Australian Government

Commonwealth Environmental Water Office

Commonwealth Environmental Water

Portfolio Management Plan

Victorian Rivers in the Murray-Darling Basin

2017–18

Front cover image credit: Goulburn River. Photo by Goulburn Broken Catchment Management Authority.

Back cover image credit: Goulburn River. Photo by Goulburn Broken Catchment Management Authority.

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.

Commonwealth environmental water portfolio management planning

Commonwealth Environmental Water Holder

The Commonwealth Environmental Water Holder is a statutory position established under the *Water Act 2007* and is responsible for managing the Commonwealth's environmental water holdings. This water must be managed to protect and restore the rivers, wetlands and floodplains (and the native animals and plants they support) of the Murray-Darling Basin. Mr David Papps is the current Commonwealth Environmental Water Holder and is supported by staff of the Commonwealth Environmental Water Office. The Office employs six local engagement officers who live and work in regional centres across the Murray-Darling Basin.

Commonwealth environmental water

Commonwealth environmental water holdings are water entitlements that have been acquired by the Australian Government through investments in water-saving infrastructure and purchases on the water market. The holdings are a mix of entitlement types held across 19 catchments. The rules governing the entitlements vary across states and across catchments. Commonwealth environmental water entitlements are subject to the same fees, allocations, carryover and other rules as equivalent entitlements held by other water users.

There are broadly three options for managing Commonwealth environmental water:

- delivering water to a river or wetland to meet an identified environmental demand
- leaving water in storage and carrying it over for use in the next water year (referred to as 'carryover')
- trading water, that is, selling water and using the proceeds to buy water in another catchment or in a future year, or investing in complementary 'environmental activities'.

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 2017–18. Efficient and effective management of Commonwealth environmental water requires the utilisation of all portfolio management options. 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 Commonwealth environmental water, consistent with the Basin-wide environmental watering strategy and having regard to the Basin annual environmental watering priorities.

To learn more about the planning approach see *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2017–18* (available at: http://www.environment.gov.au/water/cewo/publications under 'Planning approach').

Delivery partners

Commonwealth environmental water is managed in conjunction with and delivered by a range of partners. This portfolio management plan has been developed in consultation with our delivery partners, including 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.

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.

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1. 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. 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 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).

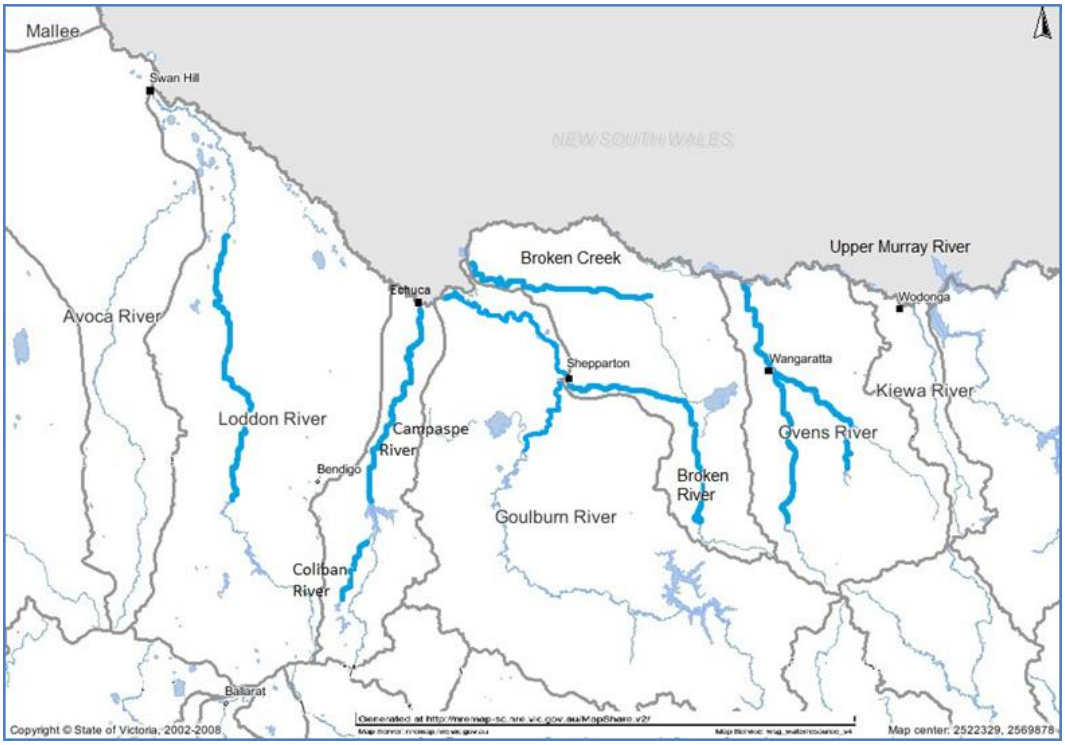

Figure 1: Map of the Victorian rivers in the Murray-Darling Basin. The Wimmera catchment is not shown here but is located in central-west Victoria.

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 River 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 is 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 in the Victorian Rivers in the Murray-Darling Basin

The long-term environmental objectives for the Murray-Darling Basin are described in the Basin Plan's environmental watering plan and the Basin-wide environmental watering strategy, which includes 'quantified environmental expected outcomes' at both a Basin-scale and for each catchment. The expected outcomes relevant for the Victorian rivers are described in Attachment A.

The Victorian state government has also developed a long-term watering plan for all northern Victorian catchments. The plan identifies the priority environmental assets and ecosystem functions in the catchment, the objectives and targets for these assets and functions, and their watering requirements (https://www.water.vic.gov.au/waterways-and-catchments/rivers-estuaries-and-waterways/environmental-water).

Based on these strategies and plans, and in response to best available knowledge drawing on the results of environmental watering monitoring programs, the objectives for environmental watering in Victorian rivers are summarised in Table 1 below. The objectives 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 objectives being targeted by environmental watering in the Victorian rivers

BASIN-WIDE MATTERS (Matters in red link to the Basin-wide Environmental Watering Strategy)	**OBJECTIVES FOR ENVIRONMENTAL ASSETS IN THE VICTORIAN RIVERS**	
	IN-CHANNEL ASSETS	**OFF-CHANNEL ASSETS**
	Goulburn (lower and middle reaches), Broken, Campaspe, Loddon, Ovens and Wimmera rivers; Upper and lower Broken Creek	**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. 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.	
		Support waterbird breeding, including 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 and to the River Murray for environmental functions such as nutrient and sediment transport, organism dispersal and water quality. Support lateral connectivity by increasing 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.
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 dissolved oxygen and hypoxic blackwater), including minimising accumulation of Azolla (aquatic plant) in lower Broken Creek to help maintain DO levels.	Support the transport of nutrients and carbon off the floodplain and into the river channel and downstream.
+RESILIENCE	Provide drought refuge habitat.	

Information sourced from: Cottingham et al. (2003; 2007; 2010; 2014) GBCMA (2017a-d), NCCMA (2017a-b), NECMA 2017) WCMA (2017).

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 while others are met by large unregulated/natural flows events, or are beyond what can be delivered within operational constraints.

Figure 3 shows the broad environmental demands that are in scope for Commonwealth environmental water. Importantly, these are broad, indicative demands. 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.

