SECTION 4

Western region

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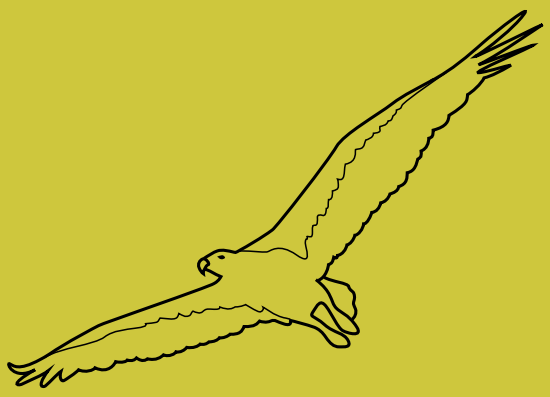


4.1 Western region overview

In the western region, regulated environmental flows can be delivered to the Wimmera River system, the Glenelg River and the Wimmera-Mallee wetlands. The Wimmera River system and Wimmera-Mallee wetlands are part of the Murray-Darling Basin.

Water for the environment in the western region is supplied from the Wimmera-Mallee headworks system. The Wimmera and Glenelg systems share water available under the environmental entitlement and the VEWH works with the Wimmera and Glenelg Hopkins CMAs to determine how the available allocation will be used in each river in a given year. There is an additional volume of water available to the Glenelg River, as a compensation flow account. The Commonwealth Environmental Water Holder (CEWH) also holds entitlement in the Wimmera system that can be used to supply the Wimmera River and lower Mount William Creek systems. Water for the environment available to the Wimmera-Mallee wetlands is provided under the same entitlement but not shared with the Glenelg system. Instead, the water is available for use in small wetlands supplied by the Wimmera-Mallee pipeline across the Wimmera, Mallee and North Central CMA regions.

Cultural, economic, environmental, recreational, social and Traditional Owner values, recent conditions, environmental watering objectives and planned actions for each system in the western region are presented in the system sections that follow.

Traditional Owners in the western region

Traditional Owners and their Nations in the western region continue to have a deep connection to the region's rivers, wetlands and floodplains.

The Registered Aboriginal Parties in the region are the Barengi Gadjin Land Council Aboriginal Corporation (BGLC), Eastern Maar Aboriginal Corporation, Gunditj Mirring Traditional Owners Aboriginal Corporation and Martang Pty Ltd.

In 2005, the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagalk peoples, who are often referred to collectively as the Wotjobaluk Peoples and who are represented by BGLC, were recognised in a Native Title Consent Determination. BGLC also entered into an Indigenous Land Use Agreement with the Victorian and Australian governments in 2005.

In 2007 the Gunditjmara people were granted non-exclusive native title rights and interests over almost 140,000 ha of vacant Crown land, national parks, reserves, rivers, creeks and sea in Victoria's western district, and the State of Victoria reached an Indigenous Land Use Agreement with the Gunditjmara People that establishes how they will exercise their rights and interests in the determination area.

In recognition of the cultural importance of water for Aboriginal people and their traditional ecological knowledge, waterway managers are working with Traditional Owners to involve them in management of environmental flows. In 2019–20, this will include the following initiatives:

- Work will continue on the Towards Cultural Flows project, a partnership between Glenelg Hopkins CMA, Gunditj Mirring Traditional Owners Aboriginal Corporation, BGLC and Burrandies Aboriginal Corporation (in South Australia), which aims to understand and support Traditional Owners' interests, aspirations, challenges and opportunities for water management on the Glenelg River. In 2019–20, they will continue to provide opportunities for Traditional Owners to spend time on Country, to increase their knowledge and expertise in water management while educating the CMA about cultural values that can guide future environmental planning.
- The highly successful watering of Ranch Billabong at Dimboola by Wimmera CMA will be repeated. The Ranch Billabong contains important environmental values, and during an Aboriginal Waterways Assessment in 2017 it was highlighted as a culturally significant site by the local Aboriginal community. Wimmera CMA worked in partnership with BGLC to arrange environmental flows and a community event in December 2018, with a follow-up watering in March 2019. The Ranch Billabong watering sparked activity from native wildlife and halved salinity levels, which improved growth of aquatic plants. Wimmera CMA and BGLC are planning to build on these outcomes by delivering additional water in 2019. The watering will also improve the site's amenity and suitability for gatherings and events (such as earth oven and bark canoe re-creations).

Engagement

Seasonal watering proposals are informed by longer-term regional catchment strategies, regional waterway strategies, relevant technical studies (such as environmental flow studies and environmental water management plans), as well as by input from program partners and affected stakeholders. The strategies and technical reports collectively describe a range of cultural, economic, environmental, recreational, social and Traditional Owner perspectives and longer-term integrated catchment and waterway management objectives that influence environmental watering actions and priorities. Program partners and other stakeholders help to identify environmental watering priorities and opportunities for the coming year.

The International Association for Public Participation's Public Participation Spectrum (IAP2 Spectrum) has been used to categorise the levels of participation of stakeholders involved in the environmental watering planning process. Table 4.1.1 shows the IAP2 Spectrum categories and participation goals.

Table 4.1.1 IAP2 Spectrum categories and participation goals[1]

Engagement category	Engagement goal
Inform	Provide balanced and objective information to assist understanding, alternatives, opportunities and/or solutions
Consult	Obtain feedback on analysis, alternatives and/or decisions
Involve	Work directly throughout a process to ensure that concerns and aspirations are consistently understood and considered
Collaborate	Partner in each aspect of the decision including the development of alternatives and the identification of the preferred solution
Empower	Place final decision making in the hands of the stakeholder

[1] *The VEWH has the permission of the International Association for Public Participation to reproduce the IAP2 Spectrum.*

Tables 4.1.2 to 4.1.4 show the partners, stakeholder organisations and individuals with which the Wimmera, Glenelg Hopkins, Mallee and North Central CMAs engaged when preparing seasonal watering proposals. This includes engagement conducted as part of developing seasonal watering proposals as well as engagement during the preparation of key foundation documents that directly informed the proposals. The tables also show the level of engagement, based on the Wimmera, Glenelg Hopkins, North Central and Mallee CMAs' interpretation of the IAP2 Spectrum. The level of engagement differs between organisations and between systems, due to the complexity of management arrangements and individual organisation's responsibilities for each system. For example, in the Wimmera region councils have strong involvement in environmental flows planning and delivery, because they manage town weir pools in Horsham, Dimboola and Jeparit through which environmental flows must pass. Councils in the Wimmera region have also expressed a strong interest in water for the environment, because of the benefits watering provides the region's economy, tourism and environment. For these reasons, Wimmera CMA works with the councils in the planning process and during the year to ensure their concerns and aspirations are understood and considered. In other parts of the western region, where local governments are less involved in management, they may be informed of the seasonal watering proposals and invited to comments.

Table 4.1.2 Partners and stakeholders engaged by Glenelg Hopkins CMA in developing the seasonal watering proposal for the Glenelg system and other key foundation documents that have directly informed the proposal

Glenelg system	
Community groups and environment groups	• Friends of the Glenelg River • Glenelg River User Group
Government agencies	• Parks Victoria • Victorian Fisheries Authority
Landholders	• Individual landholders
Local businesses	• Balmoral Bush Nursing Centre • Balmoral Post Office • Glenelg River Boat Cruises • Grampians Resort • Paestan Canoe Hire • Nelson Boat and Canoe Hire • Vickery Brothers (sand extraction)
Program partners	• Department of Environment, Land, Water and Planning • GWMWater • Victorian Environmental Water Holder • Wimmera Catchment Management Authority
Recreational users	• Balmoral Angling Club • Casterton Angling Society • Dartmoor Angling Club • Individual anglers • South-west Fishing Reports • VRFish
Traditional Owners	• Barengi Gadjin Land Council Aboriginal Corporation • Gunditj Mirring Traditional Owners Aboriginal Corporation

Key: Inform Consult Involve Collaborate Empower

Table 4.1.3 Partners and stakeholders engaged by Wimmera CMA in developing the seasonal watering proposal for the Wimmera system and other key foundation documents that have directly informed the proposal

Wimmera system	
Community groups and environment groups	• Friends of Bungalally and Burnt Creek Group • Yarriambiack Creek Advisory Committee
Government agencies	• Parks Victoria • Victorian Fisheries Authority
Landholders/farmers	• Individual landholders
Local government	• Hindmarsh Shire Council • Horsham Rural City Council • Northern Grampians Shire Council • Yarriambiack Shire Council
Program partners	• Commonwealth Environmental Water Office • Department of Environment, Land, Water and Planning • Glenelg Hopkins Catchment Management Authority • GWMWater • Victorian Environmental Water Holder
Recreational users	• Canoeing Victoria • Dimboola Fishing Classic • Dimboola Rowing Club • Dimboola Water Ski Club • Hindmarsh Ski Club • Horsham Fishing Competition Committee • Horsham Triathlon Committee • Jeparit Anglers' Club • Lake Lonsdale Action Group • Natimuk Field and Game Club • Natimuk Lake Water Ski Club • VRFish • Wimmera Anglers' Association
Traditional Owners	• Barengi Gadjin Land Council Aboriginal Corporation

Key: Inform Consult Involve Collaborate Empower

Table 4.1.4 Partners and stakeholders engaged by Mallee, North Central and Wimmera catchment management authorities in developing seasonal watering proposals for the Wimmera-Mallee wetlands system and other key foundation documents that have directly informed the proposals

Wimmera-Mallee wetlands system	
Community groups and environment groups	• Berriwillock, Birchip, Culgoa, Hopetoun, Lalbert, Nullawil, Millewa-Carwarp, Sea Lake, Ultima, Waitche and Woomelang-Lascelles Landcare groups • Mid-Murray Field Naturalists Incorporated Association
	• Donald and District and Birchip Landcare groups
Landholders/ farmers	• Individual landholders
	• Birchip Cropping Group
Program partners	• GWMWater • Parks Victoria • Victorian Environmental Water Holder
	• Arthur Rylah Institute • Department of Environment, Land, Water and Planning
Recreational users	• Green Lake Regional Park • Lake Tchum Committee • Natimuk and District Field and Game • Ouyen Lake Project
	• Wimmera Bushwalking Club
Traditional Owners	• Barenji Gadjin Land Council Aboriginal Corporation • Dja Dja Wurrung Clans Aboriginal Corporation

Key: Inform Consult Involve Collaborate Empower

Community benefits from environmental watering

As described in subsection 1.1.1, by improving the health of rivers, wetlands and floodplains, environmental flows also provide benefits to communities. Healthy rivers and wetlands support vibrant and healthy communities.

Environmental outcomes provide direct flow-on cultural, economic, recreational, social and Traditional Owner benefits for communities. In 2019–20, examples in the western region included:

- supporting native fish species which are prized by recreational fishers (such as estuary perch, black bream and tupong in the Glenelg River and freshwater catfish and golden perch in the Wimmera system)
- social and economic benefits for local communities: research in 2017–18 found recreational visitors to the Wimmera River had spent an estimated $1.36 million, and the physical and mental health benefits at sites that received water for the environment totalled almost $8 million across the Wimmera and southern Mallee.

Additional opportunities to enhance community benefits can also sometimes be provided by modifying environmental flows, provided environmental outcomes are not compromised.

