basin-wide) for colonial nesting waterbird species

### FISH

No loss of native species

Improved population structure of key species through regular recruitment, including

- short-lived species with distribution and abundance at pre-2007 levels and breeding success every 1–2 years
- moderate to long-lived with a spread of age classes and annual recruitment in at least 80 per cent of years

Increased movement of key species

Expanded distribution of key species and populations

**Key species for the Wimmera include:**

Species	Specific outcomes	In-scope for C'th e-water in the Wimmera?
Freshwater catfish ( <i>Tandanus tandanus</i> )	Expand the core range of at least two current populations (candidate sites include Wimmera River)	Yes
Golden Perch ( <i>Macquaria ambigua</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Murray cod ( <i>Maccullochella peelii peelii</i> )	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes



# Attachment B – Library of watering actions

## Operational considerations in the Victorian Rivers in the Murray-Darling Basin

The delivery of environmental water in the Victorian rivers in the Murray-Darling Basin is currently constrained by the release capacities from storages, channel capacities and system constraints. The potential risks to third parties are an important consideration for the delivery of environmental water. Floodplain infrastructure works may also constrain maximum flow rates at different times and locations.

Further information about constraints in the Murray-Darling Basin Victorian Rivers is provided by the Murray-Darling Basin Authority and can be found in Preliminary Overview of Constraints to Environmental Water Delivery in the Murray-Darling Basin (MDBA2013a) and Constraints Management Strategy (MDBA 2013b). Specific constraints to be considered are detailed under the Potential watering actions – standard operating arrangements section later in this attachment.

Operational considerations such as constraints and risks will differ depending on the inflow scenario. Throughout the year operational and management considerations will be addressed as decisions are taken to make water available for use, and as these decisions are implemented. This will include refining the ecological objectives, assessing operational feasibility and potential risks and the ongoing monitoring of the seasonal outlook and river conditions.

## Potential watering actions under different levels of water resource availability

Under certain levels of water resource availability, watering actions may not be pursued for a variety of reasons, including that environmental demand may be met by unregulated flows and that constraints and/or risks may limit the ability to deliver environmental water. Table 4 identifies the range of potential watering actions in the Victorian Rivers in the Murray-Darling Basin and the levels of water resource availability that relate to these actions.

**Table 4:** Summary of potential watering actions for the Victorian Rivers in the Murray-Darling Basin

Broad Asset	Indicative demand	Applicable level(s) of resource availability				
		Very Low	Low	Moderate	High	Very High
Goulburn River	Baseflow 540-940 ML/day at McCoys Bridge	1a. Contribute to minimum baseflows year-round to maintain water quality and provide suitable habitat and food resources to support native fish and macroinvertebrate condition and survival.				
		1b. Contribute to higher baseflows year-round, but especially in winter/spring to provide additional habitat and food resources to support native fish and macroinvertebrate condition and survival.				
	Winter fresh (Jun-Aug) Up to 15 000 ML/day at Murchison & McCoys Bridge with 14 days above 6 600 ML/day		1c. Contribute to winter freshes to support the condition and survival of native vegetation as part of the ongoing system recovery following prolonged drought and subsequent flooding; provide channel maintenance and promote the transport of nutrients, carbon, sediment and biota.			
	Spring fresh (Sep-Nov) Up to 15 000 ML/day at Murchison/McCoys Bridge with 14 days above 5 600 ML/day	1d. Contribute to long-duration freshes in spring targeting in-channel native vegetation condition and reproduction; macroinvertebrate diversity and abundance; movement and condition of native fish; biotic dispersal and the transport of nutrients, carbon and sediment.				
	Spring/summer fresh (Oct-Dec) Up to 15 000 ML/day at Murchison & McCoys Bridge for 2 days		1e. Contribute to short-duration freshes between October and December to promote movement and breeding of native fish (flow cued spawners).			
	Summer/autumn fresh (Feb-Apr) Up to 5 600 ML/day at Murchison & McCoys Bridge for 2-10 days	1f. Contribute to low magnitude, long-duration freshes between February and April to support the survival and condition of in-channel native vegetation and promote the transport of nutrients, carbon, sediment and biota. This fresh may also contribute to fish migration.				
Lower Broken Creek	Winter-autumn baseflow (40 ML/day at Rices Weir)	2a. Contribute to minimum baseflows between mid-August and mid-May to support native fish movement through fishways.				
	Winter-autumn baseflow (120–250 ML/day at Rices Weir)	2b. Contribute to high baseflows between August and May to manage excessive Azolla growth and maintain dissolved oxygen levels above 5 mg/L.				
	Spring-summer baseflow (250 ML/day at Rices Weir)		2c. Contribute to high baseflows between September and December to provide improved habitat and migration opportunities for native fish.			
Upper Broken Creek	Fresh (up to 200 ML/day for 1-2 days in winter/spring and/or summer/autumn)		3. Contribute to moderate-size freshes in response to natural flow triggers or transfers from Broken River to maintain water quality and support condition and reproduction of in-channel vegetation, native fish and macroinvertebrates.			