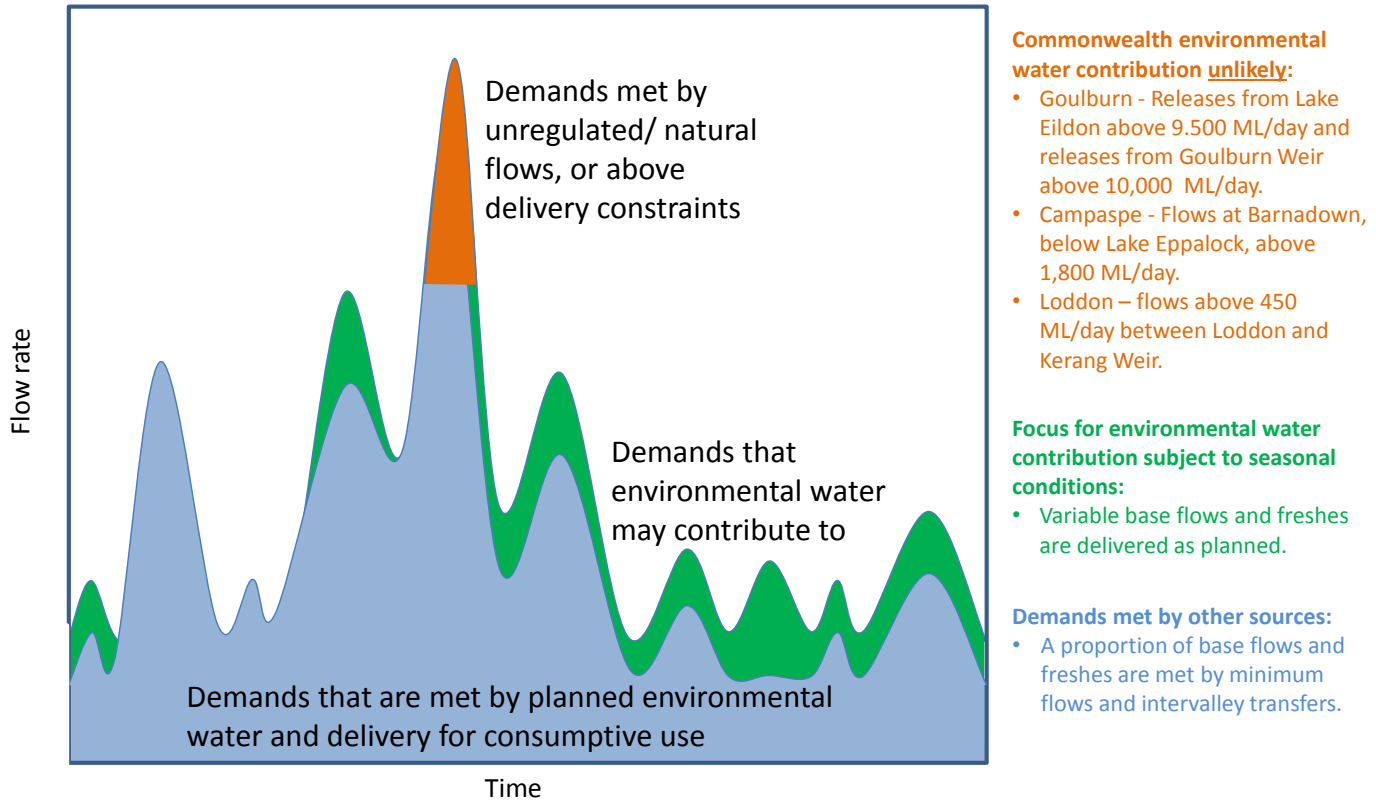

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Figure 2: Scope of demands that environmental water may contribute to in the Victorian rivers of the Murray-Darling Basin

Based on the above objectives 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, 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.

The Long Term Intervention Monitoring (LTIM) Project is also being undertaken in the lower Goulburn catchment and aims to understand the environmental response from Commonwealth environmental watering. Information on the monitoring activities in the Goulburn is available at http://www.environment.gov.au/water/cewo/catchment/northern-victorian-rivers/monitoring

Monitoring information is also provided by state governments and The Living Murray program.

Key findings and recommendations from the first two years (2014–15 and 2015–16) of the Goulburn LTIM Project include:

Bank condition

The effect of current environmental flows on bank condition is very minor compared to changes that occur under the remainder of the regulated flow regime. Maintaining the current rates of recessions will avoid bank erosion and encourage the development of mud drapes. Providing variability in baseflows and water levels will maintain wetting at varying heights on the bank and avoid bank notching.

Stream metabolism (primary production and decomposition)

Larger flow actions may be required in the future to mobilise carbon and nutrients from backwaters and the floodplain to boost primary productivity. Although higher flows are currently in planning frameworks, they are unable to be delivered (except via natural flows) due to third party risks to property. Providing flows in late spring or summer when waters are warm may improve stream primary productivity.

Macroinvertebrates

Increased primary productivity volumes may enhance river-edge habitats for macroinvertebrates. Maintaining an early spring fresh may alleviate stress to macroinvertebrates and increase their abundance and biomass for native fish food.

Bank vegetation

Spring freshes will likely contribute to maintaining lower bank vegetation and the early delivery of a spring fresh may also buffer vegetation in the event of a hot, dry summer. The delivery of winter flows are important for reestablishment of bank vegetation and the delivery of variable baseflows and water levels is likely to support the survival of young plants through to maturity.

Fish

Native fish spawning, fish movement and recruitment was detected; also for carp. Flows for golden perch movement and spawning should be delivered when water temperature is above 18 °C. Results also suggest that, where possible, spring freshes should be delivered under conditions that are less favourable for carp.

The outcomes from these monitoring activities are used to inform portfolio management planning and adaptive management decision-making as outlined in Section 2.

2. Portfolio management in 2017–18

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 objectives and watering requirements, watering history and asset condition) 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 2017–18

Asset condition across the Victorian rivers in the Murray-Darling Basin reflect 15 years of harsh climate conditions. Over this period there was prolonged drought conditions between 1997 and 2010, significant flooding in 2010–11 and a subsequent series of four moderate/dry years, until 2016–17. Environmental watering in recent years and the wet conditions experienced during 2016–17 have contributed to some improvement in river health and supported ongoing recovery across the catchments. The sites to be targeted with environmental water in the Victorian rivers are predominantly in-channel. This means that despite the high flows experienced in 2016–17, many of the sites require water every year and therefore have moderate–high demands, as summarised below and outlined in Table 3.

Goulburn River: High demand

Natural flows and environmental watering over the last couple of years has resulted in the restoration of vegetation that was drowned and scoured from the river banks in the 2010–11 floods. It has also supported the migration of native fish, particularly golden perch, into the lower river reaches. There is a high demand for flows to: maintain good water quality and suitable habitat and food resources to support the condition and survival of native fish and macroinvertebrate; maintain existing vegetation by watering banks and benches; distribute seed and support plants to flower and seed for later germination and distribution; stimulate native fish breeding (flow cued spawners), particularly golden and silver perch; and facilitate fish migration.

Lower Broken Creek: High demand

The presence of numerous small weirs in the system and ongoing issues with low dissolved oxygen levels and Azolla growth threaten native fish survival. Key demands include: maintaining dissolved oxygen above 5 mg/L; minimising Azolla presence; and keeping the fish-ways open all year to facilitate native fish passage.

Upper Broken Creek: Moderate to high demand

In summer through to early autumn, poor water quality may be experienced as a result of events such as floods, low and cease-to-flow occurrences, intense rainfall and fire. This poses a threat to the stable fish communities in the river. Environmental demands include: maintaining water quality; maintaining riparian vegetation condition and diversity; and supporting native fish and macroinvertebrates survival.

Broken River: Moderate to high demand

In late summer and autumn, if very low flows are experienced, environmental demands will be for maintaining habitats to support native fish, aquatic plants and macroinvertebrates, and also to provide native fish passage.

Goulburn-Broken catchment wetlands: Low to moderate demand

During 2016 natural flows inundated these wetlands and therefore any watering would be in response to natural events. If wetlands are dry in autumn there may be a need for water to maintain the health of wetland plants and waterbird habitat, for example, ridged water milfoil and cane grass at Moodie Swamp.

Campaspe River High demand

With wet conditions in 2016–17 the river health has improved. Key demands in 2017–18 include: maintaining the health of river red gum, native fish, macroinvertebrate and platypus populations; supporting longitudinal connectivity for instream emergent and fringing vegetation; maintaining pool habitat tor native fish populations, especially with respect to dissolved oxygen and salinity levels; and flushing river benches of organic matter in cooler months to mitigate potential water quality issues during the summer.