The following are two examples:

- Wimmera CMA may actively support community events by consulting with local community groups about the timing of environmental flows to coincide with events such as water skiing during the Kanamaroo Festival in Horsham, the Peter Taylor Barefoot Waterski Memorial Tournament in Dimboola and the Horsham triathlon and fishing competitions in the Wimmera River at Horsham, Dimboola and Jeparit.
- Glenelg Hopkins CMA will consider timing the release of a summer fresh to the Glenelg River to align with the Johnny Mullagh Cup cricket match held in Harrow; the match is played by Aboriginal descendants of the first Australian international team that toured England in 1868.

The ability of the VEWH and its partners to deliver these benefits will depend on the weather, climate considerations, the available water and the way the system is being operated to deliver water for other purposes.

Integrated catchment management

Altered water regimes are one of many threats to the health of Victoria's waterways. To be effective, water for the environment planning and releases of water for the environment need to be part of an integrated approach to catchment management. Many of the environmental objectives outlined in this seasonal watering plan will not be fully met without simultaneously addressing issues such as excessive catchment erosion, barriers to fish movement, high nutrient loads, loss of stream bank vegetation and invasive species, to name just a few issues.

Victorian and Australian government agencies, community groups and private landowners collectively implement a wide range of programs that aim to protect and improve the environmental condition and function of land, soils and waterways throughout Victoria's catchments.

Examples of complementary programs that are likely to support environmental watering outcomes in the western region include:

- major works by Glenelg Hopkins CMA to improve fish passage at Sandford Weir and Dergholm Gauge, in combination with delivery of water for the environment to facilitate the movement of migratory fish from the estuary to the upstream reaches of the Glenelg and Wannon rivers
- erosion control by Wimmera CMA in the upper Wimmera catchment to improve water quality
- stock-exclusion fencing along priority waterways by Wimmera and Glenelg Hopkins CMAs throughout the Wimmera and Glenelg catchments, to support the re-establishment of riparian and in-stream vegetation, with over 600 farming families involved along the Glenelg River alone
- carp management activities in both the Wimmera and Glenelg systems to reduce the number of carp and to build understanding about their behaviour in both rivers to facilitate better environmental watering outcomes
- extensive installation of large woody fish habitat in Glenelg River reach 2 using red gum trunks and root balls to restore complex habitat
- control of invasive species in the Wimmera-Mallee wetlands.

For more information about integrated catchment management programs in the western region refer to the Glenelg Hopkins, Wimmera, North Central and Mallee regional catchment strategies and waterway strategies.

Seasonal outlook 2019–20

The western region experienced near-average rainfall through winter 2018, but because the catchment was still very dry from the previous year the catchment run off was low, and most major storages received very modest inflows. The main gains in winter 2018 were flows into Rocklands Reservoir and through the Glenelg tributaries. From early spring 2018 to the end of autumn 2019, rainfall was below average and temperatures were above-average, resulting in system inflows for the entire 2018–19 year that were just 20 percent of the historic average of inflows. For the first time on record, there was no measurable flow in the upper Wimmera River at Huddlestons Weir for the entire year.

Dry and hot conditions over the two previous years caused storage levels to decline to below 40 percent of total storage capacity in early April 2019, and the allocations to the VEWH's entitlement reached a maximum of 55 percent in April 2019. The CEWH did not receive any allocation in 2018–19, but it retained some carryover from previous years which was used.

Waterway managers and the VEWH were cautious with the use of water for the environment in 2018–19, to assure supply for the upcoming 2019–20 year. Some good natural flow in the Glenelg catchment reduced the need for supply of the Glenelg River in winter and spring. In both the Wimmera and Glenelg systems, passing flows were reduced at times and accrued for use late in the year.

Below-average rainfall and above-average temperatures are predicted to continue for the western region through winter 2019. If dry conditions persist, the highest priority for the use of water for the environment will be to protect water quality, maintain connectivity between deep pool habitats and continue to improve the resilience of in-stream native plants and animals. Carryover available going into 2019–20 will be particularly important going into all climatic scenarios this year, as allocation to the environmental entitlements in the western region are not expected to be made in July 2019. It is also unlikely that under drier climatic conditions, without significant inflows to storages during winter and spring, both the wetland entitlement and CEWH's entitlement are expected to receive no allocations in 2019–20.

If conditions become wetter and environmental allocations increase, priority will be given to reserving water for use in 2020–21 and delivering some larger flows to maintain or improve conditions in the waterways and wetlands. The continuing focus of environmental watering in the Wimmera-Mallee wetlands will be to provide refuge and maintain habitat in the dry landscape, to support local plants and animals.

Risk management

During the development of the seasonal watering proposals for the Glenelg and Wimmera systems, environmental watering program partners held a workshop to assess risks associated with potential environmental watering actions for 2019–20 and identify appropriate mitigating strategies. Risks and mitigating actions are continually assessed by program partners throughout the year (see subsection 1.3.6).

4.2 Glenelg system

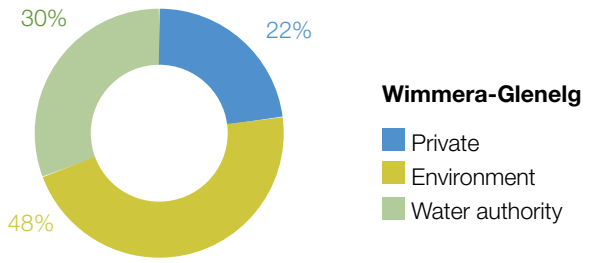
Waterway manager – Glenelg Hopkins Catchment Management Authority

Storage manager – GWMWater

Environmental water holder – Victorian Environmental Water Holder

Did you know ...?

The Glenelg River, known as *Bochara* in the Dhawurd Wurrung language, features in creation stories from the south-west Victoria region and is a traditional boundary between the Gunditjmara, Boandik and Jadawadjali people.



Proportion of water entitlements held across the Wimmera and Glenelg basins held by private users, water corporations or environmental water holders at 30 June 2018.

The Wimmera-Glenelg headworks system captures run-off from both the Wimmera and Glenelg catchments. Entitlements to water held in this system cannot be accounted for separately in the two river basins, therefore this figure shows the proportion of entitlements across both systems.

Top: Glenelg River, by Glenelg Hopkins CMA
Centre: Glenelg spiny freshwater crayfish, by Glenelg Hopkins CMA
Above: Glenelg riverbank in flower, by Glenelg Hopkins CMA

System overview

The Glenelg River rises in the Grampians and flows west through Harrow and then south to Casterton and Dartmoor. The Glenelg River estuary flows west from Dartmoor and passes through South Australia for a short distance before returning to Victoria and flowing into the sea at Nelson. At over 500 km, the Glenelg River is one of the longest rivers in Victoria.

The Glenelg River is an integral part of the Wimmera-Mallee headworks system, which supplies towns and properties across the western region. Moora Moora Reservoir and Rocklands Reservoir, in the upper Glenelg catchment and three weirs on the upper Wannon River, are all used to divert water from the Glenelg system to the Wimmera catchment. Water for the environment is actively managed in the main stem of the Glenelg River between Moora Moora Reservoir and Rocklands Reservoir and below Rocklands Reservoir. Passing-flow rules are in place for the Glenelg River and upper Wannon River.

The priority reaches of the Glenelg River that can be targeted by environmental flow releases are Moora Moora Reservoir to Rocklands Reservoir (reach 0), Rocklands Reservoir to 5-Mile Outlet (reach 1a), 5-Mile Outlet to the confluence with the Chetwynd River (reach 1b), Chetwynd River to the Wannon River (reach 2) and Wannon River to the tidal extent just below the confluence with Crawford River (reach 3). Water for the environment in the Glenelg system is released from Rocklands Reservoir for reach 1a via the reservoir wall outlet and for reach 1b via the 5-Mile and 12-Mile outlets. Releases are made at these points to meet objectives in these reaches as well as reaches 2 and 3. The Glenelg River estuary benefits from releases of water for the environment to upstream reaches, but releases do not currently target the estuary.

The Glenelg River upstream of Rocklands Reservoir (reach 0) runs mostly through the Grampians National Park and retains significant environmental values. Flows through this reach are affected by the operation of Moora Moora Reservoir and work is continuing in 2019–20 to confirm its flow requirements. Work is also continuing to better understand how environmental releases from Rocklands Reservoir can influence the health of the Glenelg River estuary, which is listed as a heritage river reach and a site of international significance under the Ramsar Convention.

Environmental values

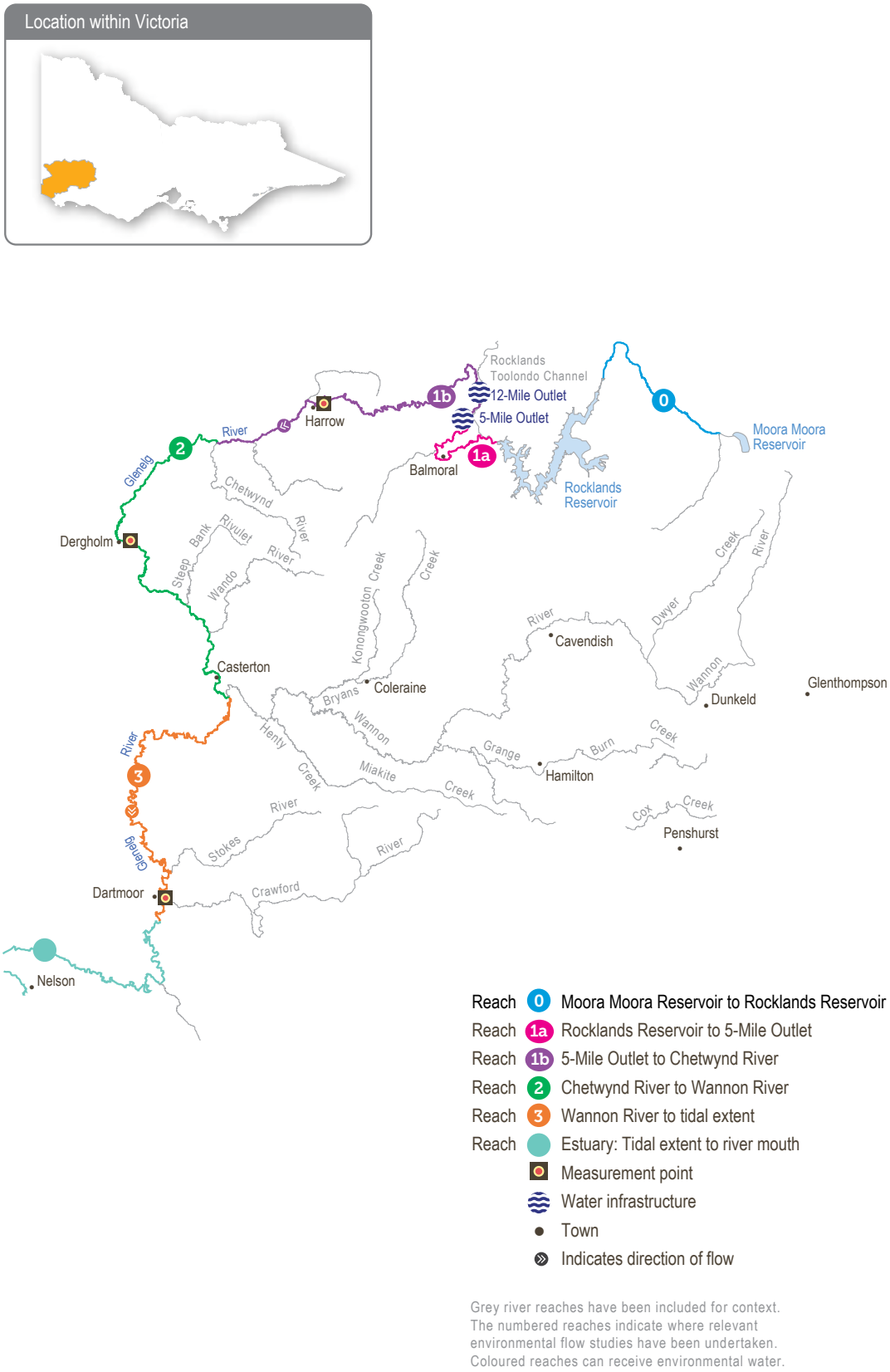
The lower reaches of the Glenelg River are part of a landscape recognised as one of Australia's 15 national biodiversity hotspots. Its listing is due in part to the aquatic life it supports including the endangered Glenelg freshwater mussel and Glenelg spiny crayfish. It is also home to platypus and populations of native fish including river blackfish, estuary perch, tupong and several species of pygmy perch. Some of these fish species migrate long distances upstream from the Glenelg River estuary to complete their life cycles. Frasers Swamp is another important feature of the upper Glenelg system, and is home to a healthy growling grass frog population.

