Seasonal Watering Plan 2023-24

Section 3

VICTORIAN ENVIRONMENTAL WATER HOLDER

VICTORIA State Government

Section 3
Central region

3.1 Central region overview

The systems in the central region that can receive water from the VEWH's environmental entitlements are *Birrarung* (Yarra River) and Tarago River in the east and *Wirribi Yaluk/Weariby Yallok* (Werribee River), *Murrabul Yaluk* (Moorabool River) and Barwon (upper Barwon River and lower Barwon wetlands) in the west. The VEWH does not hold an environmental entitlement in the Maribyrnong system, but in some years, the VEWH purchases available allocation to allow delivery of water for the environment in selected reaches of the Maribyrnong system.

Environmental values, objectives and planned actions for delivering water for the environment for each system in the central region are presented in the system sections that follow.

Traditional Owners in the central region

Traditional Owners in the central region have a deep connection to Country that has endured for tens of thousands of years. This includes inherent rights and cultural obligations to Country and community.

The Bunurong Land Council Aboriginal Corporation, Eastern Maar Aboriginal Corporation, Wadawurrung Traditional Owners Aboriginal Corporation and Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation are the Registered Aboriginal Parties under the Victorian *Aboriginal Heritage Act 2006* for the areas incorporating waterways covered by this section of the seasonal watering plan.

In 2023 formal recognition of Eastern Maar's rights under the Commonwealth *Native Title Act 1993* was extended to include much of the coastline of the Great Ocean Road and part of the Great Otway National Park. In relation to this seasonal watering plan, it also includes parts of the Barwon River catchment. The native title determination acknowledges Eastern Maar's ongoing connection and intrinsic relationship to Country in south-western Victoria.

Gunaikurnai Land and Waters Aboriginal Corporation is also a Registered Aboriginal Party within the central region geographic area. Gunaikurnai waterways managed with water for the environment are covered in the Gippsland region section of the seasonal watering plan.

Traditional Owner objectives for water in the central region have been acknowledged in several strategies and plans recently, including the *Rivers of the Barwon (Barre Warre Yulluk) Action Plan*, the *Waterways of the West Action Plan*, the *Yarra Strategic Plan (Burndap Birrarung burndap umarkoo)*, and the *Central and Gippsland Region Sustainable Water Strategy*.

The Victorian Government is committed to self-determination for Traditional Owners through Treaty negotiations and policies such as *Water is Life: Traditional Owner Access to Water Roadmap 2022* and through actions in the *Central and Gippsland Region Sustainable Water Strategy*. The VEWH and partners are working with Traditional Owners to embed the outcomes of government policy in the Victorian environmental watering program. Program partners in the environmental watering program are aware that structural changes (such as legislative, policy and governance changes) to how water is managed may be made in the future in recognition of Aboriginal water rights. Program partners have heard that Traditional Owners want empowerment and agency in water management and, in many cases, want to manage water on Country on their own terms.

Engagement

The environmental watering program is informed by engagement with Traditional Owners, stakeholders and local communities. Program partners undertake extensive engagement at the local level to understand community priorities for the delivery of water for the environment in the coming year.

Program partners also seek to understand how cultural, social, economic and recreational values, uses and objectives may be supported by delivering environmental flows. Opportunities to support these values, uses and objectives are incorporated into watering decisions where possible and provided they do not compromise environmental outcomes. Cultural, social, economic and recreational values considered for each system in the central region are presented in the following system sections.

Environmental flows objectives are also informed by engagement undertaken through other strategies, plans and processes. These include regional catchment strategies, regional waterway strategies and technical studies (such as environmental flows studies and environmental water management plans). Traditional Owners' cultural objectives for environmental flows may refer to cultural flows studies, Aboriginal Waterway Assessments, Traditional Owner Country Plans and other tools. These strategies, plans and technical reports collectively describe a range of environmental, economic, social and Traditional Owner perspectives and longer-term integrated catchment and waterway management objectives that influence environmental flows and priorities for water for the environment.

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Table 3.1.1 Partners and stakeholders engaged by Corangamite Catchment Management Authority in developing seasonal watering proposals for the Moorabool system, upper Barwon River and lower Barwon wetlands and other key foundation documents that have directly informed the proposals (grouped in alphabetical order)

	Moorabool system	Upper Barwon River	Lower Barwon wetlands
Community groups and environment groups	• Corangamite Waterwatch • Geelong Landcare Network • Moorabool Catchment Landcare Group • People for A Living Moorabool	• Environment Victoria • Friends of the Barwon • Geelong Field Naturalists Club • Land and Water Resources Otway Catchment • Otway Agroforestry Network Ltd • Upper Barwon Landcare Network • Winchelsea Land and Rivercare Group	• Corangamite EstuaryWatch • Geelong Environment Council Inc. • Geelong Field Naturalists Club
Government agencies	• Barwon Water • Central Highlands Water • Department of Energy, Environment and Climate Action • Parks Victoria • Southern Rural Water • Golden Plains Shire Council • Moorabool Shire Council • Victorian Environmental Water Holder	• Barwon Water • Department of Energy, Environment and Climate Action • Southern Rural Water • Victorian Environmental Water Holder • Colac Otway Shire Council	• Barwon Water • City of Greater Geelong • Department of Energy, Environment and Climate Action • Parks Victoria • Southern Rural Water • Victorian Environmental Water Holder • Victorian Fisheries Authority
Landholders/farmers	• Landholders on the Moorabool Stakeholder Advisory Committee	• Individual landholders	• Individual landholders
Local businesses	• Adelaide Brighton Cement		• Commercial eel fishers
Recreational users		• Individual users	• Field and Game Australia (Geelong Branch) • Geelong Gun and Rod Association Inc. • VRFish
Traditional Owners	• Wadawurrung Traditional Owners Aboriginal Corporation	• Wadawurrung Traditional Owners Aboriginal Corporation • Eastern Maar Aboriginal Corporation	• Wadawurrung Traditional Owners Aboriginal Corporation