Loddon River High demand

Wet conditions in 2016–17 brought ecological benefit to the system. In 2017–18 environmental demands include: supporting longitudinal connectivity and maintaining water volume and quality in refuge pools for fish, platypus and water rat movement; and maintaining healthy ecosystem processes such as transporting nutrients and carbon and regularly replenishing biofilms.

Ovens River: High demand

In a dry to very dry scenario the environmental need is for: native fish movement; connectivity between pools and riffles and with the River Murray; supporting microinvertebrate habitat; and scouring of bio-film from beds.

Wimmera River: High demand

Key demands in the Wimmera include providing 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-wide environmental watering strategy and 2017–18 annual priorities

In contributing to these demands, the Commonwealth Environmental Water Office will also be aiming to contribute to the expected outcomes in the Basin-wide environmental watering strategy (see Attachment A) and the following 2017–18 Basin annual environmental watering priorities relevant to the Victorian rivers in the Murray-Darling Basin:

- Support Basin-scale population recovery of native fish by reinstating flows that promote key ecological processes across local, regional and system scales for the southern-connected Basin
- Support viable populations of threatened native fish and maximise opportunities for range expansion and the establishment of new populations
- Through the use of return flows, support improved connectivity between freshwater, estuarine and marine environments and improve habitat conditions in the Coorong by optimising and managing inflows through the Lower Lakes

2.2. Water availability in 2017–18

Forecasts of Commonwealth water allocations

The volume of Commonwealth environmental water likely to be carried over in the Victorian rivers for use in 2017–18 is estimated to be around 42 GL. Total carryover in the southern-connected Basin is estimated to be around 300–310 GL.

Allocations against Commonwealth water entitlements in the Victorian rivers are determined by state governments and will vary depending on inflows. The following forecasts in Table 2 are based on the best available information including state forecasts and historical inflow scenarios.

Table 2: Forecasts of Commonwealth water allocations (including carryover) in 2017–18 in the Victorian rivers as at 31 May 2017

Entitlement type	Forecasts of Commonwealth water allocations (including carryover) in 2017–18 (GL)[1]					
	Very dry ◄					► Very wet
	95 percentile	90 percentile	75 percentile	50 percentile	25 percentile	10 percentile
Goulburn[2] (High/Low Reliability)	171	322	322	322	314	306
Upper Broken Creek and Broken River	0.2	0.3	0.3	0.3	0.3	0.3
Campaspe[2] (High/Low Reliability)	13	13	13	13	10	7
Loddon (High/Low Reliability)	1.5	3.4	3.4	3.4	3.4	3.9
Ovens (High Reliability)	0.07	0.07	0.07	0.07	0.07	0.07
Wimmera & Glenelg)	12	12	12	12	26	33
Total – Vic Rivers	**197.91**	**350.91**	**350.91**	**350.91**	**353.91**	**350.41**
Total – Southern-Connected Basin	**861**	**1273**	**1376**	**1614**	**1577**	**1526**

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 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.

Water resource availability scenarios

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 and available to contribute to environmental objectives. 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 2017–18 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).

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 that are suitable for maximising outcomes. Figure 3 shows how current demands and forecasted supply in the Goulburn system are considered together.

The overall 'purpose' for managing the Commonwealth's water portfolio in the Victorian rivers in the Murray-Darling Basin for 2017–18 is to protect and improve 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.

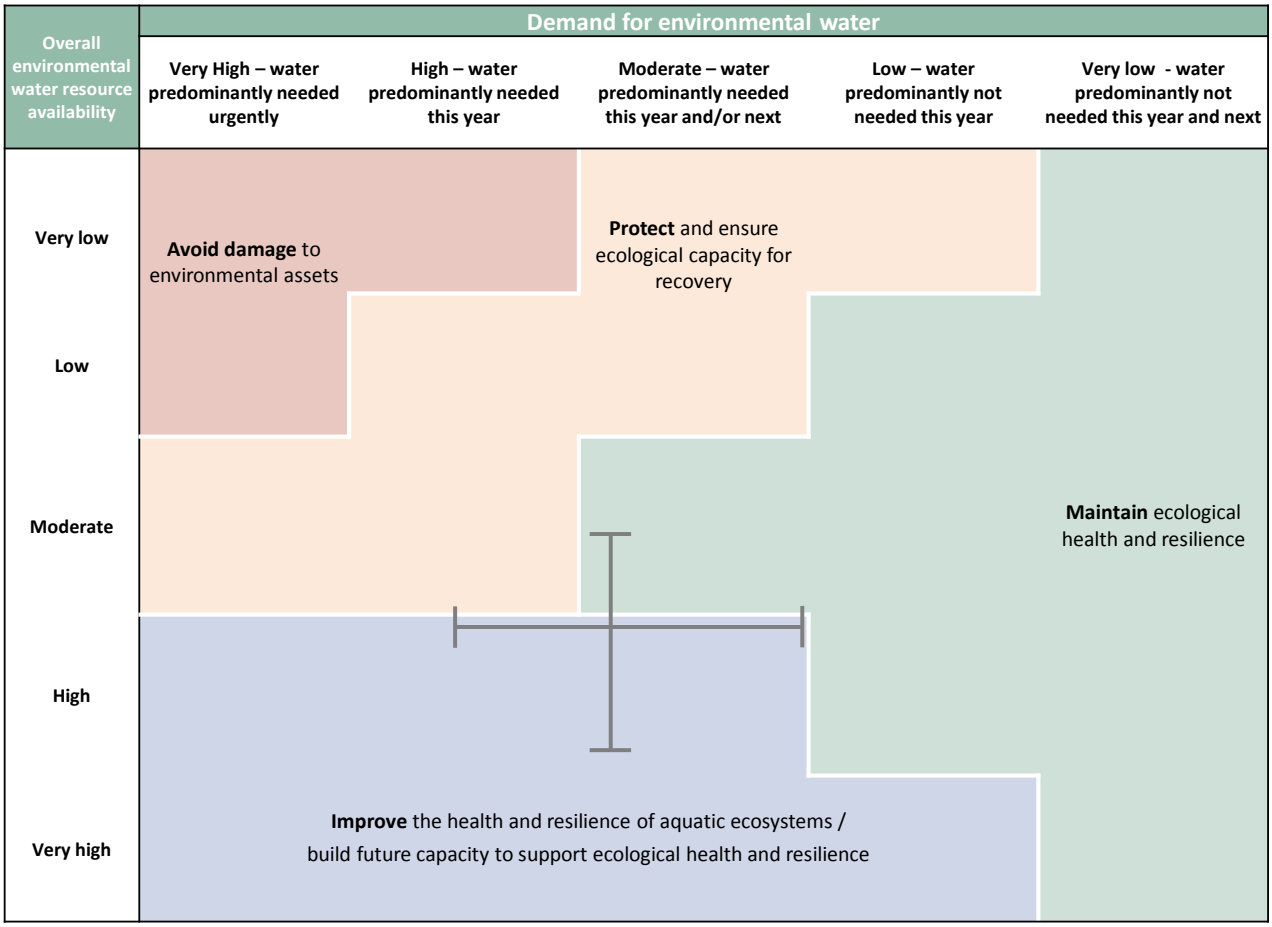

Figure 3: Determining a broad purpose for portfolio management in the Goulburn-Broken system for 2017–18. Note: grey lines represent potential range in demand and resource availability.

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, 2017–18* (available at: http://www.environment.gov.au/water/cewo/publications).

2.4. Water Delivery in 2017–18

Consistent with the demands and purpose described above, the Commonwealth Environmental Water Office is considering supplying environmental water to the following watering actions for 2017–18 (see also Table 3 for supporting information regarding the basis for determining these watering intentions). Volumes and flows for each action are agreed between the delivery partners and reflect those in the Victorian Catchment Management Authority Seasonal Watering Proposals and Victorian Environmental Water Holder Seasonal Watering Plan. Specific information on operational arrangements are provided in Attachment B.

Goulburn River (See Attachment B, Table 4 options 1a. – 1g.)