The Glenelg River supports a variety of riparian vegetation communities including the endangered Wimmera bottlebrush. Riparian and floodplain vegetation is comprised of river red gum woodlands with paperbark, bottlebrush and tea tree understorey.

Environmental objectives in the Glenelg River

	Protect and increase populations of native fish
	Maintain deep pool habitats and connectivity along the river
	Maintain the platypus population
	Maintain the health and increase the abundance of in-stream and riparian vegetation (such as river red gums and Wimmera River bottlebrush)
	Maintain a wide range and large number of waterbugs to provide energy, break down organic matter and support the river's food chain
	Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals

Figure 4.2.1 The Glenelg system



Recent conditions

The regions experienced below-average rainfall for much of 2018–19. Several natural high-flow events in July and August 2018 met many of the environmental flow objectives for those months, but inflows to storages were well-below average between September 2018 and April 2019. The dry conditions meant the VEWH only received a portion of allocation against its Wimmera-Glenelg environmental entitlement. As of March 2019, the VEWH had received 55 percent allocation for the year, but the total volume of available water for the environment was supplemented by system reserves that were carried over from 2017–18. Passing flows were suspended during the high-flow events in July and August, to reduce the flood risk to communities downstream of Rocklands Reservoir, and water accumulated at those times was used to help meet environmental objectives in spring.

A combination of natural inflows and managed environmental flows maintained continuous flow between Rocklands Reservoir and the Glenelg estuary for most of 2018–19. The only disruption to this flow occurred in March 2019, when releases were suspended for two weeks to allow maintenance works on headworks infrastructure, carp screen cleaning and an upgrade of the Sandford fishway.

Water for the environment was used throughout the year to provide opportunities for native fish, platypus and crayfish to disperse between river reaches and to access a variety of habitats throughout the system. Spring flows also watered riparian vegetation including recently recruited seedlings, and helped move nutrients, leaf litter and small branches from the riverbank into the river channel where they can provide food, energy and habitat for aquatic biota. Low flows delivered during 2018–19 maintained the quality and quantity of water in riffles and pools along the river, to provide suitable habitat for waterbugs, native fish and other aquatic species. Occasional freshes reduced salinity and water temperature and increased dissolved oxygen concentrations in deeper pools along the river system.

Hot and dry conditions through summer and autumn increased seepage and evaporation losses, which meant that some target low flows did not achieve intended flow rates in downstream reaches. Fish monitoring conducted as part of the Victorian Environmental Flows Monitoring Assessment Program (VEFMAP) in autumn recorded a nationally threatened Australian grayling in the Glenelg River below Casterton (reach 3) for the first time in 122 years. The presence of Australian grayling and other fish species that rely on specific flows in freshwater reaches and the estuary indicates that managed environmental flows in the Glenelg River are helping to meet the requirements of native fish.

In late November 2018, water for the environment was delivered over 12 days to reach 0 from Moora Moora Reservoir. This is the second time water for the environment has been released from Moora Moora Reservoir, and the event was monitored to understand how water can be delivered from the reservoir to maintain and improve remnant plant and animal populations. Temporary gauges installed in reach 0 showed that the released water spread along several natural flow paths and did not contribute any detectable flow at the end of the reach.

Scope of environmental watering

Table 4.2.1 describes the potential environmental watering actions that may be delivered in 2019–20, their functional watering objectives (that is, the intended physical or biological effect of the watering action) and the longer-term environmental objective they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological functions.

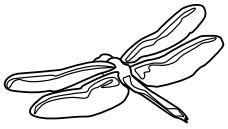


Table 4.2.1 Potential environmental watering actions and objectives for the Glenelg system

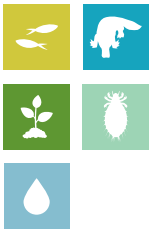
Potential environmental watering action	Functional watering objective	Environmental objective
Summer/autumn freshes targeting reach 1a (two freshes of 60 ML/day for two to three days each during December to May)	• Scour sand from pools to increase the quality and quantity of fish and waterbug habitat • Inundate emergent vegetation on the lower banks • Flush pools to improve water quality and lower temperatures • Provide sufficient flow to allow platypus to access habitat	
Summer/autumn freshes targeting reaches 1b (two freshes of 100 ML/day for two to three days each during December to May)		
Summer/autumn freshes targeting reach 2 (two freshes of 150 ML/day for two to three days each during December to May)		
Summer/autumn freshes targeting reach 3 (two freshes of 150 ML/day for three days each or natural during January to April)		
Summer/autumn low flows targeting reach 1a (10 ML/day or natural during December to May)[1]	• Protect against rapid water quality decline over the low-flow period • Maintain edge habitats, pools and shallow-water habitat for fish, waterbugs and platypus • Maintain a near-permanent inundated stream channel to promote the growth of in-stream vegetation and prevent encroachment by terrestrial plants	
Summer/autumn low flows targeting reach 1b (15 ML/day or natural during December to May)[1]		
Summer/autumn low flows targeting reach 2 (25 ML/day or natural during December to May)[1]		
Summer/autumn low flows targeting reach 3 (80 ML/day or natural during January to April)		
Autumn/winter low flows targeting reach 3 (260 ML/day or natural during May to June)	• Trigger fish movement and possibly assist seagrass germination in the estuarine reach downstream of reach 3, as based on estuary salinity profiles	
Winter/spring freshes targeting reach 1b (one to five freshes of 250 ML/day for one to five days during June to November)[2]	• Wet benches to improve the condition of emergent vegetation and maintain habitat diversity • Provide adequate depth for fish passage and cue fish movement • Provide triggers for platypus burrow selection • Scour sand from pools to improve the quality of fish habitat • Inundate vegetation in the river channel and on the channel benches to support recruitment and growth	
Winter/spring freshes targeting reach 2 (one to five freshes of 300 ML/day for one to five days during June to November)		
Winter/spring low flows targeting reach 1a (60 ML/day or natural during June to November)[1,3]	• Maintain water quality for fish and waterbugs • Inundate aquatic vegetation to maintain its condition and prevent encroachment by terrestrial species • Maintain shallow-water habitat for fish, waterbugs and platypus	
Winter/spring low flows targeting reach 1b (100 ML or natural per day during June to November)[1,3]		
Winter/spring low flows targeting reach 2 (160 ML/day or natural during June to November)[1,3]		
Winter/spring low flows targeting reach 3 (400 ML/day or natural during July to December)	• Inundate benches to increase habitat and allow widespread fish passage and keep the estuary mouth open (based on estuary mouth flows)	

Table 4.2.1 Potential environmental watering actions and objectives for the Glenelg system *continued...*

Potential environmental watering action	Functional watering objective	Environmental objective
Winter/spring trial release to reach 0 (up to 50 ML/day during July to November)	• Develop an operational understanding of our ability to deliver environmental flows to support plant, waterbug and animal populations in this reach including the capacity of infrastructure, metering and safety considerations	

1 *Cease-to-flow events occur naturally in the Glenelg system and may be actively managed with deliveries of water for the environment to reduce stress on environmental values. In the most-recent flows study, the recommendation is that cease-to-flow events should occur as infrequently as possible and not exceed the duration of events that might have occurred naturally. Cease-to-flow events ideally should be followed with a fresh.*

2 *Winter/spring freshes in reach 1a are important to the health of the Glenelg River but due to operational constraints and potential flooding risks they can only be achieved through natural events.*

3 *Passing flows provided under the environmental entitlement generally provide winter/spring low flows. However, if passing flows are reduced, managed releases of water for the environment may be required to supplement them.*

Scenario planning

Table 4.2.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

While proposed watering actions are similar in each climatic scenario, the magnitude, duration and/or frequency differ between scenarios. Moreover, the proportion of each action that is likely to be delivered by natural inflows will also vary between scenarios. For these reasons, the volume of water for the environmental required under each scenario also differs.

The highest priorities (tier 1a) under drought conditions are to deliver summer/autumn low flows in reaches 1a, 1b and 2. These flows will be used to maintain connectivity and water quality between pool habitats upstream of Casterton, in reach 2. Additional priority actions under dry, average and wet climate scenarios include summer/autumn freshes in all reaches and winter/spring low flows in reach 1a. The only exception to this are the summer/autumn freshes in reach 3 under average conditions, that are likely to benefit from freshes delivered in reach 2 as well as tributary inflows under wetter conditions.

The flows described above are unlikely to meet all environmental objectives however, as under a drought scenario flows of shorter duration are expected throughout the Glenelg River and a lower number of freshes than recommended is likely. Extended periods of cease-to-flow are likely to occur below Casterton, especially during drought and dry conditions, which increases the risks of fish kills, high salinity and blue-green algae blooms in the lower reaches of the Glenelg River. To mitigate the risks, it will be important to secure supply to deliver summer/autumn freshes in all reaches, as well as summer/autumn lows flows, to extend flows to Dartmoor in reach 3 under drought conditions. Extending summer/autumn low flows to reach 3, delivering winter/spring freshes in reach 1b and reach 2 and winter/spring low flows in reach 1a and reach 1b are a high priority under dry conditions, with summer/autumn freshes in reach 3 under average conditions. Under wet conditions, delivering winter/spring freshes in reach 1b and reach 2 are a high priority.

Additional priorities (tier 2) under dry to wet conditions are delivering the full watering regimes during the water year in the Glenelg River including winter/spring freshes to reach 2 in drought conditions and extending winter/spring low flows through to reach 3 in dry to wet conditions.

A third trial release to reach 0 from Moora Moora Reservoir is planned subject to climatic conditions and water availability. Releases aim to improve the understanding of how water for the environment can be delivered from Moora Moora Reservoir to support important plant and animal populations in reach 0. Water monitoring associated with the planned release will be used to refine the preliminary environmental flow recommendations that were developed in 2013. Delivering a trial flow in reach 0 is a high priority under dry, average and wet climatic conditions, although natural inflows under average and wet scenarios may make it difficult to distinguish the effect of managed releases. The trial flow is therefore identified as a tier 1a watering action under dry conditions and a tier 1b watering action under average and wet conditions. The trial delivery to reach 0 is a lower priority in drought conditions because any available water for the environment will be used to maintain critical habitat for aquatic life.

Reserving water for carryover into the 2020–21 water year will be a priority under all scenarios to ensure sufficient water is available to deliver the highest-priority flows during summer and autumn 2021. The volume carried over against the Wimmera-Glenelg environmental entitlement will be decided through consultation with both Wimmera and Glenelg Hopkins CMAs during the year and will be based on use during 2019–20, seasonal conditions and seasonal outlooks for 2020–21.

