**Commonwealth Environmental Water Office**

**Integrated planning for the use, carryover and trade of Commonwealth environmental water:**

**Victorian Rivers 2015–16**

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# Commonwealth environmental water portfolio management planning

## Purpose of the document

This document consists of two parts. Part I sets out the Commonwealth Environmental Water Office’s (the Office) portfolio management planning for the 2015–16 water year and for the following two years. While focussed on the Victorian rivers the identified use, carryover and trading intentions have been considered together with those for other catchments in a Murray-Darling Basin-wide analysis.

Part II of this document establishes the context for how the Office integrates its management of the Commonwealth environmental water portfolio in the Victorian rivers and across the Murray-Darling Basin more broadly. It sets out the environmental demands that Commonwealth environmental water may contribute to in Victorian rivers, as well as the long-term supply profile for Commonwealth environmental water. Part II also explains how these two factors are considered together to inform an overall purpose for portfolio management, as well as the most appropriate mix of portfolio management options to maximise the benefits that can be achieved with the water portfolio across multiple years.

## Purpose of portfolio management planning

Efficient and effective management of the Commonwealth environmental water holdings requires the utilisation of all portfolio management options (use, carryover and trade). To support improved outcomes from water use over time, carryover provides the opportunity to optimise water use across water years and to improve water availability early in a water year, while trade provides further capacity to optimise use over the long-term as well as across catchments.

Through multi-year integrated planning, portfolio management tools such as use, carryover and trade can be strategically managed for maximising environmental outcomes. Integrated portfolio management planning will also support the Office in:

* meeting Basin Plan obligations and contributing to the long-term objectives of the environmental watering plan, the expected outcomes in the Basin-wide environmental watering strategy and Basin annual environmental watering priorities
* managing the Commonwealth environmental water portfolio in response to the demands identified by Basin States in long-term environmental watering plans, once available
* applying adaptive management (including the setting of objectives, evaluating outcomes and informing future decision making)
* providing increased transparency in relation to the Commonwealth Environmental Water Holder’s portfolio management (use, trade and carryover) behaviour
* coordinating water use with delivery partners, including developing long-term delivery arrangements

## Scope of integrated portfolio management planning

The following portfolio management options have been determined to be in scope for integrated planning by the Office:

* use
* carryover
* trade of allocations including:
  + transfer of allocations between connected catchments
  + sale of allocations
  + purchase of allocations

The Office’s portfolio management planning seeks to consider long-term demands (i.e. flow regimes) and supply, covering at least the preceding three years and out to three years.

# Part I: Portfolio management planning in Victorian rivers in the Murray-Darling Basin

# Purpose and portfolio management for 2015–16

## Overall purpose

Demand for environmental water

Since 2010, natural flows events and environmental watering actions have resulted in improvements in the condition of many Victorian rivers and associated wetlands and promoted recovery following the millennium drought. This recovery has continued under drier conditions in 2013–14 with the provision of environmental water. Environmental water demands in Victorian rivers in 2014–15 are represented in Table 2 and summarised below:

*Goulburn River*: Moderate–High demand. River bank and in-stream vegetation is still recovering following prolonged drought and floods in 2010-2012 and requires frequent wetting to maintain condition and promote recruitment. There is a moderate demand for environmental water to support native fish spawning and recruitment to build on the outcomes of watering in 2013-15. There is a high demand for year round baseflows that provide critical habitat for fish and other biota and to maintain water quality.

*Lower Broken Creek*: High demand. Environmental water is required annually for maintaining dissolved oxygen above tolerable levels for biota and for facilitating native fish passage through fishways.

*Upper Broken Creek*: High demand. Environmental water is required to provide an in-stream fresh to replicate original bankfull flows from the Broken River, which have not occurred in over 10 years.

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

*Goulburn-Broken catchment wetlands:* The limited number of wetlands to which environmental water can be delivered are currently in a managed drying phase. In the absence of natural inflows in winter 2015 to meet the annual watering demand of these wetlands, there is a moderate to high demand for environmental water in late winter/early spring to promote the growth of EPBC listed flora species and in the case of Moodies Swamp, to encourage brolga breeding.

*Campaspe River*: There is a high demand for environmental water to contribute to in-stream flows in support of vegetation growth and survival, native fish reproduction and condition, hydrological connectivity, biotic dispersal and improved water quality.

*Loddon River*: There is a high demand for environmental water to contribute to in-stream flows in support of native riparian vegetation condition, native fish reproduction and condition, macroinvertebrates, hydrological connectivity and water quality.

*Ovens River:* There is a high demand for environmental water to contribute to in-stream flows in support of improved primary production through the disruption of biofilms, macroinvertebrate diversity through the provision of shallow water habitat, and native fish through the provision of flows sufficient to stimulate fish movement and allow passage between habitats.

*Wimmera River*: Should Commonwealth allocations become available (unlikely in 2015–16) there is a high demand for environmental water to contribute to in-stream flows to support native fish reproduction and condition, riparian vegetation condition, macroinvertebrate habitat and food, hydrological connectivity and biotic dispersal, and maintaining appropriate water quality. Larger pulses may be used to provide additional water to the terminal wetlands (Lakes Albacutya and Hindmarsh) when coupled with natural flows. This may lead to the above stated environmental benefits plus waterbird outcomes, and support Australia’s objectives under the Ramsar Convention on Wetlands of International Importance and international migratory bird agreements.

Supply

Water resource availability (supply) in the context of meeting environmental demands is made up of allocations against entitlements held for the environment by the Commonwealth Environmental Water Holder, Victorian Environmental Water Holder and The Living Murray, as well as natural and unregulated flows, and planned environmental water provisions. Further detail is provided in Part II, Section 4.

Considering carryover of Commonwealth environmental allocations from 2014-15 to 2015-16 and the range of potential opening allocations for 2015-16, along with the full range of potential streamflows, **moderate to very high** resource availability scenarios are in scope for 2015-16 (with very high resource availability only possible if conditions become wet).

Purpose

Figure 1 shows how these two factors are considered together. The overall ‘purpose’ for managing the Commonwealth’s water portfolio in the Victorian rivers for 2015–16 is to **protect** in-channel habitats and the condition/survival of native fish, vegetation and other biota, primarily through the provision of baseflows (subject to being able to access environmental water allocations). The overall purpose also includes seeking to **maintain** the ecological health and resilience of the river systems and key wetland sites by providing freshes and wetland inundation that maintain appropriate habitat and provide opportunities for breeding and recruitment. If water availability becomes high there may be scope to **improve** the health and resilience of aquatic ecosystems throughout the Victorian river system.

A figure depicting the range of potential water resource availability and environmental demands in the Victorian Rivers region for 2015-16.
Resource availability is expected to be moderate in 2015-16, or high to very high if wet conditions eventuate. Considered together with environmental demands, which are moderate on average, the overall purpose of environmental watering will be to protect and maintain ecological health and resilience, or to improve health and resilience if conditions become wet.


Figure 1: Determining a broad purpose for portfolio management in Victorian rivers in the Murray-Darling Basin for 2015–16

Note: grey lines represent potential range in demand and resource availability

## Water Use

Consistent with the demands and purpose described above, the Office is considering supplying environmental water to the following watering actions for 2015–16. Table 1 summarises which of these actions are relevant to which resource availability scenarios in 2015–16, with further detail and rationale established in Table 2, including implications for future years based on assumed use behavior for 2015–16. Table 1 also identifies the 2015–16 Basin annual environmental watering priorities (published by the Murray-Darling Basin Authority) that the various watering actions may contribute to meeting.