Commonwealth, Victorian and The Living Murray environmental water will be coordinated with natural flows and inter-valley transfers of water to meet environmental demand. All actions will be delivered in-channel and may include year-round variable baseflows, an early spring fresh, a spring/summer fresh, a summer/autumn fresh and a winter fresh. Return flows are available for use downstream. There is also potential for environmental water to contribute to a combined fish attractant flow with the River Murray as happened in 2016–17 and to coordinate releases with other southern-connected basin watering actions to meet broader environmental need.

Lower Broken Creek (See Attachment B, Table 4 options 2a. – 2d.)

In addition to natural flows and inter-valley transfer of water, Commonwealth environmental water is available to meet environmental demand. All actions would be delivered in-channel and may include year-round variable baseflows and a winter/spring flushing flow.

Upper Broken Creek (See Attachment B, Table 4 option 3.)

During summer/autumn, depending on demands, environmental water may be used to deliver a fresh of 50–100 ML/day for up to 10 days.

Broken River (See Attachment B, Table 4 options 4a. and 4b.)

Catchment run-off and irrigation releases are generally sufficient to meet environmental flow recommendations. However, when irrigation demand declines and runoff has yet to commence, environmental water may provide a minimum baseflow and/or a summer/autumn fresh to meet environmental demand.

Goulburn-Broken catchment wetlands (See Attachment B, Table 4 option 5a and 5b.)

Six natural wetlands in this region have received environmental water; Barmah Forest (see the *Mid Murray 2017–18 Portfolio Management Plan*), Black Swamp, Kinnairds Wetland, Reedy Swamp and Moodie Swamp. Two new sites may also be considered in 2017–18, Gaynor Swamp and Stockyard Plain. Commonwealth and Victorian environmental water is available to meet environmental demand in these wetlands.

Campaspe River (See Attachment B, Table 4 options 6a. – 6d.)

Commonwealth, Victorian and The Living Murray environmental water will be coordinated with natural flows and inter-valley transfers of water to meet environmental demands. All actions will be delivered in-channel and may include summer baseflows, winter high and low flows and summer freshes. Return flows are available for use downstream. There is also potential for environmental water to contribute to a combined fish attractant flow with the River Murray and Goulburn River as happened in 2016–17.

Loddon River (See Attachment B, Table 4 options 7a. – 7e.)

Commonwealth and Victorian environmental water is available to meet environmental demand throughout the year. All actions would be delivered in-stream and may include year-round low flows, summer freshes, a winter/spring high flow and an autumn high flow.

Ovens River (See Attachment B, Table 4 options 8a. and 8b.)

In average and wet years the flow recommendations are achieved via the natural flow regime. In a dry to very dry scenario environmental demand is for low flows to avoid a cease to flow event. Where possible environmental water delivery is planned to coincide with a bulk release water transfer.

Wimmera River (See Attachment B, Table 4 option 9.)

Any use of Commonwealth environmental water will be coordinated with other sources of environmental water and/or natural flows. It may be used to contribute to in-channel baseflows and freshes. If there are significant natural flows, environmental water may be used to provide additional water to the terminal wetlands (Lake Hindmarsh and Lake Albacutya). 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.

Stakeholder Feedback

Early Input to the potential watering actions for 2017–18 was received via the Environmental Watering Advisory Group (EWAG) meetings organised and chaired by the North Central and Goulburn Broken Catchment Management Authorities. Membership includes local land holders, irrigators, community members, the Victorian delivery partners (including the Victorian Environmental Water Holder) and the Commonwealth Environmental Water Office. Further feedback was provided from delivery partners on drafts of the plan and included refinements to asset demands and relative urgency for delivery, and some additional issues related to constraints.

2.5. Trading water in 2017–18

The *Water Act 2007* provides for the trade of Commonwealth environmental water allocations and entitlements and specifies the conditions under which sales may occur. To improve environmental outcomes must be the primary reason for trade of Commonwealth Environmental water. The Commonwealth Environmental Water Holder has no plans to trade entitlements in 2017–18.

As part of the portfolio management process, the Commonwealth Environmental Water Office regularly assesses environmental demand and supply throughout the year, considering factors such as environmental condition and demand, current and forecast climate conditions and water availability, carryover capacity and market conditions.

Where the need arises to adjust the availability of allocations in any valley in the southern-connected Basin for environmental use, the transfer of allocations from another southern connected catchment would be explored as the preferred and more efficient option to allocation purchase or sale. The transfer would be undertaken consistent with the rules identified in state water resource plans that apply to all water users. Possible third party impacts from portfolio transfers are considered when trade limits apply.

The Victorian Rivers region includes trade zones 1A, 1B, 2, 3, 4A, 4B, 4C, 5A, 9A, 9B and 21A. In 2017–18, likely administrative transfers between environmental water accounts to enable environmental water delivery include:

- large (> 100 GL) ***within*** trade zone 1A, due to the large size of environmental watering activities;
- moderate (~70 GL) ***out of*** Victorian Rivers region;
- small (less than 10 GL) ***within or between*** Victorian Rivers regions.

In the southern Basin, water allocation outlook statements are forecasting high allocations early in the season, and opportunities to sell allocation may arise in 2017-18. The issue of whether to sell will be considered once there is greater certainty regarding environmental use during the peak winter-spring demand period, most likely from October 2017 onwards. Should a decision be made to sell allocation, further information will be made available 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, refer to the *Commonwealth environmental water Trading Framework* at: http://www.environment.gov.au/water/cewo/publications/water-trading-framework-dec2014.

2.6. Carrying over water for use in 2018–19

The volume of water carried over for use in 2018–19 will depend upon resource availability and demand throughout the year. As the 2017–18 water year progresses a carryover target will be determined for the Victorian rivers in the Murray-Darling Basin sufficient to meet early season water requirements.
As documented in Table 3a–c below, potential demands in 2018–19 include:

- Year-round variable baseflows and freshes in the Goulburn River
- Year round variable baseflows in Lower Broken Creek
- Variable baseflows and freshes in the Campaspe and Loddon rivers
- Variable baseflows and freshes in the Wimmera river

Carryover volumes will be adjusted throughout the year as the season unfolds in response to both current and future demands and the total water available to meet these demands. These decisions will be based upon best information available at the time.

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 at: http://www.environment.gov.au/water/cewo/portfolio-mgt/carryover

2.7. Identifying Investment Opportunities

Changes to the *Water Act 2007* in 2016 have increased the flexibility for the Commonwealth Environmental Water Holder (CEWH) to use the proceeds of water allocation sales to invest in environmental activities. Under these amendments environmental activities must improve environmental outcomes and be undertaken for the purpose of protecting and restoring environmental assets in the Basin.

The CEWH will publically release a Discussion Paper seeking feedback on what type of activities stakeholders would like the CEWH to consider when developing a framework for future investment in environmental activities.

It should be noted that proceeds of past water sales must be managed based on the legislation in place at that time and are not available to be used for these activities.

Table 3a: Environmental demands, priority for watering in 2017–18 and outlook for coming years in the Goulburn-Broken – **MODERATE WATER RESOURCE AVAILABILITY (HIGH ALLOCATION, LOW INFLOW) IN 2017–18**