Table 4.2.2 Potential environmental watering for the Glenelg system under a range of planning scenarios

Planning scenario[1]	Drought	Dry	Average	Wet
Expected availability of water for the environment[2, 3]	• 35,600 ML	• 49,400 ML	• 63,600 ML	• 73,800 ML
Expected river conditions	• Some passing, compensation and low unregulated flows, particularly in winter/spring	• Some passing, compensation and low unregulated flows, particularly in winter/spring	• Some passing, compensation and unregulated flows, particularly in winter/spring	• Passing flows and unregulated flows meet some watering requirements in winter/spring
Potential environmental watering – tier 1a (high priorities)	• Summer/autumn low flows reach 1b • Summer/autumn low flows reach 2 • Summer/autumn low flows reach 1a	• Summer/autumn low flows reach 1b • Summer/autumn low flows reach 2 • Two summer/ autumn freshes reach 3 • Two summer/ autumn freshes reach 1b • Two summer/ autumn freshes reach 2 • Winter/spring trial release reach 0 • Summer/autumn low flows reach 1a • Two summer/ autumn freshes reach 1a	• Summer/autumn low flows reach 1a • Summer/autumn low flows reach 1b • Summer/autumn low flows reach 2 • Two summer/ autumn freshes reach 1b • Two summer/ autumn freshes reach 2 • Winter/spring low flows reach 1a • Two summer/ autumn freshes reach 1a	• Summer/autumn low flows reach 1a • Summer/autumn low flows reach 1b • Summer/autumn low flows reach 2 • Summer/autumn low flows reach 3 • Two summer/ autumn freshes reach 1b • Two summer/ autumn freshes reach 2 • Two summer/ autumn freshes reach 3 • Two summer/ autumn freshes reach 1a • Winter/spring low flows reach 1a
Potential environmental watering – tier 1b (high priorities with shortfall)	• Two summer/ autumn freshes reach 1b • Two summer/ autumn freshes reach 2 • Two summer/ autumn freshes reach 3 • Summer/autumn low flows reach 3 • Two summer/ autumn freshes reach 1a	• Summer/autumn low flows reach 3 • Two winter/spring freshes reach 1b • Two winter/spring freshes reach 2 • Winter/spring low flows reach 1a • Winter/spring low flows reach 1b	• Summer/autumn low flows reach 3 • Two summer/ autumn freshes reach 3 • Three winter/spring freshes reach 1b • Three winter/spring freshes reach 2 • Winter/spring trial release reach 0 • Winter/spring low flows reach 1b	• Five winter/spring freshes 1b • Winter/spring trial release reach 0 • Five winter/spring freshes reach 2

Table 4.2.2 Potential environmental watering for the Glenelg system under a range of planning scenarios *continued...*

Planning scenario[1]	Drought	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)	• Winter/spring low flows reaches 1a • Winter/spring low flows reaches 1b • Two winter/spring freshes reach 1b • Two winter/spring freshes reach 2 • Winter/spring trial release reach 0 • Winter/spring low flows reach 2	• Winter/spring low flows reach 2 • Winter/spring low flows reach 3	• Winter/spring low flows reach 2 • Winter/spring low flows reach 3	• Winter/spring low flows reach 2 • Winter/spring low flows reach 3
Possible volume of water for the environment required to achieve objective[4]	• 10,115 ML (tier 1a) • 8,760 ML (tier 1b) • 35,063 ML (tier 2)	• 14,779 ML (tier 1a) • 26,313 ML (tier 1b) • 12,190 ML (tier 2)	• 19,293 ML (tier 1a) • 19,002 ML (tier 1b) • 19,813 ML (tier 2)	• 23,927 ML (tier 1a) • 13,579 ML (tier 1b) • 12,349 ML (tier 2)

1 *Potential watering actions are listed in priority order for each planning scenario.*

2 *Water for the environment in the Wimmera-Glenelg system held by the VEWH is shared between the Glenelg and Wimmera systems. The VEWH volumes specified show the likely availability of the VEWH's environmental entitlement for both systems.*

3 *The VEWH volumes specified include volumes carried over from 2018–19 and expected allocations to be made to the Glenelg River Compensation Flows account in 2019–20. The Compensation Flows allocation can only be used in the Glenelg River.*

4 *Water for the environment requirements for tier 2 actions are additional to tier 1 requirements.*

4.3 Wimmera system

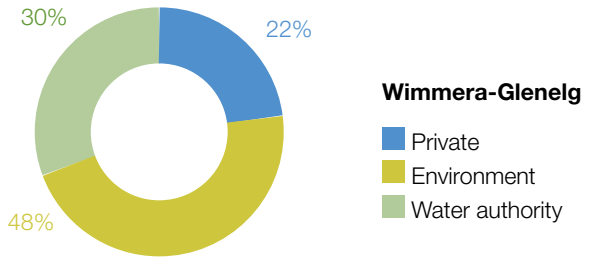
Waterway manager – Wimmera Catchment Management Authority

Storage manager – GWMWater

Environmental water holders – Victorian Environmental Water Holder, Commonwealth Environmental Water Holder

Did you know ...?

The Wimmera River is known as *Barringgi Gadyin* to the Wotjobaluk Traditional Owners and is a key feature of the local creation story. In 2018–19 water for the environment was delivered to Ranch Billabong for the first time in partnership with the Barengi Gadjin Land Council Aboriginal Corporation, to help restore native plant and animal habitats on their Country.



Proportion of water entitlements held across the Wimmera and Glenelg basins held by private users, water corporations or environmental water holders at 30 June 2018.

The Wimmera-Glenelg headworks system captures run-off from both the Wimmera and Glenelg catchments. Entitlements to water held in this system cannot be accounted for separately in the two river basins, therefore this figure shows the proportion of entitlements across both systems.

Top: Wimmera River at Ellis' Crossing, by Greg Fletcher, Wimmera CMA
Centre: Great cormorant at Mt William Creek, by Greg Fletcher, Wimmera CMA
Above: Watering at Ranch Billabong, a first for culture and environment, by Greg Fletcher, Wimmera CMA

System overview

The Wimmera River rises in the Pyrenees Range near Elmhurst and flows through Horsham, Dimboola and Jeparit before terminating at Lake Hindmarsh, which is Victoria's largest freshwater lake and the first of a series of terminal lakes. The Wimmera River receives flows from several regulated tributaries including the MacKenzie River and the Mount William and Burnt creeks. These tributaries, Bungalally Creek and the Wimmera River downstream of Mount William Creek can receive environmental flows. In exceptionally wet periods, Lake Hindmarsh may overflow into Outlet Creek and on to Lake Albacutya, which is an internationally recognised Ramsar-listed wetland. There are numerous wetlands beyond Lake Albacutya as well, which have not filled with water for decades.

Water in the Wimmera system is stored in three on-stream reservoirs — Lake Wartook on the MacKenzie River, Lake Lonsdale on Mount William Creek and Lake Bellfield on Fyans Creek — and in several off-stream storages — Taylors Lake, Lake Fyans and Toolondo Reservoir. A channel system enables water to be moved between several storages. Water can also be transferred from Rocklands Reservoir in the Glenelg system to the Wimmera system via the Rocklands–Toolondo Channel and from Moora Moora Reservoir via the Moora Channel. The connected storages and channels are collectively called the Wimmera—Mallee System Headworks, and harvested water is used for towns and stock and domestic supply throughout the Wimmera catchment and parts of the Avoca, Hopkins, Loddon, Glenelg and Mallee catchments. Passing flows are provided to the Wimmera River and to lower Mount William and Fyans creeks.

Priority reaches in the Wimmera system that can receive water for the environment are Wimmera River reaches 3 and 4, MacKenzie River reaches 2 and 3, upper and lower Mount William Creek, upper and lower Burnt Creek and Bungalally Creek.

Yarriambiack Creek is a distributary of the upper Wimmera River that would have naturally received some flows during high-flow events. Modifications to the Yarriambiack Creek offtake increase flow rates in Yarriambiack Creek but reduce the transfer of water for the environment to the high-priority reaches of the Wimmera River. During very dry years, flows entering Yarriambiack Creek may be blocked to ensure watering objectives in the Wimmera River are not compromised.

Two wetlands in the Wimmera system have been included in the environmental watering program in recent years.

Dock Lake, one of the Wimmera's large terminal lakes near Horsham, would have naturally filled when the nearby Green Lake filled and overflowed. In the 1930s, Dock Lake was modified to allow it to be used as a water storage for irrigation supply in the Wimmera-Mallee system. Dock Lake was removed from the supply system after the completion of the Wimmera-Mallee pipeline in 2010 and is now an ephemeral system. In late 2016, large-scale flooding in the catchment partially filled Dock Lake when Green Lake filled and overflowed. Managed water deliveries can now only be delivered through a small channel from Green Lake, when there is enough water in Green Lake to gravity-feed Dock Lake.

Ranch Billabong, near Dimboola, is located on land managed by Barengi Gadjin Land Council Aboriginal Corporation (BGLC). The billabong system was disconnected from the Wimmera River by levees. These levees and river regulation in the Wimmera River have significantly altered the natural water regime of Ranch Billabong. Restoring habitat for native animals, fish and plant communities at Ranch Billabong is an important outcome for the environment, Traditional Owners and their Nations.

Environmental values

The Wimmera system is home to many plant and animal species. It supports populations of native fish such as flat-headed gudgeon, obscure galaxias, river blackfish, southern pygmy perch and Australian smelt. Populations of the critically endangered Wimmera bottlebrush also occur along the MacKenzie River other locations near the Grampians.

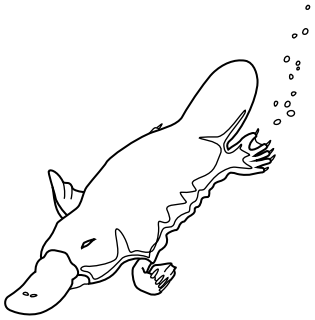
The Wimmera River supports abundant native fish, waterbird, turtle, frog and rakali (water rats) populations and one of Victoria's few self-sustaining populations of freshwater catfish.

The MacKenzie River contains the only self-sustaining population of platypus in the Wimmera system and supports populations of native fish including river blackfish and southern pygmy perch. It also supports threatened Glenelg spiny crayfish and western swamp crayfish and turtles. During dry periods, the middle and upper reaches of the MacKenzie River maintain regular flow (due to managed releases from Lake Wartook for consumptive supplies and environmental watering) and provide refuge for these populations.

Vegetation along Burnt and Bungalally creeks provide habitat corridors for terrestrial and riparian wildlife and upper Burnt Creek contains an important native fish community and a population of threatened western swamp crayfish. Mount William Creek supports regionally important populations of river blackfish and southern pygmy perch.

Dock Lake is a natural wetland that was modified and used as part of the Wimmera-Mallee headworks system until 2010. When it is inundated, Dock Lake supports large populations of feeding and breeding waterbirds. It also supports frogs and small-bodied native fish.