Table 3.1.2 Partners and stakeholders engaged by Melbourne Water in developing seasonal watering proposals for the Yarra, Tarago, Maribyrnong and Werribee systems and other key foundation documents that have directly informed the proposals (grouped in alphabetical order)

	Yarra system	Tarago system	Maribyrnong system	Werribee system
Community groups and environment groups	• Collingwood Children's Farm • Environment Victoria • Friends of Yarra Flats Park • Friends of Yarran Dheran Nature Reserve • Independent community members • Native Fish Australia • Waterwatch coordinators • Yarra Riverkeeper	• Cardinia Environment Coalition • Environment Victoria • Friends of Mt Cannibal Flora and Fauna Reserve • Friends of Robin Hood Reserve • Independent community members • Native Fish Australia • Waterwatch coordinators	• Environment Victoria • Friends of Holden Flora Reserve • Friends of the Maribyrnong Valley Inc. • Independent community members • Jacksons Creek EcoNetwork • Native Fish Australia • Waterwatch coordinators	• Ecolinc • Environment Victoria • Friends of Toolern Creek Reserve • Friends of Werribee Gorge & Long Forest Mallee Inc. • Independent community members • Moorabool Environment Group/Platypus Alliance - Bacchus Marsh • Native Fish Australia • NatureWest • Pinkerton Landcare and Environment Group • Waterwatch coordinators • Werribee Riverkeeper

	Yarra system	Tarago system	Maribyrnong system	Werribee system
Government agencies	• Banyule City Council • City of Boroondara • City of Melbourne • City of Whittlesea • Commissioner for Environmental Sustainability Victoria • Department of Energy, Environment and Climate Action • Environment Protection Authority Victoria • Manningham City Council • Melbourne Water (Service Delivery) • Nillumbik Shire Council • Parks Victoria • Victorian Fisheries Authority • Victorian Freshwater Fish Habitat and Flows Roundtable • Yarra Ranges Shire Council	• Baw Baw Shire Council • Cardinia Shire Council • Commissioner for Environmental Sustainability Victoria • Department of Energy, Environment and Climate Action • Environment Protection Authority Victoria • Melbourne Water (Service Delivery) • Parks Victoria • Southern Rural Water • Victorian Fisheries Authority • Victorian Freshwater Fish Habitat and Flows Roundtable	• Commissioner for Environmental Sustainability Victoria • Department of Energy, Environment and Climate Action • Environment Protection Authority Victoria • Greater Western Water • Hume City Council • Maribyrnong City Council • Melbourne Water (Service Delivery) • Moonee Valley City Council • Parks Victoria • Port Phillip and Westernport CMA • Southern Rural Water • Victoria Police • Victorian Fisheries Authority	• Commissioner for Environmental Sustainability Victoria • Department of Energy, Environment and Climate Action • Environment Protection Authority Victoria • Greater Western Water • Melbourne Water (Service Delivery) • Melton City Council • Parks Victoria • Southern Rural Water • Victorian Fisheries Authority • Wyndham City Council
Landholders/farmers	• Individual landholders • Licensed diverters	• Individual landholders	• Licensed diverters	• Individual landholders • Zoos Victoria
Local businesses	• East Coast Kayaking • Melbourne Adventure Hub • Sea Kayak Australia • Warburton Holiday Park • Warrior Spirit Adventures	• Glen Cromie Reserve	• Atlas Ecology Pty Ltd • Blackbird Cruises	• Camp Sunnystones
Recreational users	• Kirinari Kayak Club • Paddle Victoria • Patterson Lakes Canoe Club • VRFish • Victorian Sea Kayak Club • Whitehorse Canoe Club Inc.	• VRFish	• VRFish	• VRFish • Werribee & District Anglers Club

	Yarra system	Tarago system	Maribyrnong system	Werribee system
Technical experts	• Arthur Rylah Institute • Australian Platypus Conservancy • Cesar Australia • Melbourne Water subject matter experts • Research collaborators at Melbourne University	• Arthur Rylah Institute • Australian Platypus Conservancy • Cesar Australia • Melbourne Water subject matter experts • Research collaborators at Melbourne University	• Arthur Rylah Institute • Australian Platypus Conservancy • Cesar Australia • Melbourne Water subject matter experts • Research collaborators at Melbourne University	• Arthur Rylah Institute • Australian Platypus Conservancy • Cesar Australia • Melbourne Water subject matter experts • Research collaborators at Melbourne University
Traditional Owners	• Bunurong Land Council Aboriginal Corporation • Wurundjeri Woi wurrung Cultural Heritage Aboriginal Corporation	• Bunurong Land Council Aboriginal Corporation • Wurundjeri Woi wurrung Cultural Heritage Aboriginal Corporation	• Bunurong Land Council Aboriginal Corporation • Wurundjeri Woi wurrung Cultural Heritage Aboriginal Corporation	• Bunurong Land Council Aboriginal Corporation • Wadawurrung Traditional Owners Aboriginal Corporation • Wurundjeri Woi wurrung Cultural Heritage Aboriginal Corporation

Integrated catchment management

Altered water regimes are one of many threats to the health of Victoria's waterways. To be effective, environmental flows need to be part of an integrated approach to catchment management. Many of the environmental objectives of water for the environment in the central region will not be fully met without simultaneously addressing issues such as barriers to fish movement, high nutrient loads, loss of streambank vegetation and invasive species.