	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)			2017-18			Implications for future demands		
	Flow/volume[1]	Required frequency (maximum dry interval)	2014–15 moderate	2015–16 drying	2016–17 very wet	Predominant urgency of environmental demand for water	Purpose under moderate resource availability	Potential Commonwealth environmental water contribution	Likely urgency of demand in 2018–19 if watering occurred as planned in 2017-18	2019–20 Range of likely demand	Met in 2018–19 / Not met in 2018–19
Goulburn River (Reaches 4 and 5)	Baseflow (all year). 500–940 ML/day at Murchison/McCoys for fish and macroinvertebrate habitat and vegetation.	Annually				High	**Protect**	High	High	High High	Met in 2018–19 Not met in 2018–19
	Spring fresh (Sept/Oct). Up to 10 000 ML/day at Murchison/McCoys Bridge[2] with 14 days above 5 600 ML/day for lower bank vegetation establishment and maintenance.	Annually	Partially met (8 days above 5 600 ML/day).	Partially met (11 days above 5 600 ML/day).		High	**Protect**	High	High	High High	
	Spring/summer fresh (Nov/Dec). Up to 10,000 ML/day at Murchison/McCoys[2] with 2 days above 6,600 to stimulate golden perch spawning.	2 in 3 years		No delivery due to low water availability.	No delivery above baseflow to protect vegetation following natural inundation.	High	**Protect**	High	Moderate	Moderate High	
	Summer/autumn fresh (Feb to April). 5 600 ML/day at Murchison/McCoys for 2 days or 4,600 ML/day for 10 days for lower bank native vegetation and juvenile fish migration (when combined with a flow in the River Murray).	Annually		Partially met (peaked at only ~4,000 ML/day).		Moderate	**Maintain**	High if required	Moderate-High	Moderate High	
	Winter fresh (June/July). Up to 15 000 ML/day at Murchison/McCoys with 14 days above 6 600 ML/day[1] to provide vegetation and macroinvertebrate habitat.	1 in 2 years	Partially met (5 days above 6 600 ML/day).	No delivery due to low water availability.	Full delivery planned at time of publication.	Moderate	**Maintain**	High	Moderate	Moderate High	
	Winter/early spring fresh (August) Up to 5,000 ML/day at Murchison/McCoys for 2 days for increased fish conditioning prior to the fish spawning flow.	When a fish spawning action is planned	??	??	??	High	**Protect**	High when a fish spawning event is planned	Moderate	Moderate High	
Goulburn River (Reach 1)	Baseflow (July to Sept and April to June). 400 ML/day at Eildon for macroinvertebrates and small-bodied fish habitat and to maintain aquatic vegetation.	To be determined	Partially met with unregulated flows.	Partially met with unregulated flows.	Not met.	High Moderate	**Maintain**	High	Moderate	High	

	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)			2017-18			Implications for future demands		
	Flow/volume[1]	Required frequency (maximum dry interval)	2014–15 moderate	2015–16 drying	2016–17 very wet	Predominant urgency of environmental demand for water	Purpose under moderate resource availability	Potential Commonwealth environmental water contribution	Likely urgency of demand in 2018–19 if watering occurred as planned in 2017-18	2019–20 Range of likely demand	Met in 2018–19 / Not met in 2018–19
Lower Broken Creek (Reach 3)	Baseflow (all year). 40 ML/day at Rices Weir to operate the fish ladder which provides native fish passage.	Annually				High	**Protect**	High	High	High High	
	Spring elevated baseflow (Aug to Nov continuous). 120 ML/day at Rices Weir to minimise Azolla growth.	Annually				High	**Protect**	High	High	High High	
	Spring to autumn high baseflow (Oct to May continuous). 150–250 ML/day at Rices Weir to maintain DO levels above 5 mg/L.	Annually				High	**Protect**	High	High	High High	
	Winter/spring flushing flow (Aug to Nov). 250 ML/day at Rices Weir for up to 14 days to remove large Azolla blooms.	Annually if required				High	**Protect**	High	High	High High	
	Spring/summer baseflow (Sept to Dec). 250 ML/day at Rices Weir to increase native fish habitat during migration and breeding seasons.	Annually		Met 55% of the time due to high irrigation demand.		High	**Protect**	High	High	High High	
Upper Broken Creek	Summer/autumn fresh. 50–100 ML/day for up to 10 days to maintain water quality and support survival of native fish and macroinvertebrates	Annually	Partial (has received some flows resulting from e-water deliveries en route to Moodie Swamp).			High	**Protect**	High	High	High High	
Broken River	Summer/autumn baseflow. Minimum 15 ML/day to maintain habitat to support native fish, aquatic plants and macroinvertebrates.	Annually	Predominately met.	Partial	Partial	Moderate	**Maintain**	May be met by other means.	Moderate	Moderate High	
	Summer/autumn fresh. 400–500 ML/day for 2 to 8 days to maintain aquatic vegetation and provide native fish passage and provide flow cues for native fish breeding and migration.	Annually			Partial	Moderate	**Maintain**	May be met by other means.	Moderate	Moderate High	

	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)			2017-18			Implications for future demands		
	Flow/volume[1]	Required frequency (maximum dry interval)	2014–15 moderate	2015–16 drying	2016–17 very wet	Predominant urgency of environmental demand for water	Purpose under moderate resource availability	Potential Commonwealth environmental water contribution	Likely urgency of demand in 2018–19 if watering occurred as planned in 2017-18	2019–20 Range of likely demand	Met in 2018–19 / Not met in 2018–19
Goulburn-Broken catchment wetlands (excluding Barmah)	Infrastructure delivery to semipermanent wetlands in support of native vegetation and provision of drought refuge for waterbirds.	Maximum dry interval varies across wetlands.	Water delivered to some wetlands only	Water delivered to Moodie Swamp.	Water delivered to all wetlands	Low	**Maintain**	Low	High	Moderate	High
		Moodie Swamp maximum dry interval is 1 year.				High	**Protect**	High	Moderate	High	Moderate
							Carryover potential	Moderate proportion of available allocation expected to be carried into 2018–19; considered in the context of Southern Connected Basin carryover.	Potential carryover will depend upon resource availability and demands		
							Trade potential	Under a moderate water resource availability scenario, it is likely that transfers across trade zones from Victorian Rivers to trade zone 7 may be required for environmental use at Coorong Lagoons or elsewhere in the southern connected catchment. The high allocation balance may also provide an opportunity to sell Victorian allocation. The issue of whether to sell allocation will be considered once there is greater certainty regarding environmental water use during the winter-spring period, most likely from October 2017 onwards.			

1. Flow volumes and duration for Goulburn Broken catchments reflect those from GBCMA 2017 a–d.
2. Flows above 10,000 ML/day at McCoys Bridge or Murchison would be subject to natural flow cues.

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 2017-18

- 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 2017–18 and outlook for coming years in the Goulburn-Broken – **HIGH/VERY HIGH WATER RESOURCE AVAILABILITY (HIGH ALLOCATION/MOD-HIGH INFLOW) IN 2017–18**

Environmental assets	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)			2017-18			Implications for future demands		
	Flow/volume[1]	Required frequency (maximum dry interval)	2014–15 moderate	2015–16 drying	2016–17 very wet	Predominant urgency of environmental demand for water	Purpose under high/very high resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2018–19 if watering occurred as planned in 2017-18	2019–20 Range of likely demand	Met in 2018–19 / Not met in 2018–19
Goulburn River (Reaches 4 and 5)	Baseflow (all year). 500–940 ML/day at Murchison/McCoys for fish and macroinvertebrate habitat and vegetation.	Annually				High	**Improve**	High	High	High High	Met in 2018–19 Not met in 2018–19
	Spring fresh (Sept/Oct). Up to 10 000 ML/day at Murchison/McCoys Bridge[2] with 14 days above 5 600 ML/day for lower bank vegetation establishment and maintenance.	Annually	Partially met (8 days above 5 600 ML/day).	Partially met (11 days above 5 600 ML/day).		High	**Improve**	Likely to be met by unregulated flows.	High	High High	Met in 2018–19 Not met in 2018–19
	Spring/summer fresh (Nov/Dec). Up to 10,000 ML/day at Murchison/McCoys for 2 days above 6,600 to stimulate golden perch spawning.	2 in 3 years		No delivery due to low water availability.	No delivery to protect vegetation from further inundation.	High	**Improve**	High if required	Moderate-High	Moderate High	Met in 2018–19 Not met in 2018–19
	Summer/autumn fresh (Feb to Apr). 5 600 ML/day at Murchison/McCoys for 2 days or 4,600 ML/day for 10 days for lower bank native vegetation and juvenile fish migration (when combined with a flow in the River Murray).	Annually		Partially met (peaked at only ~4,000 ML/day).		Moderate	**Improve**	High if required	Moderate-High	Moderate High	Met in 2018–19 Not met in 2018–19
	Winter fresh (June/July). Up to 15 000 ML/day at Murchison/McCoys with 14 days above 6 600 ML/day to provide vegetation and macroinvertebrate habitat.	1 in 2 years	Partially met (5 days above 6 600 ML/day).	No delivery due to low water availability.	Full delivery planned at time of publication.	Moderate	**Maintain**	High	Moderate	Moderate High	Met in 2018–19 Not met in 2018–19
	Winter/early spring fresh (August) Up to 5,000 ML/day at Murchison/McCoys for 2 days for increased fish conditioning prior to the fish spawning flow.	When a fish spawning action is planned				High	**Improve**	High when a fish spawning event is planned	Moderate	Moderate High	Met in 2018–19 Not met in 2018–19
Goulburn River (Reach 1)	Baseflow (July to Sept and April to June). 400 ML/day at Eildon for macroinvertebrates and small-bodied fish habitat and to maintain aquatic vegetation.	To be determined	Partially meet with unregulated flows.	Partially met with unregulated flows.	Not met.	High	**Maintain**	High	Moderate	High	Met in 2018–19 Not met in 2018–19