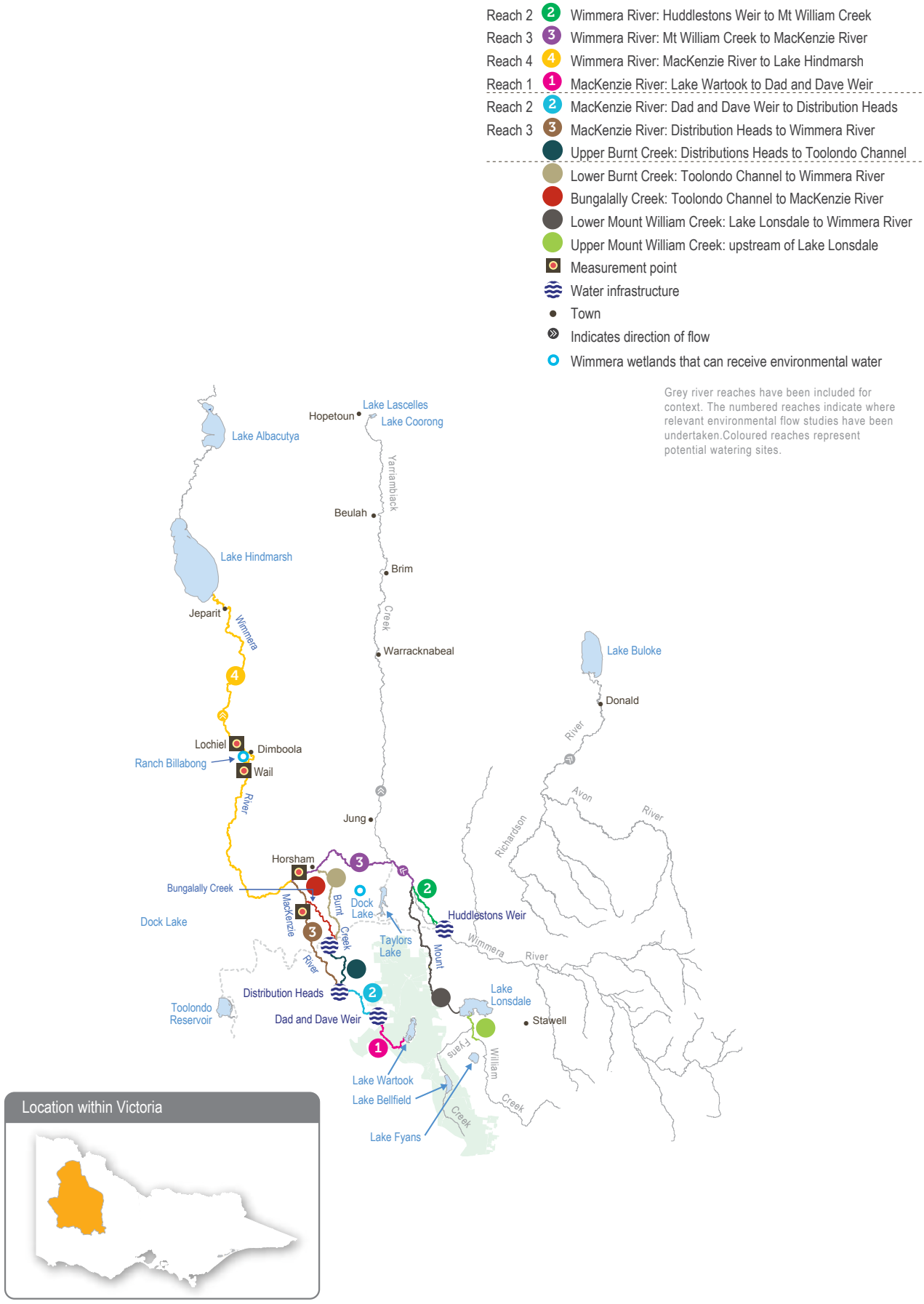
Ranch Billabong is a small wetland near Dimboola that supports river red gum trees, a variety of aquatic and amphibious plant species, ducks and frogs.



Environmental objectives in the Wimmera system

	Protect and increase populations of native fish including one of Victoria's few self-sustaining populations of freshwater catfish
	Maintain the frog population by providing feeding and breeding habitat
	Maintain channel capacity and diversity as well as prevent colonisation of waterways by terrestrial plant species
	Maintain and increase the resident platypus population by providing places to breed and feed, as well as opportunities for juveniles to disperse
	Maintain the turtle population by providing feeding and breeding habitat
	Improve the condition, abundance and diversity of aquatic, emergent and riparian vegetation
	Increase the waterbird population by providing roosting, feeding and breeding habitat
	Increase the abundance and diversity of waterbugs, which break down dead organic matter and support the waterway's food chain Maintain the crayfish population by providing feeding and breeding habitat
	Maintain and improve water quality to provide suitable conditions for waterbugs, native fish and other water-dependent plants and animals
Aboriginal environmental outcomes	
	Watering is planned to be delivered in partnership with Traditional Owners and achieve Aboriginal environmental outcomes

Figure 4.3.1 The Wimmera system



Recent conditions

The Wimmera region has experienced below-average rainfall for most of the last two years. Local rainfall in late winter 2018 generated modest run off in the eastern parts of the catchment, but western tributaries had very little to no flow throughout 2018–19 and no flow was recorded in the upper Wimmera River (measured at Glenorchy) for the first time since records began in the mid-1960s. Some unregulated flows in the Wimmera River's eastern tributaries provided low flows in the lower Wimmera and MacKenzie river systems. Low volumes of passing flows that were available at Lake Lonsdale were suspended in winter and subsequently released during spring to meet Wimmera River flow objectives.

The dry conditions meant the VEWH only received a portion of allocation against its Wimmera-Glenelg environmental entitlement. As of March 2019, the VEWH had received 55 percent allocation for the year, but the total volume of available water for the environment was supplemented by system reserves that were carried over from 2017–18. The Commonwealth Environmental Water Holder (CEWH) did not receive any allocation in 2017–18 or 2018–19. The water that was allocated to the CEWH in 2016–17 was carried over and used in the Wimmera system during 2018–19 to support environmental outcomes in the Wimmera River and Mount William Creek.

The modest inflows from tributaries during winter and deliveries of water for the environment have maintained and protected the condition of the rivers and creeks, despite the very dry conditions experienced in the Wimmera system during 2018–19.

Fish monitoring conducted as part of the Victorian Environmental Flows Monitoring Assessment Program (VEFMAP) in autumn 2018 showed that populations of golden perch, freshwater catfish and small-bodied native fish have been maintained in all reaches of the Wimmera River that could receive water for the environment. In Mount William Creek, the continued improvement of both fringing and in-stream vegetation is supporting a stable population of small-bodied fish including obscure galaxias and flat-headed gudgeons. Platypus surveys in the MacKenzie River in April 2018 also showed the platypus population has grown and doubled its range within the river since 2016. However, the MacKenzie River platypus population remains small and lacks genetic diversity and potential translocations are being considered to boost its resilience.

Scope of environmental watering

Table 4.3.1 describes the potential environmental watering actions that may be delivered in 2019–20, their functional watering objectives (that is, the intended physical or biological effect of the watering action) and the longer-term environmental objective they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological functions.

Table 4.3.1 Potential environmental watering actions and objectives for the Wimmera system

Potential environmental watering action	Functional watering objective	Environmental objective
Wimmera River (reach 4)		
Summer/autumn low flows (15–30 ML/day or natural[1] during December to May)	• Maintain in-stream habitat to support native fish populations and waterbugs • Maintain near-permanent inundated stream channel for riparian vegetation and to prevent the growth of terrestrial plants in the stream bed	
Winter/spring low flows (15–30 ML/day during June to November)	• Provide flow variability to maintain access to habitat for native fish, waterbugs and in-stream vegetation	
Summer/autumn freshes (one to three freshes of 70 ML/day for two to seven days during December to May)	• Flush pools to improve water quality and maintain habitat for fish and waterbugs • Provide fish passage to allow fish to move through the reach	
Winter/spring freshes (one to five freshes of 70 ML/day for one to four days during June to November)	• Increase water depth to provide stimulus for fish movement • Provide flow variability to maintain water quality and diversity of fish habitats • Wet lower benches, entraining organic debris and promoting habitat diversity for waterbugs	

Table 4.3.1 Potential environmental watering actions and objectives for the Wimmera system *continued...*

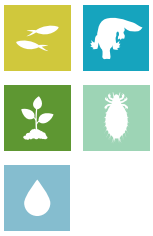
Potential environmental watering action	Functional watering objective	Environmental objective
Winter/spring freshes (one to three freshes of 200 ML/day for one to three days during June to November)[2]	• Provide variable flow for native fish movement • Maintain water quality and habitat diversity by flushing surface sediments from hard substrates for macroinvertebrates	
MacKenzie River (reach 2 and 3)		
Year-round low flows (of 2–27 ML/day or natural, year-round)[1]	• Maintain edge habitats and deeper pools and runs for waterbugs • Maintain near-permanent inundated stream channel for riparian vegetation and to prevent the growth of terrestrial plants in the stream bed, and to support the growth of aquatic vegetation for fish habitat • Maintain a sufficient area of pool habitat for native fish and crayfish populations • Facilitate the annual dispersal of juvenile platypus into the Wimmera River	
Summer/autumn freshes (three to four freshes of 5–50 ML/day for two to seven days each during December to May)	• Provide variable flows in the low-flow season for fish movement • Maintain water quality and habitat diversity for waterbugs	
Winter/spring freshes (five freshes of 35–55 ML/day for two to seven days during June to November)	• Stimulate fish movement by increasing flow rates and water depth • Maintain water quality • Increase habitat availability and connectivity for aquatic species including in-stream and riparian vegetation, platypus, native fish and waterbugs	
Winter/spring freshes (one to five freshes of up to 130–190 ML/day for one to four days during June to November)	• Stimulate fish movement and maintain water quality • Flush sediments from hard substrates to support waterbugs • Wet the higher benches to entrain organic debris and promote habitat diversity for aquatic species including in-stream and riparian vegetation, platypus, native fish and waterbugs	
Burnt Creek		
Year-round low flows targeting upper Burnt Creek (1 ML/day or natural, year-round)[1]	• Maintain edge habitats and shallow-water habitat for waterbugs • Maintain the inundated stream channel to protect riparian vegetation and prevent excessive stream bed colonisation by terrestrial vegetation species • Maintain a sufficient area of pool habitat for native fish and crayfish populations	
Summer/autumn freshes targeting upper Burnt Creek (three freshes of 30 ML/day for two to seven days each during December to May)	• Prevent a decline in water quality by flushing pools in the low flow season	

Table 4.3.1 Potential environmental watering actions and objectives for the Wimmera system *continued...*