Victorian and Australian government agencies, Traditional Owner groups, community groups and private landholders 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 support the outcomes of environmental flows in the central region include:

- works to protect and enhance streambanks along priority reaches, including willow removal, revegetation and fencing to exclude stock
- urban billabong restoration along the lower *Birrarung* (Yarra River) using ecological and Traditional Owner knowledge
- an update to the Werribee Diversion Weir (proposed in the *Central and Gippsland Regional Sustainable Water Strategy*) to improve fish passage and delivery of environmental flows.

For more information about integrated catchment management programs in the central region, refer to the Corangamite CMA and Melbourne Water regional catchment strategies and regional waterway strategies.

Risk management

During the development of the seasonal watering proposals for the Yarra, Tarago, Maribyrnong, Werribee, Moorabool and Barwon systems, environmental watering program partners assessed risks associated with potential environmental flows for 2023-24 and identified appropriate mitigating strategies. Risks and mitigating actions are continually assessed by program partners throughout the year (see subsection 1.2.7).

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Seasonal outlook 2023-24

Catchments in the central region received above-average winter and spring rainfall for the third consecutive year in 2022, but late summer and autumn 2023 were drier than the long-term average. Parts of the Barwon, Moorabool and Yarra systems recorded their highest October rainfall totals, which caused significant flooding. Reservoirs in all systems spilled during 2022-23, including Rosslynne Reservoir, which spilled for the first time since 1996. Upper Yarra Reservoir reached its maximum operating capacity in October, but Melbourne Water released additional water to prevent it from spilling. Those releases increased flow in the Yarra River during November and December and meant water for the environment that had been carried over from 2021-22 was lost. Additional water was also released from Merrimu Reservoir in 2022-23 to prevent it from spilling. These spills, managed releases and natural inflows met many planned environmental watering actions across the region during winter and spring, but water for the environment was still needed to deliver the planned low flows and freshes in many systems during summer and autumn. The VEWH purchased water from licence holders in the Maribyrnong system to deliver environmental flows in Jacksons Creek.

The Bureau of Meteorology has forecast below-median rainfall and above-median temperatures during autumn, winter and spring 2023 across the central region.

All systems in the central region are expected to receive full allocations of water for the environment in 2023-24, but the loss of some carryover due to reservoir spills and/or pre-spill releases in the Yarra and Werribee systems in 2022-23 means that the total water availability for 2023-24 may be less than it was in 2022-23.

Forecast available supply in the Yarra, Tarago and Werribee systems should be sufficient to deliver the potential environmental watering actions in all climate scenarios to build on environmental outcomes achieved over the last three wet years.

A near-full Rosslynne Reservoir will likely create an opportunity to purchase water to deliver environmental flows in the Maribyrnong system. However, outcomes in upper Jacksons Creek continue to be limited by infrastructure delivery constraints.

Options for delivering water for the environment in the Moorabool and Barwon systems in 2023-24 will be heavily influenced by local climatic conditions due to their smaller and more variable environmental allocations. Larger flows in the Moorabool and upper Barwon systems rely on significant contributions from local rainfall and are, therefore, only likely to be achieved under average or wet climatic conditions. Natural inflows will also have a significant bearing on the low flows and freshes in the Moorabool and upper Barwon systems, and summer and autumn flows may need to be delivered at the lower end of their recommended range to conserve available environmental supply if those seasons are dry. Delivery of water for the environment in the lower Barwon wetlands is not affected by annual allocations of water for the environment, and the proposed fill in winter/spring and partial drawdown in summer/autumn should be possible in all climate scenarios if river levels allow.

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3.2 Yarra system

Waterway manager – Melbourne Water

Storage manager – Melbourne Water

Environmental water holder – Victorian Environmental Water Holder

The Yarra system includes *Birrarung* (Yarra River), the Plenty River and Yarra billabongs.

System overview

***Birrarung* (Yarra River) flows west from the Yarra Ranges above Warburton, through the Yarra Valley and then opens out into a wider plain as it meanders through the suburbs and city of Melbourne before entering Port Phillip Bay (Figure 3.2.1). Over time, the Yarra River below Warrandyte has been straightened, widened and cleared of natural debris as Melbourne has developed.**

Up to 400,000 ML per year (long-term average diversion limit) can be harvested from the Yarra system for consumptive use in Melbourne and surrounding areas. The Upper Yarra, O'Shannassy and Maroondah reservoirs harvest water from headwater tributaries, and a pump station at Yering Gorge is used to divert water from the Yarra River to Sugarloaf Reservoir.

Tributaries, including Armstrong Creek, McMahons Creek, Starvation Creek, Woori Yallock Creek and the Watts and Little Yarra rivers, influence flow in the upper reaches of the Yarra River. Urbanised tributaries (such as Olinda Creek, Mullum Mullum Creek, Diamond Creek, Plenty River and Merri Creek) provide additional water to the middle and lower reaches of the Yarra River.