Broad Asset	Indicative demand	Applicable level(s) of resource availability				
		Very Low	Low	Moderate	High	Very High
<b>Broken River</b>	Winter/spring baseflow 80-200 ML/day at downstream Back Creek Junction	4a. Contribute to baseflows between June and November to maintain water quality and provide suitable habitat and food resources to support native fish and macroinvertebrates condition and survival.				
	Small fresh 270-500 ML/day for 2-8 days in winter/spring and summer/autumn	4b. Contribute to small freshes throughout the year to support the condition and reproduction of native in-channel vegetation; the condition, movement and reproduction of native fish; and provide suitable habitat for biota through maintaining water quality, scouring biofilms, inundating benches and flushing fine sediment from the riverbed.				
	Large fresh 2600-4500 ML/day for 1 day in winter/spring				4c. Contribute to large freshes in winter/spring, subject to appropriate triggers, to support the condition and reproduction of native in-channel vegetation; the condition, movement and reproduction of native fish; and channel maintenance.	
<b>Goulburn-Broken Catchment Wetlands</b>	Infrastructure delivery to semi-permanent wetlands (for Goulburn River wetlands, equivalent to >20 000 ML/day at Shepparton)	5. Contribute flows via wetland regulators and/or pumping to inundate semi-permanent, temporary and ephemeral wetlands.				
<b>Campaspe River</b>	Summer/autumn low flows 10-50 ML/day to reach 4 between the Campaspe Siphon and the Murray River. Lower end of range during dry conditions – maintain at all times.	6a. Contribute to low flows in summer/autumn to maintain water quality, especially dissolved oxygen, for native fish populations. Support native vegetation, platypus and macroinvertebrates.				
	Winter/spring fresh 1000-1800 ML/day for 2-7 days to reaches 2 and 4. Lower end of range during dry conditions	6b. Contribute to winter/spring high flows to support native fish movement, riparian vegetation and macroinvertebrate habitat and encourage female platypus to choose burrows higher on the river bank. Additionally, flush channel and river benches of organic matter to mitigate potential blackwater events in summer.				
	Winter/spring low flows 50-200 ML/day at Barnadown Weir - Lower end of range during dry conditions	6c. Contribute to winter/spring low flows to support native fish and macroinvertebrate populations and maintain water quality. Support native vegetation and platypus.				
	Summer/autumn freshes 50-200 ML/day for 1-3 days at Barnadown Weir. Lower end of range during dry conditions – only if winter fresh has been delivered.	6d. Contribute to summer/autumn freshes to support native fish populations and improve water quality and macroinvertebrate habitat.				