Environmental assets	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)			2017-18			Implications for future demands		
						Predominant urgency of environmental demand for water	Purpose under high/very high resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2018–19 if watering occurred as planned in 2017-18	2019–20 Range of likely demand	Met in 2018–19
	Flow/volume[1]	Required frequency (maximum dry interval)	2014–15 moderate	2015–16 drying	2016–17 very wet						Not met in 2018–19
Lower Broken Creek (Reach 3)	Baseflow (all year). 40 ML/day at Rices Weir to operate the fish ladder which provide native fish passage.	Annually				High	Improve	High	High	High	High
	Spring elevated baseflow (Aug to Nov continuous). 120 ML/day at Rices Weir to minimise Azolla growth.	Annually				High	Improve	High	High	High	High
	Spring to autumn high baseflow (Oct to May continuous). 150–250 ML/day at Rices Weir to maintain DO levels above 5 mg/L.	Annually				High	Protect	High	High	High	High
	Winter/spring flushing flow (Aug to Nov). 250 ML/day at Rices Weir for up to 14 days to remove large Azolla blooms.	Annually if required				High	Protect	High	High	High	High
	Spring/summer baseflow (Sept to Dec). 250 ML/day at Rices Weir to increase native fish habitat during migration and breeding seasons.	Annually		Met 55% of the time due to high irrigation demand.		High	Improve	High	High	High	High
Upper Broken Creek	Summer/autumn fresh. 50–100 ML/day for up to 10 days to maintain water quality and support survival of native fish and macroinvertebrates.	Annually	Partial (has received some e-water flows from deliveries en route to Moodie Swamp).			High	Protect	High	High	High	High
Broken River	Summer/autumn baseflow. Minimum 15 ML/day to maintain habitat to support native fish, aquatic plants and macroinvertebrates.	Annually				Moderate	Maintain	May be met by other means.	Moderate	Moderate	High
	Summer/autumn fresh. 400–500 ML/day for 2 to 8 days to maintain aquatic vegetation and provide native fish passage and provide flow cues for native fish breeding and migration.	Annually				Moderate	Maintain	May be met by other means.	Moderate	Moderate	High

Environmental assets	Indicative demand (for all sources of water in the system)		Watering history (from all sources of water)			2017-18			Implications for future demands		
	Flow/volume	Required frequency (maximum dry interval)	2014–15	2015–16	2016–17	Predominant urgency of environmental demand for water	Purpose under high/very high resource availability	Potential Commonwealth environmental water contribution?	Likely urgency of demand in 2018–19 if watering occurred as planned in 2017-18	2019–20 Range of likely demand	Met in 2018–19 / Not met in 2018–19
			moderate	drying	very wet						
Goulburn-Broken catchment wetlands (excluding Barmah)	Infrastructure delivery to semi-permanent wetlands in support of native vegetation and provision of drought refuge for waterbirds.	Variable across wetlands.	Water delivered to some wetlands only	Water delivered to Moodie Swamp.	Natural flows to all wetlands.	Low	**Maintain**	Low – if provided by other water holders.	High	Moderate	High
		Moodie Swamp max dry interval is 1 year.				High	**Maintain**	High if required	Moderate	High	Moderate

1. Flow volumes and duration for Goulburn Broken catchments reflect those from GBCMA 2017 a–d.
2. Flows above 10,000 ML/day at McCoys Bridge or Murchison would be subject to natural flow cues.

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 2017-18

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

Carryover potential	Moderate proportion of available allocation expected to be carried into 2018–19; considered in the context of Southern Connected Basin carryover.	Potential carryover will depend upon resource availability and demands
Trade potential	Under high and very high water resource availability scenarios, there may be an opportunity to sell Victorian allocation (subject to an assessment that a reasonable level of supply or demand exists within the water market). The issue of whether to sell allocation will be considered once there is greater certainty regarding environmental water use during the winter-spring period, most likely from October 2017 onwards.	

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[1]

Environmental Asset	Indicative demand		Watering history (from all sources of water)			Potential Commonwealth environmental water contribution 2017-18 to 2019-20	Purpose and Expected Outcomes
	Flow/volume[2]	Required Frequency	2014–15	2015–16	2016–17		
			drying	drying	very wet		
Campaspe River	Up to the total Commonwealth environmental water entitlement of 6913 ML (6 517 HRWS and 396 LRWS) per year to contribute to in-stream flows at Barnadown Weir, to reach 4, with en route benefit to reaches 2 and 3, for example: • Summer low flows: 10–50 ML/day, continuous. • Winter low flow: 20-200 ML/day, continuous with flow variability. • Winter high flow: 1 000–1 500 ML/day for 2–4 days peak prior to platypus egg laying (August). • Summer freshes: 100-200 ML/day, up to three actions for 2–3 days peak each. High priority if winter high flow has been delivered.	Annually as per agreed hydrographs with the Victorian Environmental Water Holder and Catchment Management Authorities.			All priority flows were achieved.	High	Under different scenarios the purpose is to 'protect', moving towards 'maintain and then 'improve' the health and condition of targeted assets. Environmental water will contribute to in-stream flows in support of vegetation growth and survival; native fish reproduction, colonisation, and condition; adult river red gums; platypus populations; hydrological connectivity; biotic dispersal and improved water quality - including controlling salinity and stratification in deep pools in reaches 3 and 4.
Loddon River	Up to the total Commonwealth environmental water entitlement of 3 883 ML (3 356 HRWS and 527 LRWS) per year to contribute to in-stream flows in reach 4 between Loddon and Kerang Weir, for example: • Summer/autumn freshes (Dec-May): 50-100 ML/day for 3–4 days at peak, up to 3 times/year. • Winter/spring high flow (Sept-Oct): 450–750 ML/day with a 7-10 day peak. • Winter/spring low flow (continuous June-Nov): 50-100 ML/day. • Summer/autumn low flows (continuous Dec-May): 25–50 ML/day. • Autumn high flow - not expected in a drought scenario (April-May): 400 ML/day with a 6 day peak. Event will be 3 weeks overall and occur once a year.			All priority flows delivered – some modified to take account of dry conditions.	All priority flows were achieved, with some exceeding the required rate and duration due to natural flows.	High	Under different scenarios the purpose is to 'protect', moving towards 'maintain' and then 'improve' the health and condition of targeted assets. Commonwealth environmental water will contribute to: maintaining adequate depth in pools for fish; water rats and platypus; connectivity for in-stream and fringing non-woody vegetation; flushing fine sediment and organic material; promoting fish movement; and minimising terrestrialisation.
Ovens River	Up to the total Commonwealth environmental water entitlement of 70 ML per year (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: • Pulsed autumn fresh in conjunction with a bulk water transfer from Lake Buffalo. • Variability in baseflows if bulk water transfer is not available (Nov-May).					High	When released with a bulk water transfer, Commonwealth environmental water will contribute to maintaining: the movement of native fish; natural connectivity between pools; microinvertebrate habitat; and scouring of bio-film from beds. When contributing to low flows, Commonwealth environmental water will help to maintain: water quality; native fish habitat; connectivity sufficient for fish passage between pools; and movement of sediment for microinvertebrate habitat.
Wimmera System	Up to the total Commonwealth entitlement of 28 000 ML (LRWS[2]) per year[3] to contribute toward in-stream flows within the Wimmera River (baseflow and freshes), subject to environmental need, delivery constraints and water availability. At time of writing 14,280 ML of 2016-2017allocation was available. This will be carried over minus 15 per cent evaporative loss (net 12,138 ML).	Due to the low reliability of the Commonwealth holdings, delivery is not expected to occur in most years.				Commonwealth environmental water carried over from 2016-2017. Commonwealth environmental water will 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 carryovers from previous years. Watering the terminal wetlands is unlikely as it requires significant volumes of water that are only available under successive very wet conditions when unregulated conditions would flow to the lakes.	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 consistent with contributions from the VEWH and with the seasonal watering proposal prepared by the Wimmera CMA. Releases will focus on reaches 3 and 4 in the Wimmera River. In future years, larger pulses may be used to provide additional water to the terminal wetlands (Lake Hindmarsh and Lake 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 agreements. This may include waterbird reproduction and recruitment and an increase in local and landscape waterbird survival and diversity.