Environmental flows can be released from the Upper Yarra, Maroondah and O'Shannassy reservoirs to support ecological processes and environmental outcomes in downstream river reaches and wetlands. Requests can also be made to cease diversions from the Yarra River at the Yering Gorge Pumping Station, allowing the flow to pass down the whole river system. The priority Yarra River reaches for water for the environment are 2 and 5, shown in Figure 3.2.1. Reach 6 is also a priority in summer and autumn to manage poor water quality upstream of Dights Falls, as flow targets in reach 5 may not be sufficient. Water for the environment delivered to reaches 2 and 5 will help meet flow targets in other reaches. Occasionally, watering actions met naturally in reaches 2 and beyond are not achieved in reach 1 due to the lack of unregulated tributary inflows immediately downstream of Upper Yarra Reservoir. If so, water for the environment can also be used to meet flow targets in reach 1.

The Plenty River rises from the slopes of Mount Disappointment in the Great Dividing Range about 50 km north of Melbourne. It flows downstream through rural and semi-rural areas and Plenty Gorge before joining the Yarra River near Viewbank, east of Banyule Flats Reserve. Yan Yean Reservoir is located off the waterway north of Plenty Gorge, and it receives a flow from Toorourrong Reservoir via a channel. The Plenty River has not received managed environmental flows before, but there may be opportunities to deliver water for the environment from Yan Yean Reservoir in the coming years.

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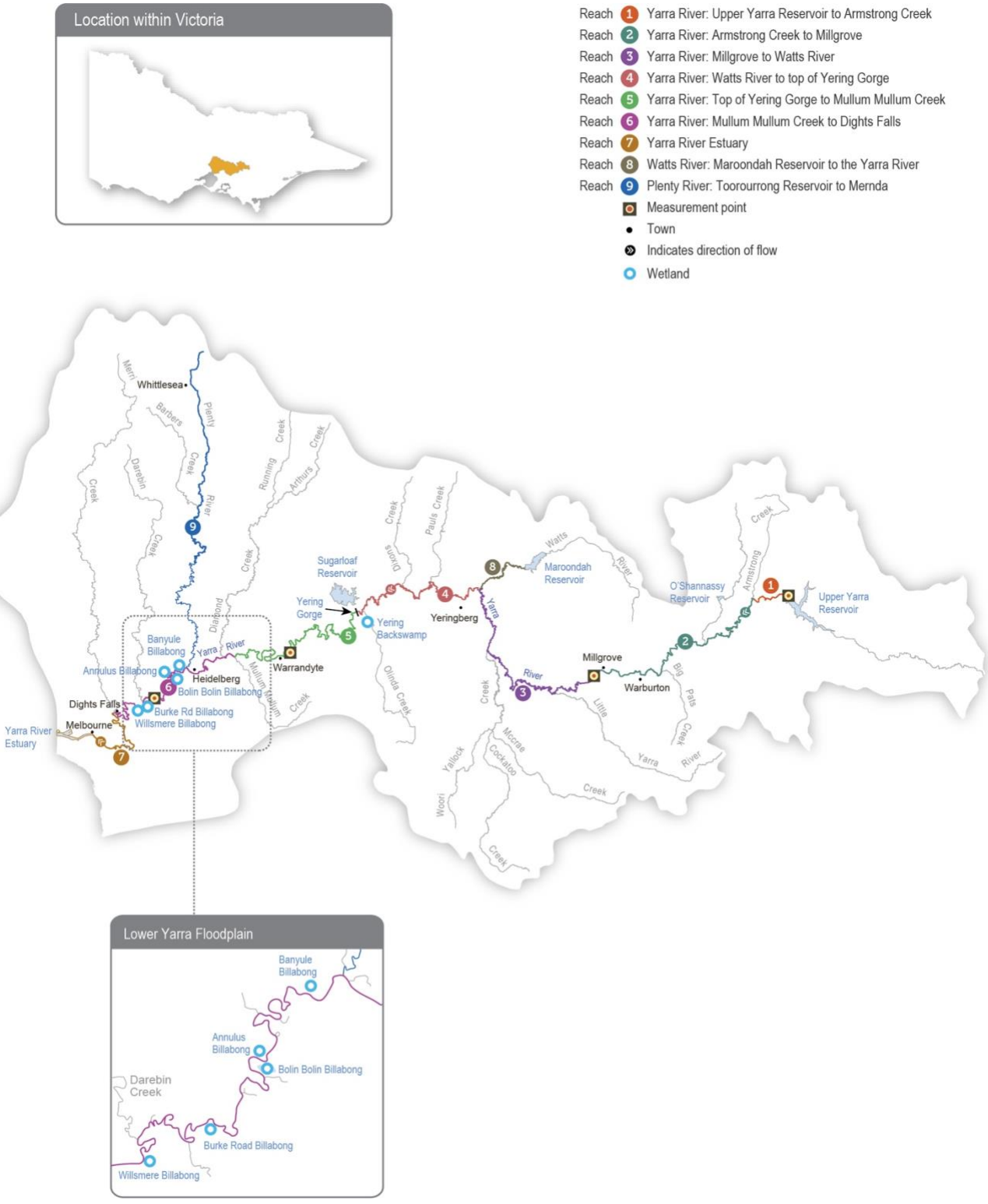
Figure 3.2.1 The Yarra system



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Environmental values

The upper reaches of the Yarra River (reaches 1-3) have good-quality streamside and aquatic vegetation and provide habitat for native fish species, including river blackfish, mountain galaxias and common galaxias. The middle and lower reaches of the Yarra River (reaches 4-6) flow through forested gorges, cleared floodplains and some highly-urbanised areas, and they support several populations of native fish, including Australian grayling, river blackfish, Macquarie perch and tupong. Macquarie perch were introduced to the Yarra River last century, and the population is now considered one of Victoria's largest and most important.