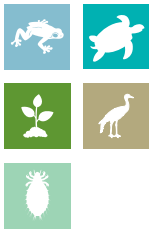
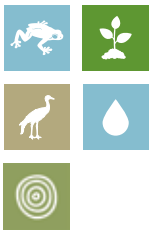
Potential environmental watering action	Functional watering objective	Environmental objective
Winter/spring freshes targeting upper Burnt Creek (one to five freshes of 55 ML/day for three to seven days during June to November)	• Allow fish to move throughout the reach • Flush sediments from hard substrates to increase biofilm production and food for waterbugs	
Winter/spring freshes targeting upper Burnt Creek (one to three freshes of up to 160 ML/day for one to three days during June to November)	• Disturb biofilms present on rocks or woody debris, to stimulate new growth and provide food for waterbugs	
Year-round fresh targeting lower Burnt Creek (one fresh of 45 ML/day or natural for two days at any time)[3]	• Inundate riparian vegetation to maintain plant condition and facilitate recruitment • Move organic debris in the channel to support waterbugs • Maintain the structural integrity of the channel	
Mount William Creek		
Top-up of upper Mount William Creek pools (winter/spring and summer/autumn)	• Maintain habitat for native fish and waterbugs	
Year-round low flows targeting lower Mount William Creek (5 ML/day or natural, year-round)[1]	• Maintain edge habitats and shallow-water habitat for waterbugs and endemic fish • Maintain near-permanent inundated stream channel for riparian vegetation and to prevent the growth of terrestrial plants in the stream bed	
Summer/autumn freshes targeting lower Mount William Creek (three freshes of 20–30 ML/day for two to seven days during December to May)	• Prevent a decline in water quality by flushing pools during low flows • Provide variable flows and habitat diversity during the low-flow season for waterbugs, for fish movement and to maintain water quality	
Winter/spring freshes targeting lower Mount William Creek (one to five freshes of up to 100 ML/day for one to seven days during June to November)	• Wet benches to entrain organic debris and promote habitat diversity for native fish • Flush surface sediments from hard substrates to support waterbugs	
Bungalally Creek		
Bankfull (one fresh of 60 ML/day for two days at any time)[3]	• Inundate the riparian zone to maintain its condition and facilitate the recruitment of riparian vegetation communities • Maintain the structural integrity of the channel and prevent the loss of channel capacity	
Dock Lake		
Partial fill (winter/spring)	• Maintain and improve the diversity and abundance of wetland vegetation • Support feeding and breeding habitat for waterbirds, frogs, waterbugs and turtles	

Table 4.3.1 Potential environmental watering actions and objectives for the Wimmera system *continued...*

Potential environmental watering action	Functional watering objective	Environmental objective
Ranch Billabong		
Top-ups (winter/spring and summer/autumn)	• Maintain and improve wetland vegetation diversity and abundance • Improve water quality for frogs and waterbirds	

1 *Cease-to-flow events occur naturally in the Wimmera system and may be actively managed with deliveries of water for the environment to reduce stress on environmental values. In the most-recent flow study, the recommendation is that cease-to-flow events should occur as infrequently as possible and not exceed the duration of events that might have occurred naturally. Cease-to-flow may be managed to conserve water for the environment allocation, and events ideally should be followed with a fresh.*

2 *Depending on catchment conditions, the timing of this fresh may vary to optimise environmental outcomes.*

3 *These actions will only occur if on-ground works have been completed to prevent third-party impacts potentially caused by bankfull events in these creeks.*

Scenario planning

Table 4.3.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

Similar watering actions are planned under each climate scenario for 2019–20, but the magnitude, duration and frequency of specific watering actions may vary, depending on likely water availability and the extent to which actions are met by natural events. For example, a low-priority action under a dry climate scenario may become a high-priority action under an average to wet scenario if more water is available. The environmental watering demands presented under each climate scenario reflect the environmental objectives for different climate scenarios.

If current dry conditions continue, it is unlikely that water for the environment will be able to be delivered from Lake Lonsdale. Under these circumstances, Mount William Creek downstream of Lake Lonsdale will receive little to no flow, and most demands for the Wimmera River will need to be met from Taylors Lake.

The highest priorities (tier 1a) under extreme drought conditions are to deliver summer/autumn low flows, summer/autumn freshes, winter/spring freshes and winter/spring low flows in MacKenzie reaches 2 and 3, Wimmera River reach 4, upper Burnt Creek and to provide top-ups to Ranch Billabong and upper Mount William Creek. Additional priority actions under very dry, dry, average and wet climate scenarios include winter/spring freshes in MacKenzie River reach 3 and delivering additional freshes and larger-magnitude low flows in the MacKenzie River, Wimmera River reach 4 and upper Burnt Creek. Delivering flows in lower Mount William Creek in very dry to wet conditions is a priority if Lake Lonsdale gets sufficient inflows and water quality improves. In average and wet conditions, bankfull flows in lower Burnt Creek and Bungalally Creek will be a priority.

The flows described above are unlikely to meet the environmental objectives under all conditions, with significant ecological consequences of shorter-duration and lower-than-recommended freshes occurring through the system's rivers and creeks. Extended periods of cease-to-flow are likely to occur, especially during extreme drought, very dry and dry conditions, which increases the risk of fish deaths, high salinity and blue-green algae blooms in all river and creek systems in the Wimmera. To mitigate the risks, ensuring sufficient supply to provide additional flows (tier 2) such as extra freshes in the Wimmera River reach 4 and MacKenzie River reach 3 and increased duration of winter/spring low flows in MacKenzie River reach 3, Wimmera River reach 4, upper Burnt Creek and lower Mount William Creek are a priority under very dry conditions. Additionally, increasing the duration of low flows and delivering additional freshes during summer/autumn in upper Burnt Creek and lower Mount William Creek, will provide some improvement to water quality during the drier months. In dry to wet conditions, the additional supply of water for the environment is required to increase the duration, magnitude and number of low flows and freshes delivered during the season to improve water quality and increase the habitat available to aquatic plants and animals.

Additional priorities under dry to wet conditions are maximising the duration and magnitude of the flows delivered in summer/autumn and winter/spring to be in line with the recommended watering regimes for the Wimmera River, MacKenzie River, upper Burnt Creek and lower Mount William Creek. These flows provide additional benefits for the native fish, waterbugs, aquatic plants and riparian plants that rely on larger flows under these conditions to improve populations or resilience in future years. Under average and wet conditions, unregulated flows and increased allocations of water for the environment will provide an opportunity for more environmental watering objectives to be met, with some flows being met by natural river flows and passing flows.

A partial fill of Dock Lake is planned in average or wet seasonal conditions. There are substantial delivery obstacles to overcome before environmental watering of Dock Lake can occur, but if possible, it would be the first time the wetland has received water for the environment. Water for the environment delivered to this wetland may trigger another substantial waterbird response, similar to the outcomes from water diverted to Dock Lake by GWMWater during the 2016 floods.

Under all climate scenarios, a small volume of water for the environment may be delivered to top up Ranch Billabong near Dimboola, to support wetland and riparian vegetation. Water delivered will help to restore and build on the environmental outcomes and improve water quality for waterbirds and frogs in the billabong. This wetland cannot receive natural flows from the Wimmera River due to levee banks under regulated conditions, and it requires water to be pumped from the river to the billabong.

Reserving water for carryover into the 2020–21 water year will be a priority under all scenarios, to ensure sufficient water is available to deliver the highest-priority flows during summer and autumn 2021. The volume carried over against the Wimmera-Glenelg environmental entitlement will be decided in consultation with the Wimmera and Glenelg Hopkins CMAs during the year, and it will be based on use during 2019–20, seasonal conditions and seasonal outlooks for 2020–21.

With drier conditions expected in the western region, waterway managers are exploring contingency measures (such as using the Wimmera-Mallee pipeline network) to pipe water for the environment directly into critical refuges sites in some river systems.[6]

6 *A variation to the seasonal watering plan would be required to complete watering actions such as these.*

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios

Planning scenario	Extreme drought	Very dry	Dry	Average	Wet
Expected river conditions	• No passing flows or unregulated flows	• Some passing flows but no unregulated flows	• Some passing but no unregulated flows	• Passing and unregulated flows particularly in winter/spring	• Passing flows and unregulated flows
Expected availability of water for the environment entitlements[1,2]	• 29,900 ML	• 35,500 ML	• 49,300 ML	• 62,700 ML	• 70,400 ML
Potential environmental watering – tier 1a (high priorities)[3]					
MacKenzie River reaches 2 & 3	• Summer/ autumn low flows reach 2 and reach 3[3] • Three summer/ autumn freshes reach 2 • Winter/spring low flows reach 2	• Summer/ autumn low flows reach 2 and reach 3[3] • Three summer/ autumn freshes reach 2 • Winter/spring low flows reach 3 • One winter/ spring freshes reach 3	• Summer/ autumn low flows reach 2 and reach 3[3] • Four summer/ autumn freshes reach 2 • Winter/spring low flows reach 3 • Two winter/ spring freshes reach 3	• Summer/ autumn low flows reach 3 • Four summer/ autumn freshes reach 3 • Winter/spring low flows reach 3 • Five winter/ spring freshes reach 3	• Summer/ autumn low flows reach 3 • Four summer/ autumn freshes reach 3 • Winter/spring low flows reach 3 • Five winter/ spring freshes reach 3
Wimmera River reach 4	• Summer/ autumn low flows • One summer/ autumn freshes • Winter/spring low flows • One winter/ spring freshes	• Summer/ autumn low flows • Two summer/ autumn freshes • Winter/spring low flows • One winter/ spring freshes	• Summer/ autumn low flows • Two summer/ autumn freshes • Winter/spring low flows • Two winter/ spring freshes	• Summer/ autumn low flows • Two summer/ autumn freshes • Winter/spring low flows • Five winter/ spring freshes	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows • Five winter/ spring freshes

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *continued...*

Planning scenario	Extreme drought	Very dry	Dry	Average	Wet
Upper Burnt Creek	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows
Upper Mount William Creek	• Top-ups	• Top-ups	• Top-ups	• N/A	• N/A
Lower Mount William Creek	• N/A	• N/A	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows • Three winter/ spring freshes	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows • Five winter/ spring freshes	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows • Five winter/ spring freshes
Lower Burnt Creek	• N/A	• N/A	• N/A	• Bankfull	• Bankfull
Bungalally Creek	• N/A	• N/A	• N/A	• Bankfull	• Bankfull
Dock Lake	• N/A	• N/A	• N/A	• Partial fill	• Partial fill
Ranch Billabong	• Top-ups	• Top-ups	• Top-ups	• Top-ups	• Top-ups
Potential environmental watering – tier 1b (high priorities with shortfalls)					
MacKenzie River reaches 2 & 3	• N/A	• Increased duration winter/ spring low flows reach 3 • Two winter/ spring freshes reach 3	• Increased duration summer/ autumn low flows reach 3 • Three summer/ autumn freshes reach 3	• Increased duration summer/ autumn low flows reach 3 • Three summer/ autumn freshes reach 3 • Increased duration winter/ spring low flows reach 3 • Five winter/ spring freshes reach 3	• Increased duration summer/ autumn low flows reach 3 • Three summer/ autumn freshes reach 3 • Increased duration winter/ spring low flows reach 3 • Five winter/ spring freshes reach 3

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *continued...*

Planning scenario	Extreme drought	Very dry	Dry	Average	Wet
Wimmera River reach 4	• N/A	• Increased duration winter/ spring low flows • Two winter/ spring freshes	• Increased duration summer/ autumn low flows • Two summer/ autumn freshes • Increased duration winter/ spring low flows • Three winter/ spring freshes	• Increased duration summer/ autumn low flows • Two summer/ autumn freshes • Increased duration winter/ spring low flows • Five winter/ spring freshes	• Increased duration winter/ spring low flows • Five winter/ spring freshes
Upper Burnt Creek	• N/A	• Increased duration summer/ autumn low flows • Three summer/ autumn freshes • Increased duration winter/ spring low flows	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes • Increased duration winter/ spring low flows • Increased duration and magnitude winter/spring freshes	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes • Increased duration winter/ spring low flows • Increased duration and magnitude winter/spring freshes
Upper Mount William Creek	• N/A	• Top-ups	• N/A	• N/A	• N/A
Lower Mount William Creek	• N/A	• Summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows	• Increased duration summer/ autumn low flows • Three summer/ autumn freshes • Winter/spring low flows	• Winter/spring low flows • Five winter/ spring freshes	• Winter/spring low flows • Five winter/ spring freshes