1. 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.
2. Flow volumes and duration for Campaspe, Loddon and Ovens Rivers catchments reflect those from NCCMA 2017 a and b, and NECMA 2017.
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3. Next steps

3.1. From planning to decision making

It is important to distinguish between planning and operational decision making. As shown in Figure 4, planning allows the Commonwealth Environmental Water Office to manage the environmental water portfolio in a holistic manner and is an exercise in developing 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.

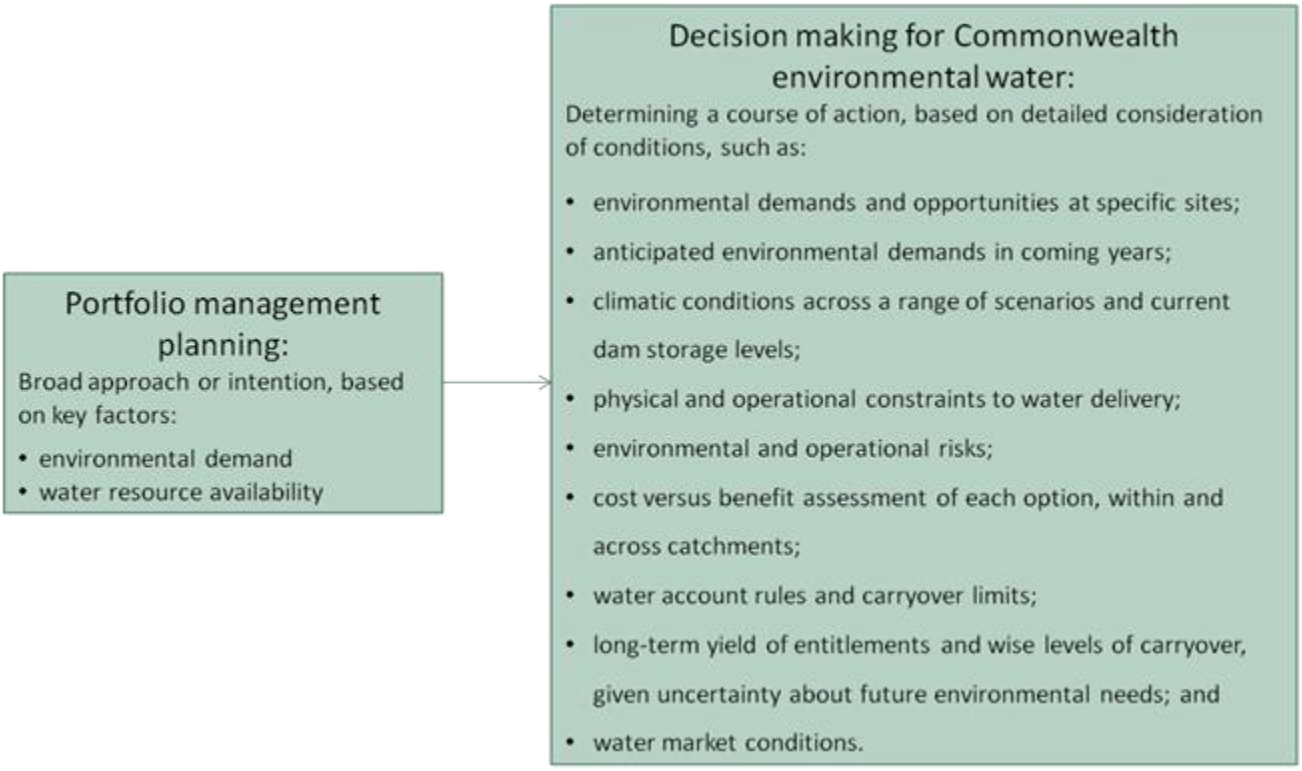

Figure 4: Planning and decision making for Commonwealth environmental water use

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/cewoor the sites below:

- Water use: 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

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(GBCMA) – see Goulburn Broken Catchment Management Authority

Goulburn-Broken Catchment Management Authority (2017a) Goulburn River Seasonal Watering Proposal 2017-18.

Goulburn-Broken Catchment Management Authority (2017b) Lower Broken Creek Seasonal Watering Proposal 2017-18.

Goulburn-Broken Catchment Management Authority (2017c) Broken River and Upper Broken Creek Seasonal Watering Proposal 2017-18.

Goulburn-Broken Catchment Management Authority (2017d) Goulburn Broken Wetlands Seasonal Watering Proposal 2017-18.

(MDBA) – see Murray-Darling Basin Authority

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

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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.

Contribute 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 rivers

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 (*Galaxias rostratus*)	Improved core range in additional locations, including the Goulburn.	No
Golden perch (*Macquaria ambigua*)	A 10–15 per cent increase of mature fish abundance (of legal take size) in key populations.	Yes
Macquarie perch (*Macquaria australasica*)	Establishment of at least four additional riverine populations (candidate sites include mid-Goulburn River).	Yes
Murray cod (*Maccullochella peelii peelii*)	A 10–15 per cent increase of mature fish abundance (of legal take size) in key populations.	Yes
Silver perch (*Bidyanus bidyanus*)	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 (*Maccullochella macquariensis*)	Establishment of at least two additional populations (candidate sites include the mid-Goulburn River). Note: attempts to re-establish mid-Goulburn populations 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 (*Gadopsis bispinosus*)	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'th 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.

Contribute 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 (*Macquaria ambigua*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations.	Yes
Murray cod (*Maccullochella peelii peelii*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations.	Yes
River blackfish (*Gadopsis marmoratus*)	Establish 1–3 additional populations (candidate sites include downstream of the Campaspe Rivers).	Yes
Silver perch (*Bidyanus bidyanus*)	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.