The Plenty River (reach 9) provides habitat for waterbugs and native fish species (such as common galaxias). Platypus have been detected in the Plenty River in the past, but none were recorded in recent surveys.

Billabongs are an important feature of the lower Yarra River floodplain between Heidelberg and Dights Falls and in the upper reach around Yarra Glen. The billabongs support distinct vegetation communities and provide foraging and breeding habitat for waterbirds and frogs. Except in times of very high flow, most billabongs are disconnected from the Yarra River.

Environmental objectives in the Yarra system
Protect and increase populations of native fish, including threatened species (such as the Australian grayling, Macquarie perch and river blackfish)
Maintain the population of frogs, particularly on the mid-Yarra River floodplain
Maintain the form of the river channel Scour silt from riffles and clean cobbles
Provide sufficient rates of carbon and nutrient production and processing to support native fish and waterbug communities
Maintain the population of resident platypus
Maintain native streamside and aquatic vegetation on the riverbank and in the channels Increase the growth of threatened wetland plant species to rehabilitate shallow marsh, deep marsh and freshwater meadows on the floodplain and billabongs
Maintain the diversity and increase the abundance of waterbugs to support aquatic food webs
Improve water quality in river pools, ensuring adequate oxygen concentration in the water to support fish, crustaceans and waterbugs

Traditional Owner cultural values and uses

Melbourne Water is working with the Registered Aboriginal Parties (RAPs) within the *Birrarung* (Yarra River) system — the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, the Bunurong Land Council Aboriginal Corporation and the Taungurung Land and Waters Council Aboriginal Corporation — to develop and strengthen relationships with them and to increase Traditional Owners' involvement in the planning and delivery of water for the environment.

Melbourne Water is in discussions with each of the Traditional Owner corporations to work towards developing overarching partnership agreements. In terms of environmental water management, the intent is for Traditional Owners to be active partners in the planning, delivery and monitoring of all deliveries of water associated with *Birrarung* (Yarra River) and the Plenty River.

The part of the lower *Birrarung* (Yarra River) floodplain included in the environmental watering program is on Wurundjeri Woi wurrung Country upstream of Chandler Highway. The parts of the lower *Birrarung* (Yarra River) floodplain on Bunurong Country are not currently in the environmental watering program.

In 2021, changes to the RAP boundaries resulted in the lower *Birrarung* (Yarra River) from just upstream of Moonee Ponds Creek to Port Phillip Bay now falling within the Bunurong Land Council Aboriginal Corporation's boundaries. The Bunurong Land Council Aboriginal Corporation is working with the Bunurong people to determine the cultural objectives for the *Birrarung* (Yarra River) on Bunurong Country.

In early 2023, Melbourne Water met with the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation to discuss 2023-24 priorities for water for the environment on the lower *Birrarung* (Yarra River) floodplain. The Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation indicated it supports the priorities for the year ahead.

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Where possible, Melbourne Water and the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation work together to link water for the environment on the lower *Birrarung* (Yarra River) floodplain with cultural outcomes for the Wurundjeri Woi wurrung people. In general, environmental flows management on the lower Birrarung (Yarra River) floodplain aligns with a landscape-scale approach for billabong watering, developed in consultation with Wurundjeri Woi wurrung people. Management of water for the environment (including wetting and drying) at Annulus, Banyule and Bolin Bolin billabongs is closely aligned with Wurundjeri Woi wurrung aspirations.

Increasing the involvement of Traditional Owners in environmental flows management and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its agency partners. This is reinforced by a range of legislative and policy commitments, including the *Water Act 1989*, the Victorian Aboriginal Affairs Framework, the 2016 *Water for Victoria*, the 2022 *Central and Gippsland Region Sustainable Water Strategy*, the 2022 *Water is Life: Traditional Owner Access to Water Roadmap*, and in some cases, agreements under the *Traditional Owner Settlement Act 2010*.

Where Traditional Owners are more deeply involved in the planning and/or delivery of environmental flows for a particular site, their contribution is acknowledged in Table 3.2.1 with an icon. The use of this icon is not intended to indicate that these activities are meeting all the needs of Traditional Owners but is used in the spirit of valuing that contribution.

Watering planned and/or delivered in partnership with Traditional Owners to support cultural values and uses

There are many places of tangible and intangible cultural significance for the Wurundjeri Woi wurrung people and the Bunurong people on the lower *Birrarung* (Yarra River) floodplain.

A monitoring project continues at the billabongs with the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation's Narrap ('Country') Unit, the University of Melbourne and Melbourne Water. The group has been monitoring vegetation and water quality outcomes from environmental flows and held an on-Country knowledge-sharing day in 2022 to discuss learnings. The intent is to further the role and leadership of the Wurundjeri Woi Wurrung people in managing the billabongs, including vegetation management, research and being partners in decision-making processes.

In 2023-24, filling Bolin Bolin Billabong in the average and wet scenarios will provide an exit strategy for eels that have entered the billabong while connected with *Birrarung* (Yarra River). The Narrap Unit suggested this watering action to support the landscape-scale approach to watering floodplain billabongs. The Narrap Unit will collaborate on Bolin Bolin water delivery and monitoring, depending on the unit's availability in 2023-24.

Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.2.1, Melbourne Water considered how environmental flows could support values and uses, including:

- water-based recreation (such as kayaking, canoeing, fishing and swimming)
- riverside recreation and amenity (such as birdwatching, camping, picnicking, cycling, running and walking)
- community events and tourism (such as the Moomba Festival and the Inflatable Regatta)
- socioeconomic benefits (such as for diverters for irrigation, stock needs and domestic use: water levels and water quality can rely on the delivery of water for the environment, particularly in summer).