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *continued...*

Planning scenario	Extreme drought	Very dry	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)[5]					
MacKenzie River reaches 2 & 3	• N/A	• N/A	• Increased duration summer/ autumn low flows reach 3 • Increased duration and magnitude summer/ autumn freshes reach 3	• Increased duration summer/ autumn low flows reach 3 • Increased duration and magnitude summer/ autumn freshes reach 3	• Increased duration and magnitude summer/ autumn freshes reach 3
Wimmera River reach 4	• N/A	• N/A	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes • Winter/spring low flows (reach 3)	• Increased duration and magnitude summer/ autumn freshes • Winter/spring low flows (reach 3)
Upper Burnt Creek	• N/A	• N/A	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes • Increased duration winter/ spring low flows • Increased duration and magnitude winter/spring freshes	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes	• Increased duration and magnitude summer/ autumn freshes • Increased duration summer/ autumn low flows

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *continued...*

Planning scenario	Extreme drought	Very dry	Dry	Average	Wet
Lower Mount William Creek	• N/A	• N/A	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes	• Increased duration summer/ autumn low flows • Increased duration and magnitude summer/ autumn freshes
Possible volume of water for the environment required to achieve objectives[4,5]	• 9,090 ML (tier 1a)	• 10,115 ML (tier 1a) • 8,105 ML (tier 1b)	• 14,779 ML (tier 1a) • 13,721 ML (tier 1b) • 3,135 ML (tier 2)	• 19,443 ML (tier 1a) • 21,062 ML (tier 1b) • 15,670 ML (tier 2)	• 23,297 ML (tier 1a) • 20,413 ML (tier 1b) • 15,635 ML (tier 2)

1 *Water for the environment in the Wimmera-Glenelg system held by the VEWH is shared between the Glenelg and Wimmera systems. The VEWH volumes specified show the likely availability of the VEWH's environmental entitlement for both systems.*

2 *Water for the environment held by the CEWH is only available for use in the Wimmera system.*

3 *Under extreme drought, very dry and dry scenarios the highest priority is to deliver summer/autumn low flows in reach 2 and to top up refuge pools in reach 3 of the MacKenzie River system.*

4 *A prioritisation process will be undertaken in consultation with the Wimmera and Glenelg Hopkins CMAs to determine the potential watering actions that will be undertaken in each system in the 2019–20 year, taking into consideration both VEWH and CEWH environmental entitlements.*

5 *Water for the environment requirements for tier 2 actions are additional to tier 1 requirements.*

4.4 Wimmera-Mallee wetlands

Waterway managers – Mallee, North Central and Wimmera catchment management authorities

Storage manager – GWMWater

Environmental water holder – Victorian Environmental Water Holder

Did you know ...?

The Wimmera-Mallee wetlands provide a critical habitat for native species such as turtles, waterbirds and the vulnerable growling grass frog, who rely on them as drinking holes and refuges in times of drought.

Top: Wetland at Carapugna, Spring 2018, by Wimmera CMA
Centre: Australasian grebe at Crow Swamp, by Jenny Stephens
Above: White plumed honey eaters at Mutton Swamp, by Jenny Stephens

System overview

The Wimmera-Mallee wetlands include 51 wetlands on public and private land spread across north-west Victoria. Historically, these wetlands received water most years from the open channels associated with the Wimmera-Mallee Domestic and Stock Channel System.

The Wimmera-Mallee Pipeline Project (WMPP) replaced stock and domestic supply dams with tanks, and the open-channel distribution system with pipelines, to improve water efficiency. A portion of the water savings from the WMPP was converted to an environmental entitlement to improve the condition of the area's flow-stressed rivers, creeks and wetlands; the rest was used to create regional development opportunities and boost the reliability of supply for other users. The WMPP reduced the amount of open-water habitat in areas that were formerly supplied by the open-channel system, so a separate 1,000 ML environmental entitlement was created to water selected wetlands that were previously supplied through the channel system. In 2011, a project identified priority wetlands that could receive water from the new environmental entitlement, and 51 wetlands have been connected to the Wimmera-Mallee pipeline system to receive that water.

Water for the environment can only be delivered to the wetlands when there is sufficient capacity in the Wimmera-Mallee pipeline system, which can be affected by demand from other pipeline customers. The North Central, Mallee and Wimmera CMAs work closely with GWMWater and land managers (including Parks Victoria, the Department of Environment, Land, Water and Planning and private landowners) to take account of pipeline capacity constraints when managing environmental deliveries to wetlands.

Environmental values

There are a wide range of wetland types in the Wimmera-Mallee wetlands system including freshwater meadows, open freshwater lakes and freshwater marshes. This diversity provides a range of different wetland habitats for plants and animals in the western part of the state. The wetlands also vary in size, consist of many different vegetation communities and are home to native waterbird populations including brolgas, egrets, blue-billed ducks, freckled ducks, Australian painted snipes and glossy ibis. The wetlands are used by the vulnerable growling grass frog, turtles and many other native animals that rely on them as drought refuges and drinking holes. Rare and vulnerable vegetation species (such as spiny lignum, ridged water milfoil, chariot wheel and cane grass) are also present in some wetlands.

Environmental objectives in the Wimmera-Mallee wetlands

	Maintain and increase the population of frogs and turtles
	Maintain and improve the condition of aquatic and fringing plants including lignum, river red gum and black box communities Improve the diversity of vegetation communities by providing watering regimes to support plant life cycles in and around the wetlands
	Maintain and increase populations of waterbirds and other native birds by providing resting, feeding and breeding habitat
	Maintain the population of waterbugs
	Provide watering holes for native animals and terrestrial birds across the landscape

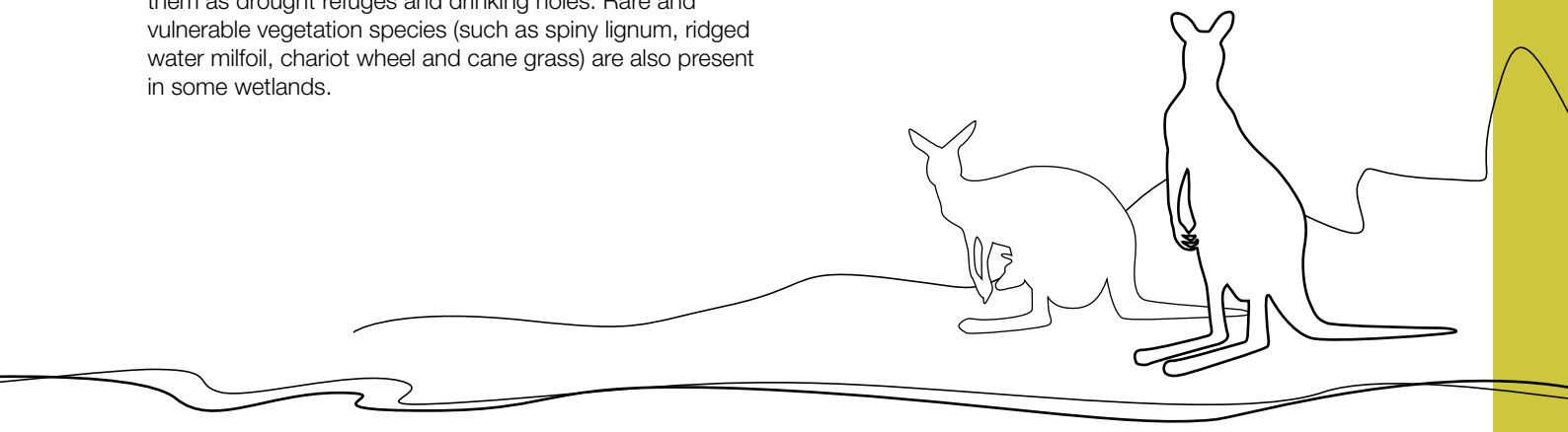
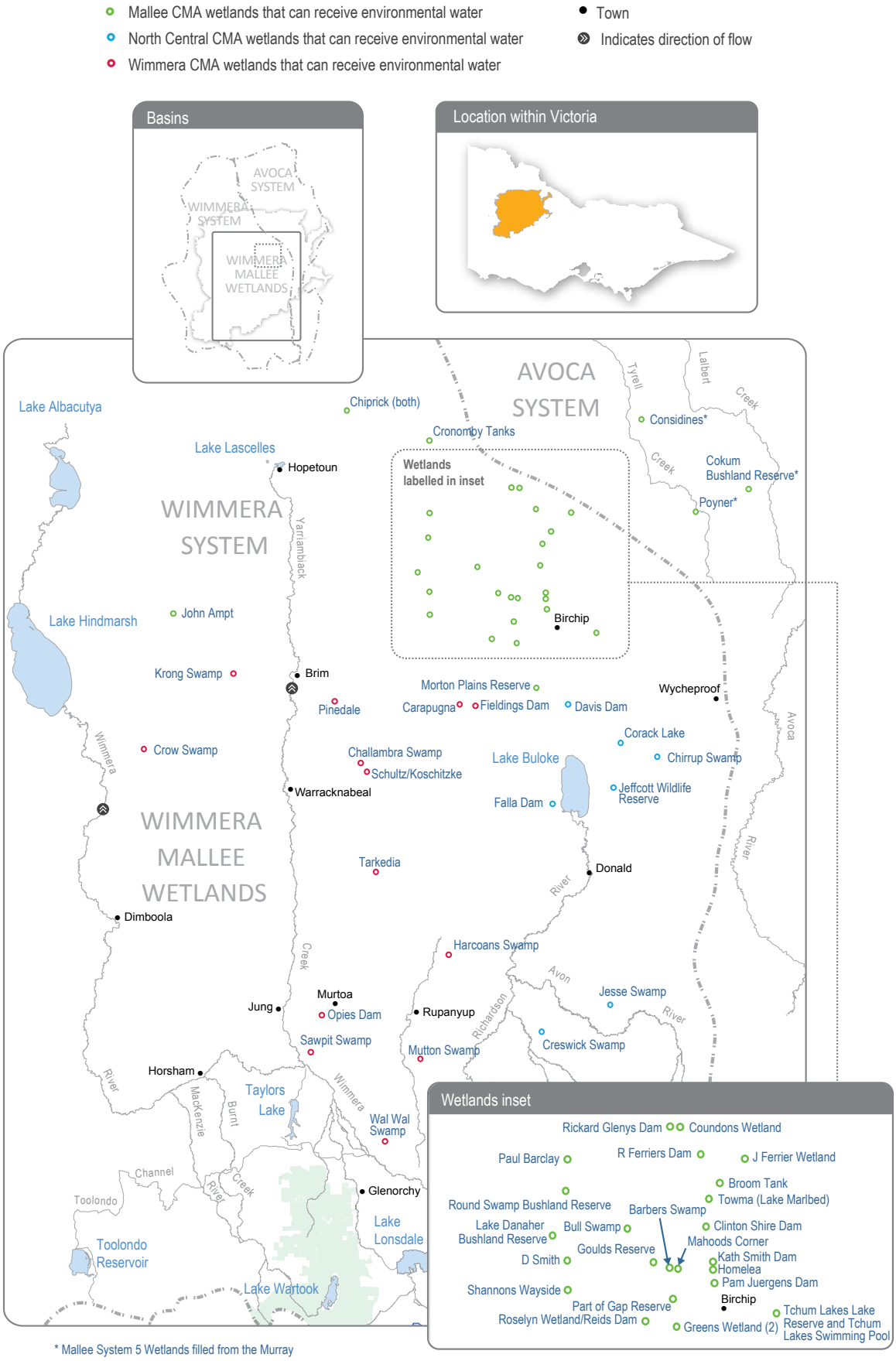


Figure 4.4.1 The Wimmera-Mallee wetlands



Recent conditions

The Wimmera-Mallee received below-average rainfall and had above-average temperatures throughout 2018–19. A large rainfall event in December 2018 caused floods across some of the region and filled some wetlands. The dry conditions experienced over the last two years have meant that there was little to no inflow into storages in the Wimmera-Mallee headworks system, and no allocation was made to the wetland environmental entitlement in 2018–19. Environmental demand for the Wimmera-Mallee wetlands in 2018–19 was met by water for the environment carried over from previous seasons.