**Table 1:** Potential Commonwealth watering actions and applicable resource availability scenarios for the Victorian rivers in the Murray –Darling Basin in 2015–16

|  |  |  |  |
| --- | --- | --- | --- |
| **Watering action** | * **2015–16 Basin annual environmental watering priority(s) [[1]](#footnote-1)** | **Resource availability scenarios action is likely to be pursued under** | |
| **Moderate** | **High – very high** |
| Goulburn River | * Basin-wide flow variability and longitudinal connectivity * Basin-wide in-stream and riparian vegetation * Basin-wide native fish habitat and movement * Silver perch | Yes | Yes |
| Lower Broken Creek | * Basin-wide native fish habitat and movement * Silver perch | Yes | Yes |
| Upper Broken Creek | * Basin-wide flow variability and longitudinal connectivity * Basin-wide native fish habitat and movement * Basin-wide in-stream and riparian vegetation | Yes | Yes |
| Broken River | * Basin-wide flow variability and longitudinal connectivity * Basin-wide native fish habitat and movement * Basin-wide in-stream and riparian vegetation | Yes | Yes |
| Goulburn-Broken wetlands | * Basin-wide in-stream and riparian vegetation * Basin-wide waterbird habitat and future population recovery | Yes | Yes |
| Campaspe River | * Basin-wide flow variability and longitudinal connectivity * Basin-wide in-stream and riparian vegetation * Basin-wide native fish habitat and movement | Yes | Yes |
| Loddon River | * Basin-wide flow variability and longitudinal connectivity * Basin-wide in-stream and riparian vegetation * Basin-wide native fish habitat and movement | Yes | Yes |
| Ovens River | * Basin-wide native fish habitat and movement | Yes | Yes |
| Wimmera System | * Basin-wide flow variability and longitudinal connectivity * Basin-wide in-stream and riparian vegetation * Basin-wide waterbird habitat and future population recovery * Basin-wide native fish habitat and movement | No | Yes |

**Goulburn River**

Summary: Commonwealth environmental water would be provided under this option in partnership with the Goulburn Broken Catchment Management Authority, the Victorian Environmental Water Holder and The Living Murray. The purpose would be to support vegetation condition and recruitment; native fish reproduction and condition; macroinvertebrates abundance and diversity; hydrological connectivity; biotic dispersal; transport of carbon, sediment and nutrients; and improved water quality.

Timing: Year round

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 1. Goulburn River (see Part II, section 3).

**Lower Broken Creek**

Summary: Commonwealth environmental water would be provided under this option in partnership with the Goulburn Broken Catchment Management Authority and the Victorian Environmental Water Holder. The purpose would be to support native fish passage through fishways; provide improved native fish habitat during breeding and migration seasons; improve water quality, in particular maintaining dissolved oxygen levels above tolerable thresholds for biota and managing excessive Azolla growth.

Timing: mid August to mid May

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 2. Lower Broken Creek (see Part II, section 3).

**Upper Broken Creek and Broken River**

Summary: Commonwealth environmental water would be provided under this option in partnership with the Goulburn Broken Catchment Management Authority and the Victorian Environmental Water Holder. The purpose would be to maintain water quality and support the condition and reproduction of in-channel vegetation, native fish and macroinverterbrates.

Timing: winter/spring and/or summer/autumn

Operational considerations and feasibility:

* Delivery of freshes of up to 200 ML/day to upper Broken Creek is subject to the outcomes of current investigations by the Goulburn Broken Catchment Management Authority into channel capacity along the creek to ensure that environmental water has no third party impacts.
* As per the standard operational considerations for watering action 3. Upper Broken Creek and 4. Broken River (see Part II, section 3).

**Goulburn-Broken Catchment Wetlands**

Summary: Commonwealth environmental water would be provided under this option in partnership with the Goulburn Broken Catchment Management Authority and the Victorian Environmental Water Holder. The purpose would be to promote the condition or wetland vegetation, provide habitat for birds, frogs and other biota, and in the case of Moodies Swamp, to encourage brolga breeding.

Timing: spring and/or summer/autumn

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 5. Goulburn-Broken Catchment Wetlands (see Part II, section 3).

**Campaspe River**

Summary: Commonwealth environmental water would be provided under this option in partnership with the North Central Catchment Management Authority and the Victorian Environmental Water Holder. The purpose would be to support vegetation growth and survival, native fish reproduction and condition, hydrological connectivity, biotic dispersal and improved water quality.

Timing: Year round

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 6. Campaspe River (see Part II, section 3).

**Loddon River**

Summary: Commonwealth environmental water would be provided under this option in partnership with the North Central Catchment Management Authority and the Victorian Environmental Water Holder. The purpose would be to support riparian vegetation condition, native fish reproduction and condition, hydrological connectivity and water quality.

Timing: Year round

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 7. Loddon River (see Part II, section 3).

**Ovens River**

Summary: Commonwealth environmental water would be provided under this option in partnership with the North East Catchment Management Authority. The purpose would be to improve primary production through the disruption of biofilms, contribute toward macroinvertebrate diversity through the provision of shallow water habitat, and support native fish through the provision of flows sufficient to stimulate fish movement and allow passage between habitats.

Timing: Year round

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 8. Ovens River (see Part II, section 3).

**Wimmera System**

Summary: Commonwealth environmental water would be provided under this option in partnership with the Wimmera Catchment Management Authority and the Victorian Environmental Water Holder. The purpose would be to support native fish reproduction and condition, riparian vegetation condition, hydrological connectivity and biotic dispersal.

Timing: Year round

Operational considerations and feasibility:

* As per the standard operational considerations for watering action 9. Wimmera System (see Part II, section 3).

**Stakeholder feedback:** Consultation on long term portfolio management planning has occurred with key delivery partners (Victorian Environmental Water Holder, the Goulburn-Broken, North Central, North East and Wimmera Catchment Management Authorities) and scientists engaged in monitoring the outcomes of Commonwealth environmental water use. Feedback will be sought on an ongoing basis as planning transitions to implementation phase (see Section 1.6).

## Carryover

A moderate proportion of allocations available in 2014–15 are expected to be carried over to 2015–16 in the southern connected basin (350-360 gigalitres). Given the moderate to high environmental demands in the Victorian rivers for 2015–16, if water resource availability remains moderate, a moderate to high proportion of Commonwealth’s available allocations for 2015–16 are expected to be used for the watering actions described above. A low to moderate proportion of allocations are expected to be carried over to support environmental demands in 2016–17 (see Table 2). The level of available allocations to be carried over to 2017–18 will depend upon resource availability and demand.

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. More information on how the Commonwealth makes decisions on carryover is here: http://www.environment.gov.au/water/cewo/portfolio-mgt/carryover

## Trade

At this time there is no plan to buy or sell allocations in the southern connected basin in 2015–16. While supplementing supplies (through the purchase of regulated or supplementary allocation) may assist in meeting environmental demands, there is currently limited market opportunity for allocation purchase to be pursued. The moderate to high demands for environmental water that may extend to 2016–17 mean that the trade of allocations will be considered based on ongoing assessments of environmental demands within the southern connected basin and across the Murray-Darling Basin over the next two years (Table 2). The types of scenarios where the need to adjust the availability of Commonwealth allocations is most likely to arise in coming years include:

* If environmental demands have been met and it is determined that there is sufficient forecast allocation to meet future demands across the southern connected Basin, the market will be assessed to determine if there are opportunities to sell surplus water and  secure proceeds to improve the Commonwealth Environmental Water Holder’s capacity to meet current or future environmental demands across the Murray Darling Basin
* If a Basin-scale analysis identifies urgent environmental demands within a particular catchment and allocation purchase provides an opportunity to meet those demands using proceeds from the sale of water in a catchment with less urgent demands
* If conditions were to become wet while environmental demands remain high, market conditions might provide a favourable opportunity to purchase allocations to assist in meeting demands and augmenting natural flows

Refer to the [Commonwealth environmental water Trading Framework](http://www.environment.gov.au/water/cewo/publications/water-trading-framework), which includes operating rules, procedures, and [protocols](http://www.environment.gov.au/water/cewo/trade/trading-framework#protocols), for further information.