Scope of environmental watering

The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.2.1 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

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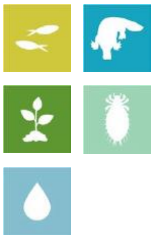
Table 3.2.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Yarra system

Potential environmental watering action	Expected watering effects	Environmental objectives
Yarra River The highest priority reaches for the Yarra River are reaches 2 (upper Yarra River) and 5 (lower Yarra River); water delivered to these reaches generally benefits other reaches		
Winter/spring low flow (June to November) Reach 2: 80-350 ML/day Reach 5: 350-750 ML/ day	• Physically mix pools to minimise the risk of stratification and low oxygen • Maintain access to habitats for fish, waterbugs and platypus • Wet bank vegetation to promote growth	
Winter/spring freshes (two freshes for three to seven days during June to September) Reach 2: 700 ML/day Reach 5: 1,300-2,500 ML/day	• Scour sediment and biofilm from gravel in riffles to improve spawning opportunities for Macquarie perch • Wet native streamside vegetation on the banks of the river to promote growth • Provide cues for upstream migration of juvenile migratory fish (e.g. Australian grayling and tupong) • Entrain organic material to support carbon cycling	
Winter/spring high flow (one high flow for three days during June-September) Reach 1: 300 ML/d	• Scour sediment and biofilm from gravel in riffles • Provide prolonged wetting to favour flood-tolerant native vegetation in the streamside zone • Entrain organic material to support carbon cycling	
Spring high flow (one high flow for 14 days during September to October) Reach 2: 700 ML/day Reach 5: 2,500 ML/day	• Scour sediment and biofilm from gravel in riffles • Provide prolonged wetting to favour flood-tolerant native vegetation in the streamside zone • Provide cues for upstream migration of juvenile migratory fish (e.g. Australian grayling and tupong) • Trigger spawning of Macquarie perch • Entrain organic material to support carbon cycling	
Summer/autumn low flow (December to May) Reach 2: 80 ML/day Reach 5: 200 ML/day Reach 6: 300-450 ML/ day	• Physically mix pools to minimise the risk of stratification and low oxygen • Maintain access to habitats for fish, waterbugs and platypus	
Summer/autumn freshes (three freshes for two days during December to May) Reach 2: 350 ML/day Reach 5: 750 ML/day	• Flush pools to prevent a decline in water quality • Scour sediment and biofilm from gravel in riffles and pools to maintain habitat quality for fish and waterbugs • Provide opportunities for the localised movement of fish and platypus • Wet the banks of the river to maintain flood-tolerant vegetation on the banks	
Autumn high flow (one high flow for seven to 14 days during April to May) Reach 2: 560 ML/day Reach 5: 1,300 ML/day	• Cue the migration of Australian grayling • Scour sediment and biofilm from gravel in riffles and pools to maintain habitat quality for fish and waterbugs	

Potential environmental watering action	Expected watering effects	Environmental objectives
Yarra billabongs		
Bolin Bolin Billabong (fill in spring/summer) 	• Fill the wetland to full supply level to engage the inlet/outlet channel to the Yarra River as an exit strategy for eels • Allow to draw down to support the growth of threatened wetland plant species and encourage the regeneration of spreading aquatic herbs • Maintain a permanent pool to provide habitat for frogs, waterbugs and any remaining eels	
Yering Backswamp (fill in autumn/winter/spring)	• Wet the deepest parts of the wetland to about 80 cm to provide habitat for fish, frogs and waterbugs • Wet remaining areas of the wetland to about 40-60 cm to support the growth of threatened wetland plant species and encourage the regeneration of spreading aquatic herbs	

Scenario planning

Table 3.2.2 outlines potential environmental watering and expected water use in a range of planning scenarios.

In the Yarra system, dry, average and wet planning scenarios are considered. A drought planning scenario for the Yarra has not been included as the actions would be almost identical to the dry scenario and because drought conditions don't affect the allocation of water for the environment.

Wet conditions in 2022-23 caused widespread flooding in the Yarra catchment, which naturally met most of the planned environmental flows actions for the year and delivered a range of larger flows that cannot be achieved with water for the environment. The wet conditions also caused reservoirs in the Yarra-Thomson system to spill, meaning accumulated carryover from previous years was deducted from the VEWH's accounts. Accordingly, water availability heading into 2023-24 will be less than in recent years. The reliable allocation of 17,000 ML per year that is provided on 1 July will allow critical watering actions to be delivered in all planning scenarios in 2023-24, but the lower carryover volume may restrict some watering actions that would otherwise be planned. This represents a relatively low risk for the environmental values of the Yarra system, given the environmental flow recommendations have been met or exceeded for the last three years.

Environmental flow planning in the Yarra River focuses on providing a sufficiently low flow throughout the year to maintain habitat for aquatic life and providing a high flow at critical times to support the migration and breeding requirements of native fish. A summer/autumn low flow and freshes, a winter/spring high flow (in reach 1) and a winter/spring low flow and freshes are needed to achieve these outcomes in all planning scenarios. The extent to which these flows are likely to be met by natural tributary inflows varies between the dry, average and wet planning scenarios, and water for the environment will be used to fill the main deficits in each scenario, where possible.