Broad Asset	Indicative demand	Applicable level(s) of resource availability				
		Very Low	Low	Moderate	High	Very High
Loddon River	Summer/autumn low flows (continuous Dec-May) 25–50 ML/day at Loddon Weir	7a. Contribute to summer/autumn low flows to maintain sufficient depth and habitat in pools to support macroinvertebrates, native fish, aquatic plants and fauna, provide continuous flow through the reach to maintain water quality and connecting flows to encourage in-stream and fringing non-woody vegetation.				
	Summer/autumn freshes (Dec-May) 50-100 ML/day for 3–4 days at Loddon Weir	7b. Contribute to summer/autumn freshes to promote local movement of native fish, flush fine sediment from hard surfaces, promote growth of fringing emergent macrophytes and promote dispersal of juvenile fish and platypus in autumn.				
	Autumn high flow (April-May) 400 ML/day at Loddon Weir with a 6 day peak		7c. Contribute to autumn high flows to cue and facilitate upstream movement of >1 year old golden perch, silver perch and Murray cod.			
	Winter/spring low flow (continuous June-Nov) 50–100 ML/day at Loddon Weir	7d. Contribute to winter/spring low flows to increase depth for fish, platypus and water rat movement, keep submerged wood and other hard surfaces clear of fine silt and sediment, support the range of vegetation types, provide habitat for platypus and maintain safe passage for juvenile platypus dispersal in June.				
	Winter/spring high flow (Sept-Oct) 450–750 ML/day at Loddon Weir with a 7 day peak		7e. Contribute to winter/spring freshes to provide flows through flood runners, flush accumulated organic matter from banks and benches, stimulate native fish movement and breeding, promote recruitment and maintenance of riparian and emergent vegetation and scour some pools.			
Ovens River	Summer/autumn fresh (Feb – May) when the bulk water transfer from Lake Buffalo is available 70 ML over 2 days		8a. Contribute to maintaining the movement of native fish, natural connectivity between pools and riffles and with the River Murray, supporting microinvertebrate habitat and scouring of bio-film from beds			
	Baseflows if bulk water transfer not available (Nov–May) 70 ML over 2 days		8b. Contribute to maintaining native fish habitat and connectivity sufficient for fish passage between pools.			

<b>Wimmera System</b>	<p>Variable baseflows and freshes throughout the year in accordance with priority watering actions designed to meet recommended flow volumes for reaches 2, 3 or 4 of the Wimmera River. Larger pulses may be used to provide additional water to the terminal wetlands (Lakes Albacutya and Hindmarsh) when coupled with unregulated flows.</p>		<p>9. When available, Commonwealth environmental water may be used to assist the Victorian Environmental Water Holder in meeting objectives in the greater Wimmera system via a combination of partial allocations and/or carryover from previous years. Due to the low reliability of the Commonwealth holdings, allocation is only expected in very wet years, or average years immediately preceded by wet years.</p>
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Note: Under certain resource availabilities, options may not be pursued for a variety of reasons including that environmental demand may be met by unregulated flows and that constraints and/or risks may limit the ability to deliver environmental water.

## Potential watering actions – standard operating arrangements

Table 4 identifies the range of potential watering actions in Victorian Rivers in the Murray-Darling Basin that give effect to the long-term demands and flow regime identified as being in scope for the contribution of Commonwealth environmental water in any given year. The standard considerations associated with these actions are set out below.

*A note on approvals:* watering actions in Victorian rivers are implemented with local delivery partners who play a key role in engaging with the local community and third parties. As some actions may be constrained by other demands in the system, the Office routinely seeks advice from river operators on the timing, magnitude and duration of planned watering.

### **Watering action 1: Goulburn River**

#### *Standard operational considerations*

- Commonwealth environmental water delivery will not contribute to flows above 9500 ML/day at Molesworth to minimise the risk of potential impacts on private property in reach 1, located between Eildon Dam and Molesworth.
- Unless otherwise agreed, Commonwealth environmental water will only contribute to flows up to 15 000 ML/day at McCoys Bridge. Fresh events are unlikely to target flows above 9500 ML/day in the lower Goulburn River at McCoys Bridge, however, recession management of natural high flow events may commence at 15 000 ML/day at McCoys Bridge.
- Any rapid changes to planned environmental flows are currently restricted to avoid bank erosion and slumping along the Goulburn River.
- The design of environmental watering action will take into consideration other river users, including recreational fishers and irrigators, to minimise the risk and inconvenience of inundation of private land and infrastructure and disruption to recreational activities.
- Intervalley transfers undertaken by Goulburn Murray Water may impact on the volume and timing of Commonwealth Environmental Water releases.
- Drawdowns from Lake Eildon during summer/autumn may attract community concern if the lake-level recedes and affects recreational activity.