## A note on transfer

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

## Your input

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

**Table 2a**: Environmental demands, potential watering in 2015–16 and outlook for coming years in the Goulburn-Broken in the Murray-Darling Basin – **MODERATE WATER RESOURCE AVAILABILITY IN 2015–16**

| **Environmental assets** | **Indicative demand**  **(for all sources of water in the system)** | | **Watering history**  **(from all sources of water)** | | | **2015-16** | | | **Implications for future demands** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Predominant urgency of environmental demand for water** | **Purpose under moderate resource availability** | **Potential Commonwealth environmental water contribution?** | **Likely urgency of demand in 2016–17 if watering occurred as planned in 2015-16** | **2017–18**  **Range of likely demand** | Met in 2016–17 |
| **Flow/volume** | **Required frequency (maximum dry interval)** | **2012–13** | **2013–14** | **2014–15** |
| wet | moderate | drying | Not met in 2016–17 |
| **Goulburn River**  **(mid and lower)** | Baseflow  540–940 ML/day at McCoys Bridge1 | Year round |  |  |  | High | **Protect** | High potential for partial contribution to baseflow requirements in conjunction with other contributors (minimum releases, Intervalley Transfer and other environmental water holders) | High | High | |
| High | |
| Winter fresh (Jun-Aug)  Up to 15 000 ML/day at Murchison & McCoys Bridge2 with 14 days above 6 600 ML/day1 | 1-2 events per year  (1 year) |  |  | McCoys Bridge only | High – annual requirement and only partially met in 2014-15. | **Protect** | High potential – subject to unregulated flow conditions in the Goulburn and Murray. Event is planned for June-July 2015. Alternatively, delivery would begin in August 2015. | Moderate | Moderate | |
| High | |
| Spring fresh (Sep-Nov)  Up to 15 000 ML/day at Murchison/McCoys Bridge2 with 14 days above 5 600 ML/day 1 | 1-2 events per year  (1 year) |  | Partially met  (for 7-9 days only) |  | High | **Protect** | High priority - to continue recovery of bank vegetation | High | High | |
| High | |
| Spring/summer fresh (Oct-Dec)  7000–15 000 ML/day2 at Murchison & McCoys Bridge2 for 2 days3 | 2 in 3 years4 |  |  |  | Moderate | **Maintain** | Moderate potential – to support native fish breeding, noting that 2 successful golden perch breeding events have been achieved in 2013-14 and 2014-15 | Moderate-High | Moderate | |
| High | |
| Summer/autumn fresh (Feb-Apr)  3 500–5 600 ML/day at Murchison & McCoys Bridge for 2-4 days3 | 1-2 events per year  (1 year) |  |  |  | Moderate | **Maintain** | High potential - to continue recovery of bank vegetation | Moderate-High | Moderate | |
| High | |
| **Lower Broken Creek** | Winter-autumn baseflow (40 ML/day at Rices Weir)5 | Continuous mid August – mid May |  |  |  | High | **Protect** | High potential for partial contribution to baseflow requirements in conjunction with consumptive deliveries and intervalley transfer | High | High | |
| High | |
| Spring-autumn baseflow (150–250 ML/day at Rices Weir)5 | Continuous Oct-May |  |  |  | High | **Protect** | High potential  - as above | High | Moderate | |
| High | |
| Spring-summer baseflow (250 ML/day at Rices Weir)5 | Continuous Sep-Dec |  |  |  | Moderate | **Maintain** | High potential  – as above | Moderate | Moderate | |
|  | |
| Moderate | |
| **Upper Broken Creek** | Fresh  (up to 200 ML/day for 1-2 days in winter/spring and/or summer/autumn)6 | 1 in 2 years |  |  |  | High | **Protect** | High potential, subject to assessment of 3rd party risks | Low | Low | |
| Moderate | |
| **Broken River** | Winter/spring baseflow  80-200 ML/d at d/s Back Creek Junction7 | Continuous (Jun-Nov) | Late winter-spring only | Late winter- spring only | Late winter- spring only | Moderate | **Maintain** | Moderate potential to supplement consumptive deliveries to meet baseflow requirements in early winter | Moderate | Moderate | |
| High | |
| Small fresh  270-500 ML/day for 2-8 days in winter/spring and summer/autumn7 | 1­‑4 per year  (1 year) | Winter only | Winter only | Winter only | Moderate | **Maintain** | Moderate potential to deliver a small fresh in summer/autumn in support of in-stream and riparian vegetation condition | Moderate | Moderate | |
| High | |
| Large fresh  2600-4500 ML/day for 1 day in winter/spring7 | 1 in 1 year (3 years) |  |  |  | Moderate | **Maintain** | Moderate potential | Moderate | Moderate | |
| High | |
| **Goulburn-Broken catchment wetlands** | Infrastructure delivery to semipermanent wetlands 8 (for Goulburn River wetlands, equivalent to >20 000 ML/d at Shepparton)9  Approximate total demand 12 000 ML per year for infrastructure delivery | 1 in 1-2 years  (4.5 years\*) |  | Water delivered to some wetlands only10 | Drying phase for several wetlands | Moderate | **Maintain** | It is anticipated that demands in the Goulburn-Broken wetlands will be met by other water holders | Moderate | Moderate | |
| High | |
| \*Moodies Swamp  max. dry interval is 1 year |  |  |  | Moderate | **Maintain** | Moderate potential | Moderate | Moderate | |
| High | |
| 1. Sourced from GBCMA (2015a) and Cottingham at el. (2007)  2. Flows above 10,000 ML/day at McCoys Bridge or Myurchison would be subject to natural flow cues.  3. Adapted from GBCMA (2015a) and Cottingham at el. (2007)  4. The required frequency of short-duration freshes targeting breeding of native fish such as golden perch remains undocumented in the literature. The frequency estimated here is based on a number of sources including flow recommendations for spring freshes (1-2 per year), analysis of the modelled natural flow record and knowledge that flow-cues spawners may not spawn every year.  5. Sourced from GBCMA (2015b)  6. Sourced from GBCMA (2014; 2015c)  7. Adapted from GBCMA (2015c) and based on advice from Goulburn-Broken CMA  8. Environmental water delivery via infrastructure is possibly for only nine wetlands including Moodies Swamp on upper Broken Creek.  9. Sourced from GBCMA (2015d)  10. Water delivered to Kinnaird Swamp and Black Swamp (Victorian environmental water) | | | | | | | Carryover potential | Low to moderate proportion of available allocations expected to be carried into 2016–17. | A moderate proportion of available allocations may be carried over to 2017–18, but will depend upon resource availability and demands | Potential carryover will depend upon resource availability and demands | |
| Trade potential | No urgency to augment available allocations, therefore limited requirement for allocation purchase. Moderate to high demands means allocation sale subject to ongoing assessment of demands within catchment and across the Basin. | No expected urgency to augment allocation, therefore limited requirement for purchase. Moderate demands within the catchment means allocation sale subject to market conditions and Basin wide analysis of demands. | Potential to trade will be depend on environmental demands and resource availability | |