A spring high flow is required every year in the average and wet planning scenarios to meet environmental objectives for streamside vegetation fully, but most other objectives associated with this flow – Macquarie perch spawning and upstream migration of Australian grayling and tupong – can be met with lower-magnitude winter/spring freshes. Given spring high flows have occurred naturally in each of the last three years and the potentially high volume of environmental flow required to deliver an equivalent flow when it does not naturally occur, a spring high flow is considered a lower priority in 2023-24.

The main objective of the autumn high flow is to trigger Australian grayling to migrate downstream to the estuary and spawn. Ideally, Australian grayling will have spawning opportunities every year, and spawning is preferred every year to maintain a healthy population, but it is critically required in two out of every three years. Autumn high flows have occurred naturally in the Yarra River in each of the last three years. Given the volume of water for the environment available in 2023-24, delivering an autumn high flow is considered a lower priority in the dry and average planning scenarios. However, Melbourne Water may still deliver an autumn high flow in any planning scenario in 2023-24 if the natural flow delivers some planned watering actions in spring and summer, freeing up the available supply.

Melbourne Water is adopting a landscape-scale approach to delivering environmental flows across its floodplain billabongs. The approach specifically considers the ecosystem services different billabongs provide, the importance of wetting and drying phases for wetland health, and which billabongs need to be watered at any given time to support regionally important plant and animal populations. Numerous billabongs throughout the Yarra River catchment are drier than natural due to river regulation and modifications to natural flow paths. Ensuring some billabongs are inundated at any given time is necessary to provide habitat for waterbirds and frogs, including some rare or threatened species.

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All the Yarra billabongs filled naturally in spring 2022 and were in various states of drawdown in autumn 2023. Melbourne Water's landscape approach to planning environmental flows has identified watering Bolin Bolin Billabong and Yering Backswamp as high priorities in 2023-24. The distinct vegetation community at Yering Backswamp has adapted to frequent or near-permanent inundation. As such, it is the only managed wetland on the Yarra floodplain actively watered annually in all planning scenarios. Filling Yering Backswamp annually also provides reliable habitat for native frogs and waterbirds, especially when other wetlands are drawing down or in their dry phases. Bolin Bolin Billabong may be watered in the average and wet planning scenarios to help eels that entered the billabong during the 2022 floods move back to the main river channel. Scientists from the Arthur Rylah Institute for Environmental Research have tagged eels in Bolin Bolin Billabong to track their movement in response to natural and managed watering events. The results of that work will help future watering at Bolin Bolin and other Yarra billabongs. All other actively managed billabongs on the Yarra floodplain will be allowed to draw down during 2023-24 to support vegetation objectives and to provide foraging habitats for birds and other fauna that use wetlands in their drawdown and drying phases.

A target carryover volume has not been prioritised in the Yarra system this year. The highly reliable environmental allocation (17,000 ML on 1 July each year) means that there will be sufficient supply for potential environmental watering actions in 2024-25 without carryover from 2023-24.

Table 3.2.2 Potential environmental watering for the Yarra system in a range of planning scenarios

Planning scenario	Dry	Average	Wet
Expected conditions	• Low streamflow year-round • Lack of unregulated freshes and high flow • Passing flow is not likely to meet the minimum environmental flow recommendations • Potential poor water quality, particularly in summer • Pools may stratify • Plenty River may experience cease-to-flow events	• Low-flow recommendations are likely to be met by passing flow • Natural flow may provide some freshes, but its duration and/or magnitude will likely be less than recommended environmental flow • Potentially poor water quality, particularly in summer • Pools may stratify • Small reservoirs may spill • Overbank flow is not likely	• Low-flow recommendations are likely to be met by passing flow • High, natural flow will occur, most likely in winter/spring • Major spills from reservoirs may occur • Some natural wetting of billabongs may occur
Expected availability of water for the environment	• 22,000 ML	• 22,000 ML	• 22,000 ML
Yarra River (targeting reach 2 and 5)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Winter/spring low flow • Winter/spring fresh (one fresh) • Winter/spring high flow (one high flow) • Summer/autumn low flow • Summer/autumn freshes (three freshes) • Yering Backswamp	• Winter/spring low flow • Winter/spring freshes (two freshes) • Winter/spring high flow (one high flow) • Summer/autumn low flow • Summer/autumn freshes (three freshes) • Bolin Bolin Billabong • Yering Backswamp	• Winter/spring low flow • Winter/spring freshes (two freshes) • Winter/spring high flow (one high flow) • Summer/autumn low flow • Summer/autumn freshes (three freshes) • Autumn high flow (one high flow) • Bolin Bolin Billabong • Yering Backswamp
	Tier 1b (supply deficit)		
	• Winter/spring fresh (one fresh) • Autumn high flow (one high flow)	• Spring high flow (one high flow) • Autumn high flow (one high flow)	• Spring high flow (one high flow) • Winter/spring high flow (one high flow)

Planning scenario	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)	• N/A		
Possible volume of water for the environment required to achieve objectives	• 21,750 ML (tier 1a) • 16,660 ML (tier 1b)	• 20,250 ML (tier 1a) • 15,800 (tier 1b)	• 20,900 ML (tier 1a) • 5,600 ML (tier 1b)
Priority carryover requirements for 2024-25	• 0 ML	• 0 ML	• 0 ML

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3.3 Tarago system

Waterway manager – Melbourne Water

Storage manager – Melbourne Water

Environmental water holder – Victorian Environmental Water Holder

System overview

The Tarago River rises in the Tarago State Forest and flows into the Tarago Reservoir at Neerim (Figure 3.3.1). The reservoir harvests inflows from all upstream tributaries to supply towns on the Mornington Peninsula and around the Western Port area. Water is released from the reservoir to supply downstream irrigators. Below the reservoir, the Tarago River flows close to Rokeby before meeting the Bunyip River at Longwarry North. From there, the Bunyip River flows through a modified, straightened channel called Bunyip Main Drain that discharges into Western Port. The Bunyip Main Drain supplies many irrigators in the catchment.