*Typical extent:* In-channel flows will be released from Lake Eildon or Goulburn Weir, particularly targeting reaches 4 and 5 (lower Goulburn River downstream of Goulburn Weir), with en route benefits to reaches 1 to 3 (Eildon to Goulburn Weir).

### **Watering action 2: Lower Broken Creek**

#### *Standard operational considerations*

- Environmental water delivery is constrained to the period mid May to mid August, when irrigation infrastructure in the Shepparton and Murray Valley is not being used to meet irrigation orders.
- Environmental water delivery will be delivered to complement consumptive water deliveries, including intervalley bulk water transfers, where appropriate. This approach provides third party benefits to other entitlement holders in the Murray-Darling Basin by allowing intervalley bulk water transfers to be diverted around the Barmah Choke, thereby reducing competition for channel capacity at the Choke.

*Typical extent:* Environmental water is delivered as in-channel flows supplied to lower Broken Creek below Katandra and Nine Mile Creek via Shepparton and Murray Valley irrigation area channel infrastructure.

### **Watering action 3: Upper Broken Creek**

#### *Standard operational considerations*

- Unless otherwise agreed, Commonwealth environmental water will only contribute to flows below channel capacity to avoid potential third party flooding impacts.
- Up to 210 ML/day can be passed into upper Broken Creek from the Broken River at Caseys Weir.

*Typical extent:* In-channel flows delivered as managed releases from Lake Nillahcoote and diverted from Broken River to upper Broken Creek at Caseys Weir.

### **Watering action 4: Broken River**

#### *Standard operational considerations*

- Delivery to Broken River is at times dependent upon ability to supplement consumptive deliveries to meet baseflow requirements in early winter.

*Typical extent:* In-channel flows delivered as managed releases from Lake Nillahcoote.

### **Watering action 5: Goulburn-Broken Catchment Wetlands**

#### *Standard operational considerations*

- Delivery to Goulburn-Broken catchment wetlands, including Moodie Swamp, involves low in-channel flow rates well below channel capacity.

*Typical extent:* Wetland inundation via infrastructure.

### **Watering action 6: Campaspe River**

#### *Standard operational considerations*

- The maximum regulated release volume from Lake Eppalock to avoid any potential third party flooding impacts is 1850 ML/day (measured at Barnadown Weir). Planned releases are below this volume.
- Intervalley transfers undertaken by Goulburn Murray Water may impact on the volume and timing of Commonwealth Environmental Water releases.
- Drawdown from Lake Eppalock during summer/autumn may attract community concern if the lake-level recedes and affects recreational activity.
- Flows greater than 10 000 ML/day in reach 2 (Eppalock Weir to Campaspe Weir) and greater than 8000 ML/day in reach 3 (Campaspe Weir to Campaspe Siphon) and 9000 ML/day in reach 4 (Campaspe Siphon to River Murray) will cause flooding of low lying floodplain including private property. These flows are not planned.
- Campaspe Weir seepage remains unsolved limiting the delivery of winter high flows.
- Potential inundation of diverter pumps may limit the magnitude of winter high flow.
- Unable to deliver water during annual maintenance of the Lake Eppalock outlet tower.

*Typical extent:* In-channel flows released from Lake Eppalock targeting reaches 2 (Lake Eppalock to Campaspe Weir) and 4 (Campaspe Siphon to Murray River).



### **Watering action 7: Loddon River**

#### *Standard operational considerations*

- Outfall capacity of the Cairn Curran Reservoir is limited to 1600 ML/day at full supply level (the environmental flow recommendation of 3000 ML/day exceeds this capacity).
- Outfall capacity of the Laanecoorie Reservoir is limited to 1300 ML/day (the environmental flow recommendation of 7300 ML/day exceeds this capacity).
- Due to potential inundation of private land, environmental water will not contribute to flows above 450 ML/day in reach 4 (Loddon Weir to Kerang Weir) without the agreement of potentially affected landholders.
- Flow travel times and attenuation from storages present a challenge for environmental watering as peak flow rates released from storage are required to be much higher than the peak flow rate at the target location.
- Environmental flow regimes are constrained by the limited capacity of the Serpentine, Loddon and Kerang weirs to regulate low flows.
- Regulator damage at Twelve Mile Creek means there is no control over the split of water entering the Loddon River and the Creek, particularly during low flows.
- Water available in the Goulburn can be delivered via the Western Waranga Channel to Loddon Weir and reach 4, depending on channel capacity during irrigation season.