**Table 2b**: Environmental demands, potential watering in 2015–16 and outlook for coming years in the Goulburn-Broken in the Murray-Darling Basin – **HIGH-VERY HIGH WATER RESOURCE AVAILABILITY IN 2015–16**

| **Environmental assets** | **Indicative demand**  **(for all sources of water in the system)** | | **Watering history**  **(from all sources of water)** | | | **2015-16** | | | **Implications for future demands** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Predominant urgency of environmental demand for water** | **Purpose under moderate resource availability** | **Potential Commonwealth environmental water contribution?** | **Likely urgency of demand in 2016–17 if watering occurred as planned in 2015-16** | **2017–18**  **Range of likely demand** | Met in 2016–17 |
| **Flow/volume** | **Required frequency (maximum dry interval)** | **2012–13** | **2013–14** | **2014–15** |
| wet | moderate | drying | Not met in 2016–17 |
| **Goulburn River**  **(mid and lower)** | Baseflow  540–940 ML/day at McCoys Bridge1 | Year round |  |  |  | High | **Protect** | High potential for partial contribution to baseflow requirements in conjunction with other contributors (minimum releases, intervalley transfer and other environmental water holders) | High | High | |
| High | |
| Winter fresh (Jun-Aug)  Up to 15 000 ML/day at Murchison & McCoys Bridge2 with 14 days above 6 600 ML/day[[2]](#footnote-2) | 1-2 events per year (1 year) |  |  | McCoys only | High – annual requirement and only partially met in 2014-15. | **Protect** | Moderate potential – subject to unregulated flow conditions in the Goulburn and Murray. Event is planned for June-July 2015. Alternatively, delivery would begin in August 2015. | Moderate | Moderate | |
| High | |
| Spring fresh (Sep-Nov)  Up to 15 000 ML/day at Murchison/McCoys Bridge2 with 14 days above 5 600 ML/day 1 | 1-2 events per year  (1 year) |  | Partially met  (for 7-9 days only) |  | High | **Protect** | High potential –  to continue recovery of bank vegetation | High | High | |
| High | |
| Spring/summer fresh (Oct-Dec)  7000–15 000 ML/day at Murchison & McCoys Bridge2 for 2 days3 | 2 in 3 years4 |  |  |  | Moderate | **Maintain** | Moderate potential – to support native fish breeding, noting that 2 successful golden perch breeding events have been achieved in 2013-14 and 2014-15 | Moderate-High | Moderate | |
| High | |
| Summer/autumn fresh (Feb-Apr)  3 500–5 600 ML/day at Murchison & McCoys Bridge for 2-4 days3 | 1-2 events per year  (1 year) |  |  |  | Moderate | **Maintain** | High potential –  to continue recovery of bank vegetation | Moderate-High | Moderate | |
| High | |
| **Lower Broken Creek** | Winter-autumn baseflow (40 ML/day at Rices Weir)5 | Continuous mid August – May |  |  |  | High | **Protect** | High potential for partial contribution to baseflow requirements in conjunction with consumptive deliveries and intervalley transfer | High | High | |
| High | |
| Spring-autumn baseflow (150–250 ML/day at Rices Weir)5 | Continuous Oct-May |  |  |  | High | **Protect** | Moderate-high potential, dependant on unregulated flow conditions, which may meet the demand | High | Moderate | |
| High | |
| Spring-summer baseflow (250 ML/day at Rices Weir)5 | Continuous Sep-Dec |  |  |  | Moderate | **Maintain** | Moderate-high potential, dependant on unregulated flow conditions, which may meet the demand | Moderate | Moderate | |
|  | |
| Moderate | |
| **Upper Broken Creek** | Fresh  (up to 200 ML/day for 1‑2 days in winter/spring and/or summer/autumn)6 | 1 in 2 years |  |  |  | High | **Protect** | Moderate-high potential, dependant on unregulated flow conditions and subject to assessment of 3rd party risks | Low | Low | |
| Moderate | |
| **Broken River** | Winter/spring baseflow  80-200 ML/d at d/s Back Creek Junction7 | Continuous (Jun-Nov) | Late winter-spring only | Late winter- spring only | Late winter- spring only | Moderate | **Maintain** | Moderate potential to supplement consumptive deliveries to meet baseflow requirements in early winter | Moderate | Moderate | |
| High | |
| Small fresh  270-500 ML/day for 2-8  days in winter/spring and summer/autumn7 | 1­‑4 per year  (1 year) | Winter only | Winter only | Winter only | Moderate | **Maintain** | Moderate potential to deliver a small fresh in summer/autumn in support of in-stream and riparian vegetation condition (subject to unregulated flow conditions) | Moderate | Moderate | |
| High | |
| Large fresh  2600-4500 ML/day for 1 day in winter/spring7 | 1 in 1 year (3 years) |  |  |  | Moderate | **Maintain** | Moderate potential, subject to unregulated flow conditions | Moderate | Moderate | |
| High | |
| **Goulburn-Broken catchment wetlands** | Infrastructure delivery to semipermanent wetlands 8 (for Goulburn River wetlands, equivalent to >20 000 ML/d at Shepparton)9  Approximate total demand 12 000 ML per year for infrastructure delivery | 1 in 1-2 years  (4.5 years\*) |  | Water delivered to some wetlands only10 | Drying phase for several wetlands | Moderate | **Maintain** | It is anticipated that demands in the Goulburn-Broken wetlands will be met by other water holders. | Moderate | Moderate | |
| High | |
| \* Moodies Swamp  max. dry interval is 1 year |  |  |  | Moderate | **Maintain** | Moderate potential | Moderate | Moderate | |
| High | |
|  | | | | | | | Carryover potential | Low to moderate proportion of available allocations expected to be carried into 2016–17. | A moderate proportion of available allocations may be carried over to 2017–18, but will depend upon resource availability and demands | Potential carryover will depend upon resource availability and demands | |
| Trade potential | No urgency to augment available allocations, therefore limited requirement for allocation purchase. Moderate to high demands means allocation sale subject to ongoing assessment of demands within catchment and across the Basin. | No expected urgency to augment allocation, therefore limited requirement for purchase. Moderate demands within the catchment means allocation sale subject to market conditions and Basin wide analysis of demands. | Potential to trade will be depend on environmental demands and resource availability | |

See bottom of Table 2a for footnotes

**Table 2c:** Long-Term Plan for the Victorian Rivers reflected in long-term commitments by the Commonwealth Environmental Water Holder – under all resource availability scenarios