Contribute 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 (*Tandanus tandanus*)	Improve core range in at least three additional locations (candidate sites include the Loddon River).	Yes
Golden perch (*Macquaria ambigua*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations.	Yes
Murray cod (*Maccullochella peelii peelii*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations.	Yes
River blackfish (*Gadopsis marmoratus*)	Establish 1–3 additional populations (candidate sites include downstream of the Loddon).	Yes
Silver perch (*Bidyanus bidyanus*)	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 (*Tandanus tandanus*)	Expand the core range of at least two current populations (candidate sites include Wimmera River)	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. For example, environmental demand may be met by unregulated flows or 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 (Reaches 4 and 5)	Year-round baseflow 540–590 ML/day at Murchison/McCoys.	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 increase habitat area for instream flora and fauna and to water bank vegetation.				
	Spring fresh (Sept/Oct) of up to 10 000 ML/day at Murchison/McCoys Bridge with 14 days above 5 600 ML/day.	1c. Contribute to long-duration freshes in spring to water bank vegetation, provide soil moisture to banks and benches, distribute seed and allow plants to flower and seed for later germination and distribution.				
	Spring/summer fresh (Nov/Dec) of up to 10,000 ML/day at Murchison/McCoys with 2 days above 6,600 ML/day.		1d. Contribute to short-duration freshes during November/December to stimulate breeding of native fish (flow cued spawners), particularly golden perch.			
	Summer/autumn fresh (Feb-Apr) of up to 5 600 ML/day at Murchison/McCoys for 2 days or 4,600 ML/day for 10 days.	1e. Contribute to a fresh to maintain existing vegetation and encourage germination of new seed and, when coordinated with flows in the Murray River, facilitate fish migration.				
	Winter fresh (June/July)) of up to 15 000 ML/day at Murchison/McCoys with 14 days above 6 600 ML/day.		1f. Contribute to a winter fresh to maintain bank vegetation, improve water quality and macroinvertebrate habitat.			
	Winter/early spring fresh (August) Up to 5,000 ML/day at Murchison/McCoys for 2 days		1g. Contribute to a late winter fresh to achieve pre-spawning migration and increase food availability and fish condition prior to the Nov/Dec fish spawning flow.			
Goulburn River (Reach 1)	Baseflow (July to Sept and April to June) of 400 ML/day at Eildon.	1g. Contribute to baseflows during the non-irrigation season to maintain macroinvertebrate communities, existing aquatic vegetation, and small-bodied fish habitat.				

Broad Asset	Indicative demand	Applicable level(s) of resource availability				
		Very Low	Low	Moderate	High	Very High
Lower Broken Creek (Reach 3)	Year-round baseflow of 40 ML/day at Rices Weir.	2a. Contribute to minimum baseflows all year to support native fish movement through fishways.				
	Spring/autumn baseflow of 120 ML/day at Rices Weir.	2b. Contribute to higher baseflows between August and November to minimise Azolla growth.				
	Spring/autumn baseflow of 150–250 ML/day at Rices Weir.	2c. Contribute to high baseflows between October and May to maintain DO levels above 5 mg/L.				
	Winter/spring flushing flow of 250 ML/day at Rices Weir for up to 14 days.	2d. Contribute to flushing flows between August and November to remove large Azolla blooms.				
	Spring/summer baseflow of 250 ML/day at Rices Weir.		2e. Contribute to high baseflows between September and December to increase native fish habitat during migration and breeding seasons.			
Upper Broken Creek	Summer/autumn fresh of 50–100 ML/day for up to 10 days.	3. Contribute to freshes to maintain water quality and support survival of native fish and macroinvertebrates.				
Broken River	Summer/autumn baseflow. Minimum 15 ML/day.	4a. Contribute to baseflows to maintain habitat to support native fish, aquatic plants and macroinvertebrates.				
	Summer/autumn fresh 400–500 ML/day for 2-8 days plus gradual rates of rise and fall.	4b. Contribute to freshes to maintain aquatic vegetation and provide native fish passage and provide flow cues for native fish breeding and migration.				
Goulburn-Broken catchment wetlands (excluding Barmah)	Watering as required for individual wetlands depending on climatic conditions, extent of inundation and maximum dry intervals.	5a. Contribute flows in response to natural events, to maintain wetland health.				
	Moodie Swamp every 1–2 years	5b. Contribute to fill, if dry, to support wetland vegetation and waterbird habitat.				

Broad Asset	Indicative demand	Applicable level(s) of resource availability				
		Very Low	Low	Moderate	High	Very High
Campaspe River	Summer baseflows 10–50 ML/day to reach 4 between the Campaspe Siphon and the River Murray.	6a. Contribute to baseflows in summer to maintain: connectivity for protecting instream and fringing vegetation; and pool habitat tor native fish populations, especially with respect to dissolved oxygen and salinity levels. Lower end of range during dry conditions and higher when possible – maintain at all times.				
	Winter low flows of 20–200 ML/day at Barnadown Weir.	6b. Contribute to winter low flows to maintain: river red gum; native fish and macroinvertebrate populations; and emergent vegetation. Lower end of range during dry conditions. Provide variability within the range.				
	Winter high flow 1,000–1,500 ML/day for 2–4 days to reaches 2 and 4. Lower end of range during dry conditions.	6c. Contribute to winter high flows to maintain: river red gum; native fish and macroinvertebrate populations; and emergent vegetation. Importantly this action will flush river benches of organic matter to mitigate potential water quality issues during summer. Deliver prior to platypus egg laying (August) to encourage female platypus to choose burrows higher on the river bank.				
	Summer freshes 100–200 ML/day for 2-3 days at Barnadown Weir - only if winter fresh has been delivered.	6d. Contribute to summer/autumn freshes to support: native fish and platypus populations; improve water quality and macroinvertebrate habitat. Volumes and duration depend on conditions.				
Loddon River Reach 4 (Loddon Weir) with benefit to reaches 1-3 en route and reach 5 downstream)	Summer freshes (Dec–May) 50-100 ML/day for 3–4 days at peak, up to 3 per year.	7a. Contribute to summer freshes in dry scenarios for water volume and quality in refuge pools. Higher flows during December to March may be required to minimise the risk of toxic blackwater events.				
	Winter/spring high flow (Sept–Oct) 450–750 ML/day with a 7–10 day peak, 1 per year under all scenarios.	7b. Contribute to the winter/spring high flow to provide flows through flood runners flush accumulated organic matter from banks and benches and reducing organic load ahead of summer.				
	Winter low flow (continuous June–Nov) 50–100 ML/day.	7c. Contribute to winter/spring low flows to maintain depth for fish, platypus and water rat movement; flush sediment and biofilm on submerged wood; maintain bank moisture and prevent terrestrialisation of bank vegetation.				
	Summer low flows (continuous Dec–May) 25–50 ML/day.	7d. Contribute to summer/autumn low flows for connectivity and water quality.				
	Autumn high flow (April–May) 400 ML/day with a 6 day peak and 3 weeks overall, 1 per year.			7e. Contribute to an autumn high flow delivered with a Pyramid Creek flow as a fish attractant flow into the river from reach 5		
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.			

Broad Asset	Indicative demand	Applicable level(s) of resource availability				
		Very Low	Low	Moderate	High	Very High
Wimmera System	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.					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.

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 Commonwealth Environmental Water 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 releases above 9,500 ML/day from Lake Eildon to minimise the risk of potential impacts on private property in reach 1, located between Eildon Dam and Yea River.
- Releases from Goulburn Weir are limited to 10,000 ML/day by Goulburn Murray Water due to unknown impact of inundating land.
- Flows greater than 3,000 ML/day below Goulburn Weir during irrigation season may impact on some access to pumps and landholder are to be notified around three week prior to these events, including the use of water from intervalley transfers.
- 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 distruption to recreational activities.
- Intervalley transfers undertaken by Goulburn Murray Water may impact on the volume and timing of Commonwealth environmental water actions.
- 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, with en route benefits to reaches 1 to 3 (Eildon to Goulburn Weir) Releases from Goulburn Weirwill target reaches 4 and 5 (lower Goulburn River downstream of 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. Delivery may also occur outside the irrigation period to keep fish ladders open.
- Environmental water 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 up to 100 ML/day to avoid potential third party flooding impacts.

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 to supplement consumptive deliveries to meet baseflow requirements in summer and/or autumn.

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 involves low in-channel flow rates below channel capacity. There are some channel restrictions along the upper Broken Creek so deliveries to Moodie Swamp may get close to channel capacity at these points. This is being investigated.

Typical extent: Wetland inundation via infrastructure.

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

Standard operational considerations

- The maximum regulated release volume from Lake Eppalock, due to the outlet capacity of Eppalock is 1,850 ML/day (measured at Barnadown Weir). Planned releases are below this volume.

- Intervalley transfers and operational water delivery (e.g. the Campapse supplement) 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. When the lake-level recedes the perception is that it adversely affects recreational activity increases.

- 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 and cannot be delivered with current Eppalock outlet capacity.

- 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, particuarly 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.

<u>Watering action 9:</u> 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. As allocations become available the Wimmera Catchment Management Authority will consult with the Commonwealth Environmental Water 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 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').

For more information about Commonwealth environmental water, please contact us at:

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