Water for the environment was delivered to 44 Wimmera-Mallee wetlands in 2018–19: 25 wetlands in the Mallee CMA area, 12 in the Wimmera CMA area and seven in the North Central CMA area. Deliveries were made in winter/spring 2018 and autumn/winter 2019 to maintain and improve ecological outcomes from natural or managed flows in previous years. Some wetlands received water once during 2018–19, while others received multiple deliveries to maintain their water-dependent values.

Water for the environment delivered to the Wimmera-Mallee wetlands maintained and improved the health of native plants and provided feeding and breeding habitat for many animals (such as eastern long-necked turtles, frogs, yabbies, egrets, herons, ducks, grebes, swans, stilts and other water and woodland birds). Aquatic and fringing plant communities in wetlands that received water (naturally or through managed deliveries) in 2018–19 have responded well. Black box trees at the edge of some wetlands flowered and set seed, while many wetlands had vigorous growth of aquatic and semi-aquatic plants including nardoo, water milfoil, water ribbons, lignum and cane grass.

Scope of environmental watering

Table 4.4.1 describes the potential environmental watering actions that may be delivered in 2019–20, their functional watering objectives (that is, the intended physical or biological effect of the watering action) and the longer-term environmental objective they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological functions.

Watering actions for the Wimmera-Mallee wetlands will typically be in winter/spring 2019 or autumn/winter 2020, but they may occur at any time of the year depending on environmental need, seasonal conditions and pipeline capacity.

Table 4.4.1 Potential environmental watering actions and objectives for the Wimmera-Mallee wetlands

Potential environmental watering action	Functional watering objective	Environmental objective
North Central wetlands		
Chirrup Swamp	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and turtles	
Corack Lake	• Provide a permanent water source for refuge and nursery habitat for turtles and frogs • Maintain varying depths of water to support aquatic and fringing plants' life cycles • Maintain varying depths of water to support a variety of feeding habitats for waterbirds	
Creswick Swamp	• Maintain varying depths of water to support the life cycle of aquatic plants including threatened marbled marshwort • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs and turtles • Maintain water levels to prolong inundation and ensure successful waterbird breeding events, if they start	
Davis Dam	• Inundate black box and rare cane grass to allow plants to complete their life cycles and to support juvenile plants • Provide a semi-permanent water source to support refuge, feeding and breeding opportunities for frogs • Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species	

Table 4.4.1 Potential environmental watering actions and objectives for the Wimmera-Mallee wetlands *continued...*

Potential environmental watering action	Functional watering objective	Environmental objective
Falla Dam	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and terrestrial species • Stimulate frog and turtle breeding by providing a deep, permanent water source in spring • Stimulate aquatic and fringing vegetation growth in winter/spring	
Jeffcott Wildlife Reserve	• Maintain a minimum depth of water to support the life cycles of aquatic plants • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbugs, waterbirds and turtles	
Jesse Swamp	• Maintain varying depths of water to support aquatic and fringing plant life cycles • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and terrestrial species	
Wimmera wetlands		
Carapugna Challambra Swamp Crow Swamp Fieldings Dam Harcoans Swamp Krong Swamp Mutton Swamp Opies Dam Pinedale Sawpit Swamp Schultz/Koschitzke Tarkedia Dam Wal Wal Swamp	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and terrestrial species • Stimulate aquatic and fringing vegetation growth and allow plants to complete their life cycles including ridged water milfoil, black box and spiny lignum	
Mallee wetlands		
Barbers Swamp Bull Swamp Cokum Bushland Reserve Morton Plains Reserve Tchum Lakes Lake Reserve (North Lake - wetland) Tchum Lakes Swimming Pool (North Lake – dam)	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species • Stimulate aquatic and fringing vegetation growth and allow the plants to complete their life cycles including ridged water milfoil, black box and spiny lignum • Maintain water levels to prolong inundation and ensure successful waterbird breeding events if they start	

Table 4.4.1 Potential environmental watering actions and objectives for the Wimmera-Mallee wetlands *continued...*

Potential environmental watering action	Functional watering objective	Environmental objective
Broom Tank Clinton Shire Dam Considines Greens Wetland Pam Juergens Dam Poyner Roselyn Wetland	• Stimulate aquatic and fringing vegetation growth and allow the plants to complete their life cycles including black box and lignum • Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species	
Goulds Reserve Newer Swamp Part of Gap Reserve Towma (Lake Marlbed)	• Stimulate aquatic and fringing vegetation growth and allow the plants to complete their life cycles including black box and lignum	
Coundons Wetland J Ferrier Wetland	• Stimulate aquatic and fringing vegetation growth and allow the plants to complete their life cycles including black box and lignum • Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs and turtles	
Mahoods Corner Shannons Wayside	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species	
Chiprick D Smith Wetland Homelea Wetland John Ampt Kath Smith Dam Paul Barclay R Ferriers Dam Rickard Glenys Dam	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species	
Cronomby Tanks Lake Danaher Bushland Reserve	• Stimulate aquatic and fringing vegetation growth and allow the plants to complete their life cycles including black box and lignum • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs and turtles	

Scenario planning

Table 4.4.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

The potential watering actions in 2019–20 have been determined by considering the environmental values, watering requirements and recent watering histories. Recent and upcoming climatic conditions, water availability and the expected capacity in the Wimmera-Mallee pipeline system also influence the ability to meet watering demands of the wetlands.

Under drought conditions, the highest priority is to provide some permanent water in the deeper sections of the wetlands, to provide drought refuge for wetland plants, waterbirds, frogs, turtles and terrestrial animals across the landscape. Under wetter climate scenarios, allocation to the environmental entitlement may allow more water to be delivered, depending on capacity in the pipeline system.

Large rainfall events and catchment inflows may partially or fully fill some wetlands, and water for the environment may be used to top up, fill or over-top wetlands to improve fringing wetland plant growth and provide additional habitat for waterbirds, frogs and turtles.

Allocations to the environmental entitlement to supply the wetlands in the Wimmera-Mallee wetland system is highly variable, and the ability to carry over unused water from one year to another allows waterway managers and the VEWH to effectively manage the systems in dry periods. The North Central, Mallee and Wimmera CMAs and the VEWH have determined that at least 120–231 ML should be carried over at the end of 2019–20, to support critical environmental demands in 2020–21. This includes providing fills and top-ups to deeper sections of the wetlands, to maintain permanent refuge for water-dependent plants and animals during winter/spring 2020.

Table 4.4.2 Potential environmental watering for the Wimmera-Mallee wetlands under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected catchment conditions	• No catchment inflows to the wetlands are expected	• No catchment inflows to the wetlands are expected	• Some localised catchment inflows may increase water levels in some wetlands	• Catchment inflows are likely to increase water levels in most wetlands
Expected availability of water for the environment	• 1,000 ML carryover • 0 ML allocation • 1,000 ML available	• 1,000 ML carryover • 0 ML allocation • 1,000 ML available	• 1,000 ML carryover • 250 ML allocation • 1,250 ML available	• 1,000 ML carryover • 1,000 ML allocation • 2,000 ML available
Potential environmental watering	• Carapugna • Challambra Swamp • Chiprick • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve[1] • Considines[1] • Corack Lake • Coundons Wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • D Smith Wetland • Fieldings Dam • Harcoans Swamp • Homelea Wetland • J Ferrier Wetland • Jeffcott Wildlife Reserve • Jesse Swamp • John Ampt	• Carapugna • Challambra Swamp • Chiprick • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve[1] • Considines[1] • Corack Lake • Coundons Wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • D Smith Wetland • Davis Dam • Falla Dam • Fieldings Dam • Harcoans Swamp • Homelea Wetland • J Ferrier Wetland • Jeffcott Wildlife Reserve	• Broom Tank • Carapugna • Challambra Swamp • Chiprick • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve[1] • Considines[1] • Corack Lake • Coundons wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • D Smith Wetland • Davis Dam • Falla Dam • Fieldings Dam • Goulds Reserve • Harcoans Swamp • Homelea Wetland • J Ferrier Wetland	• Barbers Swamp • Broom Tank • Bull Swamp • Carapugna • Challambra Swamp • Chirrup Swamp • Chiprick • Clinton Shire Dam • Cokum Bushland Reserve[1] • Considines[1] • Corack Lake • Coundons wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • D Smith Wetland • Davis Dam • Falla Dam • Fieldings Dam • Goulds Reserve • Greens Wetland

Table 4.4.2 Potential environmental watering for the Wimmera-Mallee wetlands under a range of planning scenarios
continued...

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering	• Kath Smith Dam • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains Reserve • Mutton Swamp • Opies Dam • Pam Juergens Dam • Paul Barclay • Pinedale • R Ferriers Dam • Rickard Glenys Dam • Sawpit Swamp • Schultz/Koschitzke • Tarkedia Dam • Towma (Lake Marlbed) • Wal Wal Swamp	• Jesse Swamp • John Ampt • Kath Smith Dam • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains Reserve • Mutton Swamp • Opies Dam • Pam Juergens Dam • Part of Gap Reserve • Paul Barclay • Pinedale • R Ferriers Dam • Rickard Glenys Dam • Sawpit Swamp • Schultz/Koschitzke • Shannons Wayside • Tarkedia Dam • Tchum Lakes Swimming Pool (North Lake - Dam) • Towma (Lake Marlbed) • Wal Wal Swamp	• Jeffcott Wildlife Reserve • Jesse Swamp • John Ampt • Kath Smith Dam • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains Reserve • Mutton Swamp • Opies Dam • Pam Juergens Dam • Part of Gap Reserve • Paul Barclay • Pinedale • R Ferriers Dam • Rickard Glenys Dam • Sawpit Swamp • Schultz/Koschitzke • Shannons Wayside • Tarkedia Dam • Tchum Lakes Lake Reserve (North Lake - Wetland) • Tchum Lakes Swimming Pool (North Lake - Dam) • Towma (Lake Marlbed) • Wal Wal Swamp	• Harcoans Swamp • Homelea Wetland • J Ferrier Wetland • Jeffcott Wildlife Reserve • Jesse Swamp • John Ampt • Kath Smith Dam • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains Reserve • Mutton Swamp • Newer Swamp • Opies Dam • Pam Juergens Dam • Part of Gap Reserve • Paul Barclay • Pinedale • Poyner[1] • R Ferriers Dam • Rickard Glenys Dam • Roselyn Wetland • Sawpit Swamp • Schultz/Koschitzke • Shannons Wayside • Tarkedia Dam • Tchum Lakes Lake Reserve (North Lake - Wetland) • Tchum Lakes Swimming Pool (North Lake - Dam) • Towma (Lake Marlbed) • Wal Wal Swamp
Possible volume of water for the environment required to achieve objectives	• 268 ML	• 315 ML	• 444 ML	• 620 ML
Priority carryover requirements	• 120 ML	• 231 ML	• 231 ML	• 231 ML

[1] *Water supplied to these wetlands in supply system 5 is subject to water availability in the River Murray system*