| **Environmental Asset** | **Indicative demand** | | **Watering history**  **(from all sources of water)** | | | **Potential Commonwealth environmental water contribution**  **2015-16 to 2017-18** | **Purpose and Expected Outcomes** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Flow/volume** | **Required Frequency** | **2012–13** | **2013–14** | **2014–15** |
| (wet) | (moderate) | (drying) |
| **Campaspe River** | Up to the total Commonwealth environmental water entitlement of 6 913 ML (6 517 HRWS1 and 396 LRWS2) per year3 to contribute to in-stream flows at Barnadown Weir, for example4:   * Summer/autumn low flows: 10–50 ML/day * Winter/spring high flows: 1 000–1 800 ML/day for 2-7 days * Winter/spring low flows: 50–200 ML/day * Summer/autumn freshes: 50-200 ML/day for 1-3 days | Annually as per agreed hydrographs with the Victorian Environmental Water Holder and Catchment Management Authorities8 |  |  |  | A high potential to contribute, depending on intervalley transfer requirements. | Commonwealth environmental water will contribute to: improved survival, condition and recruitment success of river red gum communities; increased population size and age structure of small and large-bodied native fish (eg golden perch, Murray cod); increased resident breeding populations of platypus; and improved longitudinal connectivity between reaches and with the River Murray (NCCMA, 2015a). |
| **Loddon River** | Up to the total Commonwealth environmental water entitlement of 3 883 ML (3 356 HRWS1 and 527 LRWS2) per year3 to contribute to in-stream flows in Reach 4 between Loddon and Kerang Weir for example5:   * Summer/autumn low flows (continuous Dec-May): 25–50 ML/day * Summer/autumn freshes (Dec-May): 50-100 ML/day for 3–4 days * Spring high flow (Sept-Oct): 450–750 ML/day with a 7 day peak * Autumn high flow (April-May): 400 ML/day with a 6 day peak * Winter/spring low flow (continuous June-Nov): 50­100 ML/day |  |  |  | A high potential to contribute to flows in Reach 4, particularly winter/spring high flows. | Depending on the timing and volume of flows, Commonwealth environmental water will contribute to: maintained adequate depth in pools for macroinvertebrates, fish, aquatic plants and fauna; improved local movement of fish and platypus; flushing of sediment from hard surfaces; and growth of fringing emergent macrophytes. |
| **Ovens River** | Up to the total Commonwealth environmental water entitlement of 70 ML per year3 (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 example6:   * Pulsed summer-autumn fresh when the bulk water transfer from Lake Buffalo is available (February – May) * Variability in baseflows if bulk water transfer not available (Nov-May) |  |  |  | A moderate-high potential to contribute to operational water releases by Goulburn Murray Water or to variability in baseflows, depending on the timing of the call by Goulburn Murray Water of the likelihood of a bulk water transfer. | When released with the bulk water drawdown, Commonwealth environmental water will contribute to maintaining the movement of native fish, natural connectivity between pools and riffles, and with the River Murray, microinvertebrate habitat and scouring of bio-film from beds. When contributing to low flows, Commonwealth environmental water will help to maintain native fish habitat and connectivity sufficient for fish passage between pools. |
| **Wimmera System** | Up to the total Commonwealth entitlement of 28 000 ML (LRWS2) per year3 to contribute toward in-stream flows within the Wimmera River (baseflow and freshes), subject to environmental need, delivery constraints and water availability7. | Due to the low reliability of the Commonwealth holdings, delivery is not expected to occur in most years. |  |  |  | If Commonwealth environmental water becomes available, consideration will be given to watering the terminal wetlands, however, this will occur very rarely as delivery to the terminal wetlands requires significant volumes of water that are only available under very wet conditions.  More likely, when available, Commonwealth environmental water may be used to assist the Victorian Environmental Water Holder in meeting objectives in the greater Wimmera system via a combination of partial allocations and/or carryover from previous years. | When available. Commonwealth water will aim to support native fish reproduction and condition, riparian vegetation condition, macroinvertebrate habitat and food, hydrological connectivity and biotic dispersal, and maintaining appropriate water quality.  Larger pulses may be used to provide additional water to the terminal wetlands (Lakes Hindmarsh and Albacutya) when coupled with natural flows. This may lead to the above stated environmental benefits plus waterbird outcomes and support Australia’s objectives under The Ramsar Convention on Wetlands and other international migratory bird agreement. Waterbird environmental outcomes may include waterbird reproduction and recruitment and an increase in local and landscape waterbird survival and diversity. |

1. High Reliability Water Shares 2. Low Reliability Water Shares

3. Plus any additional Commonwealth environmental water, including carryover, as it becomes available.

4. Sourced from NCCMA (2015a) and advice from the Victorian Environmental Water Holder

5. Sourced from NCCMA (2015b)

6. Sourced from NECMA (2015)

7. Sourced from WCMA (2015)

8. The Victorian and Commonwealth Environmental Water Holders have agreed to 5 year watering schedules (2014-15 to 2018-19) for the Campaspe, Loddon and Ovens Rivers.

# Part II: Commonwealth environmental water portfolio management planning

# Background

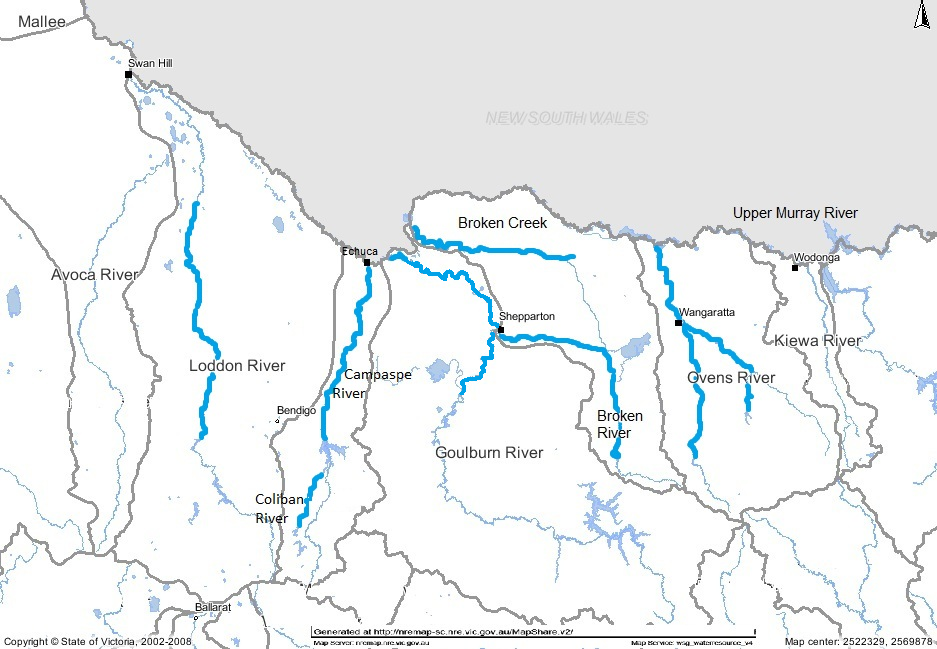
## Commonwealth environmental water

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

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

## The Victorian rivers in the Murray-Darling Basin

The Victorian rivers in the Murray-Darling Basin include the Ovens, Goulburn-Broken, Loddon, Campaspe (Figure 2) and Wimmera catchments. The northern Victorian rivers, particularly the Ovens and Goulburn-Broken, contribute significantly to the water resources of the River Murray, and 11.5 per cent of the Basin’s stream flow originates in the Goulburn-Broken (MDBA 2015). Lake Eildon on the Goulburn River is one of the Basin’s major water storages. The Wimmera River in central-west Victoria flows into Lakes Hindmarsh and Albacutya terminal wetlands and does not connect to the River Murray. The Victorian Rivers region has a highly developed agricultural sector and a population of almost half a million people (DEPI 2015).



**Figure 2**: 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. In lower Broken Creek, however, Commonwealth environmental water is delivered via irrigation infrastructure, sourced from either the Goulburn system or the Victorian Murray. Commonwealth environmental water use in the Victorian rivers contributes to both enhanced baseflows and freshes. Commonwealth environmental water used in the Victorian rivers can be credited as return flows for further environmental use downstream in the River Murray, with the exception of flows from the Loddon and the Wimmera rivers.

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

# Long-term environmental water demands in the Victorian rivers in the Murray-Darling Basin

## Basin-wide environmental watering strategy

The Murray-Darling Basin Authority has published the first Basin-wide environmental watering strategy (the Strategy, MDBA 2014). Building on Basin Plan’s environmental objectives, the Strategy sets out the Authority’s best assessment of the expected environmental outcomes over the next decade as a result of implementing the Basin Plan and associated water reforms. The Strategy focusses on four components: river flows and connectivity; vegetation; waterbirds; and native fish. The expected outcomes for each component are summarised below, with more specific quantified outcomes provided in Attachment A.

**River flows and connectivity:** Improve connections along rivers and between rivers and their floodplains

**Vegetation:** Maintain extent and improve the condition

**Waterbirds:** Maintain current species diversity, improve breeding success and numbers

**Native Fish:** Maintain current species diversity, extend distributions, improve breeding success and numbers

## Long-term watering plans

State governments are developing long-term watering plans for each catchment in the Basin. These plans will identify:

* the priority environmental assets and ecosystem functions in the catchment
* the objectives and targets for these assets and functions
* their watering requirements

In developing these plans, state governments will be consulting with environmental water holders and local communities.

Once developed, these plans will provide the key information on the long-term environmental water demands in the catchment and the Office’s planning for the Victorian rivers will be reviewed so that this information can be incorporated.