*Typical extent:* In-channel flows released from Cairn Curran, Tullaroop or Laanecoorie Reservoirs, particularly targeting reach 4 (Loddon Weir to Kerang Weir).

### **Watering action 8: Ovens River**

#### *Standard operational considerations*

- Water is released each year during periods of regulated flow and prior to the storages reverting to winter storage operating levels.
- The timing for delivery of Commonwealth environmental water is dependent on inflow rates into Lake Buffalo and Lake William Hovell as entitlements can only be released when the storages are not spilling. At Lake Buffalo the maximum outflow is 850 ML/day at full supply level and approximately 600 ML/day during periods of Lake drawdown. The minimum outflow of Lake Buffalo is 20 ML/day and this limits the capacity to deliver the 20 ML of held Commonwealth entitlement over more than one day. Similarly in Lake William Hovell, the 50 ML of held Commonwealth entitlement can only be released over a maximum of two days, limiting the ongoing contribution it can provide for critical drought refuges under dry conditions.
- Inflow rates, particularly for Lake William Hovell, are to be tracked to ensure the opportunity for delivery is not inadvertently missed.
- To maximise environmental benefits Commonwealth environmental water release may be timed to occur with the Goulburn Murray Water 'bulk release drawdown'.

*Typical extent:* In-channel flows in the Ovens, King and Buffalo Rivers released from Lake William Hovell and Lake Buffalo.

## **Watering action 9: Wimmera System**

### *Standard operational considerations*

- Commonwealth environmental water is limited to Mt William Creek, reaches 3 and 4 of the Wimmera River and the terminal wetlands (Lakes Albacutya and Hindmarsh). This is due to the entitlement 'point of source' which is limited to Taylors Lake, Rockland Reservoir and Lake Lonsdale.
- The outlet capacity at Lake Lonsdale and Taylors Lake is 600 ML/day and 400 ML/day respectively. Therefore operational constraints limit the regulated delivery of large, bankfull and overbank flows in the Wimmera River.

*Typical extent:* Subject to water availability Commonwealth environmental water will be delivered to the Wimmera River as in-channel flows to be sourced from managed releases from the Wimmera-Glenelg headworks system. Should the allocation come on-line, the Wimmera Catchment Management Authority will consult with the Office and the Victorian Environmental Water Holder regarding the planned use of this water.

# Attachment C – Long-term water availability

## Commonwealth environmental water holdings

The Commonwealth holds the following entitlements in the Victorian Rivers in the Murray-Darling Basin:

- Goulburn (high reliability)
- Goulburn (low reliability)
- Campaspe (high reliability)
- Campaspe (low reliability)
- Loddon (high reliability)
- Loddon (low reliability)
- Broken River (high reliability)
- Broken River (low reliability)
- Ovens (high reliability)
- Wimmera System (low reliability)

The full list of Commonwealth environmental water holdings can be found at [www.environment.gov.au/topics/water/commonwealth-environmental-water-office/about-commonwealth-environmental-water/how-much](http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/about-commonwealth-environmental-water/how-much) and is updated monthly.

## Other sources of environmental water

Other potential sources of held environmental water that may be used to complement Commonwealth environmental water delivery in the Victorian Rivers in the Murray-Darling Basin include:

- Environment Entitlement – The Living Murray Program: Murray-Darling Basin Authority
- Bulk Entitlement (River Murray – Flora and Fauna): Victorian Environmental Water Holder
- Goulburn River Environmental Entitlement: Victorian Environmental Water
- Campaspe River Environmental Entitlement: Victorian Environmental Water
- Bulk Entitlement (Loddon River Environmental Reserve): Victorian Environmental Water

## Planned environmental water

In addition to water entitlements held by environmental water holders, environmental demands may also be met via natural or unregulated flows and water provided for the environment under the various bulk entitlements which specify minimum passing flows for each of the Victorian river systems (referred to in this document as ‘planned environmental water’). The Bureau of Meteorology provides a seasonal streamflow forecasting service which estimates the potential for low, median or high flows for the coming three months.



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