Prior to the development of long-term watering plans, the Office will continue to draw on existing documentation on environmental water demands developed by state governments, local natural resource management agencies and the Murray-Darling Basin Authority.

Key documentation includes:

* Seasonal Watering Proposal documents for the Goulburn River, lower Broken Creek, Broken River and Goulburn-Broken Catchment Wetlands (GBCMA 2015a-d)
* Seasonal Watering Proposal documents for the Loddon and Campaspe rivers 2015-16, (NCCMA 2015).
* Seasonal Watering Proposal document for the Ovens River 2015-16, (NECMA 2015).
* Seasonal Watering Proposal document for the Wimmera System 2015-16, (WCMA 2015).
* Environmental flow recommendation studies for the Goulburn River including Cottingham et al. (2003, 2007, 2010)
* The Goulburn Monitoring and Evaluation Plan, developed under the Office’s Long-Term Intervention Monitoring Project (University of Melbourne 2014)
* The assessment of environmental water requirements for the proposed Basin Plan (MDBA 2012a-c)

The below section represents the Office’s summary of the long-term environmental water demands, based on these documents. The objectives and expected outcomes for water-dependent ecosystems will continue to be revised and refined in response to best available knowledge, including drawing on the results of environmental watering monitoring programmes.

## Expected outcomes in the Victorian rivers in the Murray-Darling Basin

The expected outcomes from environmental watering in the Victorian rivers are described below in Table 3 and how these contribute to Basin-wide outcomes. These outcomes will be refined and/or revised once the long-term watering plan for the catchment has been developed.

Table 2: Summary of expected outcomes from environmental watering in the Victorian rivers in the Murray-Darling Basin

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

Information sourced from: Cottingham at el. (2003; 2007; 2010; 2014) GBCMA (2015a-d), NCCMA (2015a-b), WCMA (2015).

## Flows in scope for Commonwealth environmental watering

Not all environmental demands can and will be met through the use of held environmental water. Some demands are met by regulated water deliveries for consumptive purposes and inter-valley transfers, 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 the Office to focus on contributing to in the Victorian rivers. Importantly, these are broad, indicative demands and individual watering events may contribute to particular opportunities, such as using infrastructure to deliver water to individual wetlands that would otherwise not be possible due to constraints. Also, there may be opportunities for Basin State governments to remove or modify constraints, which will improve the efficiency and/or effectiveness of environmental watering.

A hydrograph figure showing the scope of demands that Commonwealth environmental water may contribute to in the Victorian Rivers region.
Low flows are often met by other sources of water, such as consumptive water deliveries. Conversely, very high flows are the result of unregulated or natural flows. Commonwealth environmental water cannot contribute to these high flows, as doing so would create unacceptable third party impacts. The focus for Commonwealth environmental watering is therefore on mid-range flows, such as variable base flows and small to moderate freshes in the Goulburn, Campaspe and Loddon Rivers and Broken Creek.


Figure 3: Scope of demands that environmental water may contribute to in the Victorian rivers in the Murray-Darling Basin

The delivery of environmental water in the Victorian rivers 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 (MDBA) and can be found in *Preliminary Overview of Constraints to Environmental Water Delivery in the Murray-Darling Basin* (MDBA2013a) and *Constrains Management Strategy 2013 to 2014* (MDBA 2013b). Specific constraints to be considered are detailed in Section 3.6.

Operational considerations such as constraints and risks will differ depending on the inflow scenario and are summarised in Table 4. 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.

**Table 3:** Current constraints on environmental watering for the Victorian rivers in the Murray-Darling Basin

| **Inflow scenario** | **Very low** | **Low** | **Moderate** | **High** | **Very high** |
| --- | --- | --- | --- | --- | --- |
| **Constraints** | | | | | |
| Flow thresholds to avoid third-party impacts, such as inundation of private land or irrigation infrastructure, or to avoid adverse environmental impacts, or impacts to river works may constrain the delivery rate of environmental water, including targeted peak flow rates, duration and timing. |  | | | | |
| Flow thresholds within the Murray River to avoid the inundation of river and floodplain work programs may constrain the delivery of targeted peak flow rates from the Goulburn River. |  | | | | |
| Low allocations at the start of the water year will affect the ability to meet priority environmental flow targets during winter/spring. |  | | | | |
| Trade restrictions for transfer of allocations between catchments may limit water availability to meet all desirable flow targets. |  | | | | |

Constraints as they relate to specific watering actions are described in the standard operating considerations listed in section 3.6 below.

Based on the above outcomes sought and delivery constraints, Table 5 identifies flows that are in scope for Commonwealth environmental watering. Some specific watering requirements (flow magnitude, duration, timing and frequency) have also been listed, drawn from existing resources. Meeting these watering requirement is subject to seasonal conditions, espicially fresh flows that are reliant on natural inflows that may be augmented using environmental water. The watering requirements for the Victorian rivers will be developed in full by the state government as part of their long-term watering plan and will be reflected in future planning documents by the Commonwealth Environmental Water Office.

**Table 4:** Long-term indicative elements of a flow regime in scope for Commonwealth environmental watering in the Victorian rivers in the Murray-Darling Basin

|  |  |  |
| --- | --- | --- |
| **Environmental asset** | **Indicative demands** | **Frequency (Maximum dry interval)** |
| Goulburn River  (mid and lower) | Baseflow  540–940 ML/day @ McCoys Bridge | Year round |
| Winter fresh (Jun-Aug)  Up to 15 000 ML/day @ Murchison & McCoys Bridge with 14 days above 6 600 ML/day | 1-2 events per year  (1 year) |
| Spring fresh (Sep-Nov)  Up to 15 000 ML/day @ Murchison/McCoys Bridge with 14 days above 5 600 ML/day | 1-2 events per year  (1 year) |
| Spring/summer fresh (Oct-Dec)  Up to 15 000 ML/day @ Murchison/McCoys Bridge with 14 days above 5 600 ML/day | 2 in 3 years  (max interval unknown) |
| Summer/autumn fresh (Feb-Apr)  3 500–5 600 ML/day @ Murchison & McCoys Bridge for 2-4 days | 1-2 events per year  (1 year) |
| Lower Broken Creek | Winter-autumn baseflow  (40 ML/day at Rices Weir) | Continuous (mid August – May) |
| Spring-autumn baseflow  (150–250 ML/day at Rices Weir) | Continuous (Oct-May) |
| Spring-summer baseflow  (250 ML/day at Rices Weir) | Continuous (Sep-Dec) |
| Upper Broken Creek | Fresh  (up to 200 ML/day for 1-2 days in winter/spring and/or summer/autumn) | 1 in 2 years  (max interval unknown) |
| Broken River | Winter/spring baseflow  80-200 ML/day at downstream Back Creek Junction | Continuous (Jun-Nov) |
| Small fresh  270-500 ML/day for 2-8 days in winter/spring and summer/autumn | 1­‑4 per year  (1 year) |
| Large fresh  2600-4500 ML/day for 1 day in winter/spring | 1 in 1 year (3 years) |
| Goulburn-Broken catchment wetlands | Infrastructure delivery to semipermanent wetlands (for Goulburn River wetlands, equivalent to >20 000 ML/day at Shepparton)  Approximate total demand 12 000 ML per year for infrastructure delivery | 1 in 1-2 years  (4.5 years\*)  \* Moodies Swamp  maximum dry interval is 1 year |
| Campaspe | Summer/autumn low flows  10–50 ML/day at Barnadown Weir | Annually |
| Winter/spring high flows  1 000–1 800 ML/day for 2–7 days at Barnadown Weir |
| Winter/spring low flows  50–200 ML/day at Barnadown Weir |
| Summer/autumn freshes  50–200 ML/day for 1–3 days at Barnadown Weir |
| Loddon | Summer/autumn low flows (continuous Dec-May)  25–50 ML/day at Loddon Weir | Annually |
| Summer/autumn fresh (Dec-May)  50–100 ML/day for 3–4 days at Loddon Weir |
| Spring high flow (Sept-Oct)  450–750 ML/day with a 7 day peak at Loddon Weir |
| Autumn high flow (April-May)  400 ML/day with a 6 day peak at Loddon Weir |
| Winter/spring low flow (continuous) 50-100 ML/day at Loddon Weir |
| Ovens | Contribution options   * Pulsed summer-autumn fresh when the bulk water transfer from Lake Buffalo is available (February – May) * Variability in baseflows if bulk water transfer not available (Nov-May) | Annually |
| Wimmera | Contribution options   * 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 downstream of Huddlestons Weir. * Larger pulses may be used to provide additional water to the terminal wetlands (Lakes Albacutya and Hindmarsh) when coupled with natural flows | Subject to water availability |

Information sourced from: Cottingham at el. (2003; 2007; 2010), GBCMA (2015a-d), NCCMA (2015a-b), NECMA (2015), WCMA (2015)

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

Under certain levels of water resource availability, watering actions may not be pursued for a variety of reasons, including that environmental demand may be met by unregulated flows and that constraints and/or risks may limit the availability to deliver environmental water. Table 6 identifies the range of potential watering actions in the Victorian rivers and the levels of water resource availability that relate to these actions.

Table 5: Summary of potential watering actions for the Victorian rivers in the Murray-Darling Basin

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Broad Asset** | **Indicative demand** | **Applicable level(s) of resource availability** | | | | | | |
| **Very Low** | | **Low** | **Moderate** | | **High** | **Very High** |
| **Goulburn River** | Baseflow 540-940 ML/day at McCoys Bridge | 1a. Contribute to minimum baseflows year-round to maintain water quality and provide suitable habitat and food resources to support native fish and macroinvertebrates condition and survival. | | | | | | |
| 1b. Contribute to higher baseflows year-round, but especially in winter/spring to provide additional habitat and food resources to support native fish and macroinvertebrates condition and survival. | | | | | | |
| Winter fresh (Jun-Aug)  Up to 15 000 ML/day at Murchison & McCoys Bridge with 14 days above 6 600 ML/day |  | | 1c. Contribute to winter freshes to support the condition and survival native vegetation as part of the ongoing system recovery following prolonged drought and subsequent flooding; provide channel maintenance and promote the transport of nutrients, carbon, sediment and biota. | | | |  |
| Spring fresh (Sep-Nov)  Up to 15 000 ML/day at Murchison/McCoys Bridge with 14 days above 5 600 ML/day | 1d. Contribute to long duration freshes in spring targeting in-channel native vegetation condition and reproduction; macroinvertebrate diversity and abundance; movement and condition of native fish; biotic dispersal and the transport of nutrients, carbon and sediment. | | | | | | |
| Spring/summer fresh (Oct-Dec)  7000–15 000 ML/day at Murchison & McCoys Bridge for 2 days |  | | 1e. Contribute to short duration freshes between October and December to promote movement and breeding of native fish (flow cued spawners). | | | | |
| Summer/autumn fresh (Feb-Apr)  3 500–5 600 ML/day at Murchison & McCoys Bridge for 2-4 days | 1f. Contribute to low magnitude, long duration freshes between February and April to support the survival and condition of in-channel native vegetation and promote the transport of nutrients, carbon, sediment and biota. | | | | | | |
| **Lower Broken Creek** | Winter-autumn baseflow (40 ML/day at Rices Weir) | 2a. Contribute to minimum baseflows between mid August and mid May to support native fish movement through fishways. | | | | | | |
| Spring-autumn baseflow (150–250 ML/day at Rices Weir) | 2b. Contribute to high baseflows between October and May to manage excessive Azolla growth and maintaining dissolved oxygen levels above 4 mg/L. | | | | | | |
| Spring-summer baseflow (250 ML/day at Rices Weir) |  | | 2c. Contribute to high baseflows between September and December to provide improved habitat and migration opportunities for native fish. | | | |  |
| **Upper Broken Creek** | Fresh (up to 200 ML/day for 1-2 days in winter/spring and/or summer/autumn) |  | | 3. Contribute to moderate size freshes in response to natural flow triggers or transfers from Broken River to maintain water quality and support condition and reproduction of in-channel vegetation, native fish and macroinverterbrates. | | | | |
| **Broken River** | Winter/spring baseflow  80-200 ML/d at downstream Back Creek Junction | 4a. Contribute to baseflows between June and November to maintain water quality and provide suitable habitat and food resources to support native fish and macroinvertebrates condition and survival | | | | | | |
| Small fresh  270-500 ML/day for 2-8 days in winter/spring and summer/autumn | 4b. Contribute to small freshes throughout the year to support the condition and reproduction of native in-channel vegetation; the condition, movement and reproduction of native fish; and provide suitable habitat for biota through maintaining water quality, scouring biofilms, inundating benches and flushing fine sediment from the riverbed | | | | | | |
| Large fresh  2600-4500 ML/day for 1 day in winter/spring |  | | | | 4c. Contribute to large freshes in winter/spring, subject to appropriate triggers, to support the condition and reproduction of native in-channel vegetation; the condition, movement and reproduction of native fish; and channel maintenance | | |
| **Goulburn-Broken Catchment Wetlands** | Infrastructure delivery to semipermanent wetlands (for Goulburn River wetlands, equivalent to >20 000 ML/d at Shepparton) | 5. Contribute flows via wetland regulators and/or pumping to inundate semi-permanent, temporary and ephemeral wetlands | | | | | |  |
| **Campaspe River** | * Summer/autumn low flows * 10–50 ML/day to Reach 4 between the Campaspe Siphon and the Murray River | 6a. Contribute to low flows in summer/autumn to increase native fish populations and resident platypus breeding populations. | | | | | | |
| Winter/spring high flows  1000-1800 ML/day for 2-7 days to Reaches 2 and 4 below Loddon Weir | 6b. Contribute to winter/spring high flows to support river red gums, native fish and platypus populations, and connectivity between Campaspe reaches and with the Murray River. Multiple actions, possible when additional water is available, will also reduce exotic vegetation, flush and mix pools, inundate snags and respond to blackwater events if required | | | | | | |
| Winter/spring low flows  50–200 ML/day at Barnadown Weir | 6c. Contribute to winter/spring low flows to support native fish and platypus populations | | | | | |  |
| Summer/autumn freshes  50–200 ML/day for 1-3 days at Barnadown Weir | 6d. Contribute to summer/autumn freshes to support riparian and in-channel vegetation and native fish populations | | | | | |  |
| **Loddon River** | Summer/autumn low flows (continuous Dec-May)  25–50 ML/day at Loddon Weir | 7a. Contribute to summer/autumn low flows to maintain sufficient depth in pools to support microinvertebrates, native fish, aquatic plants and fauna, and maintain water quality and connectivity. | | | | | |  |
| Summer/autumn freshes (Dec-May)  50-100 ML/day for 3–4 days at Loddon Weir | 7b. Contribute to summer/autumn freshes to promote local movement of native fish, flush fine sediment from hard surfaces and promote growth of fringing emergent macrophytes | | | | | |  |
| Autumn high flow (April-May)  400 ML/day at Loddon Weir with a 6 day peak |  | 7c. Contribute to autumn high flows to cue and facilitate upstream movement of >1 year old golden perch, silver perch and Murray cod | | | | |  |
| Winter/spring low flow (continuous June-Nov)  50–100 ML/day at Loddon Weir | 7d. Contribute to winter/spring low flows to increase depth for fish, platypus and water rat movement, keep submerged wood and other hard surfaces clear of fine silt and sediment, support the range of vegetation types and provide habitat for platypus | | | | | |  |
| Spring high flow (Sept-Oct)  450–750 ML/day at Loddon Weir with a 7 day peak |  | 7e. Contribute to winter/spring high flows to provide flows through flood runners, flush accumulated organic matter from banks and benches, stimulate native fish movement and breeding, promoted recruitment and maintenance of riparian vegetation and scour some pools | | | | |  |
| **Ovens River** | Summer-autumn fresh (February – 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. | | | | | |  |
| **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 natural 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 |

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 the deliver environmental water.

## Potential watering actions – standard operational considerations

Table 6 above identifies the range of potential watering actions in the Victorian rivers that give effect to the long-term demands and flow regime identified as being in scope for the Office to contribute environmental water to in any given year. The standard considerations associated with these actions are set out below.

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

*Watering action 1: Goulburn River*

*Standard operational considerations*

* Commonwealth environmental water delivery will not contribute to flows above 9 500 ML/day at Molesworth to minimise the risk of potential impacts on private property in reach 1, located between Eildon Dam and Molesworth.
* Unless otherwise agreed, Commonwealth environmental water will only contribute to flows up to 15 000 ML/day at McCoys Bridge. Fresh events are unlikely to target flows above 9 500 ML/day in the lower Goulburn River at McCoys Bridge, however recession management of natuiral high flow events may commence at 15 000 ML/day at McCoys Bridge.
* 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.

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

*Watering action 2: Lower Broken Creek*

*Standard operational considerations*

* Environmental water delivery is constrained to the period mid May to mid August, when irrigation infrastructure in the Shepparton and Murray Valley irrigation areas is in operation.
* Environmental water delivery will be delivered to complement consumptive water deliveries, including intervalley bulk water transfers, where appropriate. This approach provides third party benefits to other entitlement holders in the Murray Darling Basin by allowing intervalley bulk water transfers to be diverted around the Barmah Choke, thereby reducing competition over channel capacity at the Choke.

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

*Watering action 3: Upper Broken Creek*

*Standard operational considerations*

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

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

*Watering action 4: Goulburn-Broken Catchment Wetlands*

*Standard operational considerations*

* Delivery to Goulburn-Broken catchment wetlands, inlcuding Moodies Swamp, involves low in-channel flow rates well below channel capacity.

*Typical extent:* Wetland inundation via infrastructure.

*Watering action 5: Campaspe River*

*Standard operational considerations*

* The maximum regulated release volume from Lake Eppalock to avoid any potential third party flooding impacts is 1 850 ML/day (measured at Barnadown Weir). Planned releases are below this volume.
* Intervalley transfers undertaken by Goulburn Murray Water may impact on the volume and timing of Commonwealth Environmental Water releases.
* Drawdowns from Lake Eppalock during summer/autumn may attract community concern if the lake-level recedes and affects recreational activity.
* Flows greater than 10 000 ML/day in Reach 2 (Eppalock Weir to Campaspe Weir) and greater than 8 000 ML/day in Reach 3 (Campaspe Weir to Campaspe Siphon) and 9,000 ML/d in reach 4 (Campaspe Siphon to River Murray) will cause flooding of low lying floodplain including private property. These flows are not planned.
* The timing of releases and flow rates from Lake Eppalock may need to be managed by the storage operator to limit any potential effects of cold water on fish. Structures, such as Campaspe Weir and Campaspe siphon may also be acting as constraints to fish passage (Goulburn-Murray Water [GMW] 2014, pers. comm. 21 March).

*Typical extent:* in-channel flows in support of the aforementioned expected outcomes will be released from Lake Eppalock, particularly targeting reaches 2 (Lake Eppalock to Campaspe Weir) and 4 (Campaspe Siphon t*o Murray River).*

*Watering action 6: Loddon River*

*Standard operational considerations*

* 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 agreeme*n*t of potentially affected landholders.
* A constant flow in the river is desirable but in the event the river did dry-out then it should be re-started with a bankfull flow.
* Rules and constraints related to water from the Goulburn system affect the delivery of the winter/spring fresh. Water not tied to the Goulburn system but stored in the Loddon storages, such as Commonwealth environmental water, can be used for this action.

*Typical extent:* in-channel flows in support of the aforementioned expected outcomes will be released from Cairn Curran, Tullaroop or Laanecoorie Reservoirs, particuarly targeting reach 4 (Loddon Weir to Kerang Weir).

*Watering action 7: Ovens River*

*Standard operational considerations*

* Water is to be 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 total 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 in support of the aforementioned expected outcomes will be released from Lake William Hovell and Lake Buffalo.

*Watering action 8: Wimmera System*

*Standard operational considerations*

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

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

# Long-term water availability

## Commonwealth environmental water holdings

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

* 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 (low reliability)

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

## Other sources of environmental water

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

* Environment Entitlement – The Living Murray Program: Murray-Darling Basin Authority
* Bulk Entitlement (River Murray – Flora and Fauna): Victorian Environmental Water Holder
* Environmental Entitlement (River Murray and Goulburn System Northern Victorian Rivers Irrigation Renewal Stage 1): 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
* Bulk Entitlement (Eildon to Goulburn Weir): Goulburn-Murray Water

## Planned environmental water

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

# Next steps

## From planning to decision making

It is important to distinguish between planning and operational decision making. As shown in Figure 4, planning allows the 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.

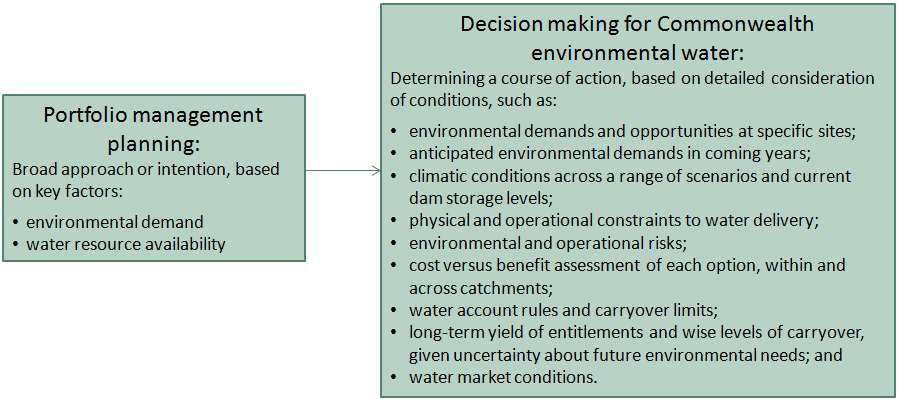


Figure 4: Planning and decision making for Commonwealth environmental water use

## Further information

For further information on how the Office plans for water use, carryover and trade, please visit our web site [www.environment.gov.au/topics/water/commonwealth-environmental-water-office](http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office)

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

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

Expected outcomes from the Basin-wide Environmental Watering Strategy (MDBA 2014) that are relevant to the Goulburn-Broken are described below.

**RIVER FLOWS AND CONNECTIVITY**

Baseflows are at least 60 per cent of the natural level

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

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

**VEGETATION**

Maintained 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 Creek, 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  abundanceand 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 movements 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, increase up the lower Goulburn River.  Improved core range in at least two additional locations (candidate site includes Broken Creek) | 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: mid-Goulburn populations - attempts to re-establish have commenced | Establishment of new populations is dependent on complimentary activities.  Environmental water will however target existing populations in the lower Goulburn River to increase abundance and potentially also range. |
| Two-spined blackfish (*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 |  |  |  |  | \* | \* | \* |

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1. For full details on the Basin annual environmental watering priorities refer to the MDBA website at http://www.mdba.gov.au/what-we-do/environmental-water/environmental-watering-priorities [↑](#footnote-ref-1)
2. [↑](#footnote-ref-2)