Water available under the *Tarago and Bunyip Rivers Environmental Entitlement 2009* is stored in and released from Tarago Reservoir. This water is primarily used to meet environmental objectives in reach 2, between the reservoir and the confluence of the Tarago and Bunyip rivers, as Figure 3.3.1 shows. Water for the environment delivered to reach 2 also supports environmental flow recommendations in reach 6 (Bunyip Main Drain).

Year-round passing flows in the Bunyip and Tarago rivers are stipulated under both the environmental entitlement and Melbourne Water's bulk entitlement. These passing flows contribute toward meeting the minimum low-flow requirements in summer/autumn and winter/spring, but they are less than the recommended minimum flows. The passing flows do not provide any of the freshes or greater flows that are needed throughout the year to support environmental outcomes.

Water released to meet irrigation demands creates variable flow patterns in the Tarago and Bunyip rivers throughout the year. The magnitude and timing of these releases can influence environmental outcomes, and Melbourne Water continues to work with Southern Rural Water to optimise the shared value derived from irrigation releases.

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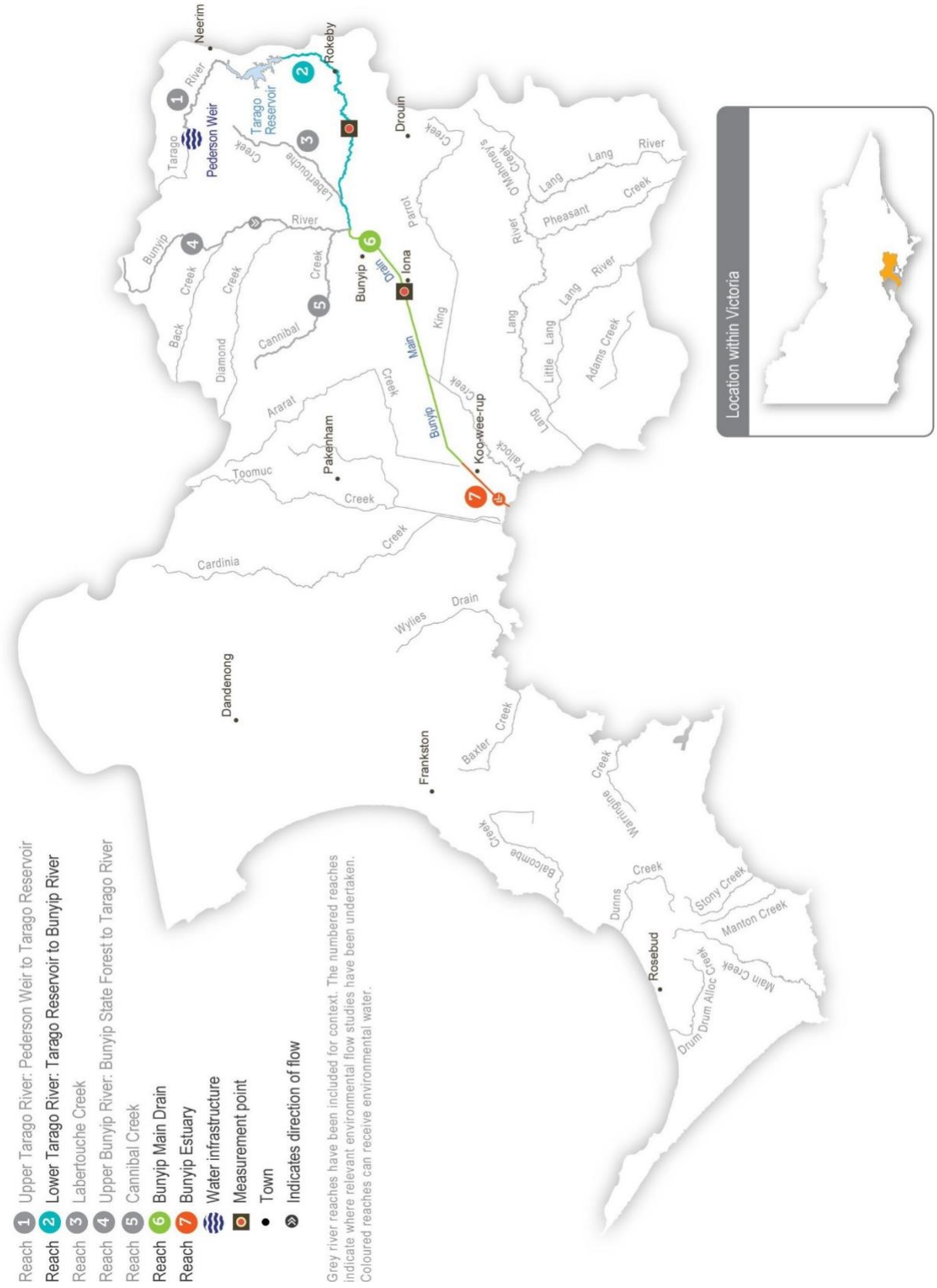
Figure 3.3.1 The Tarago system



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Environmental values

The Tarago system contains several significant and threatened native animal and plant species, including Australian grayling, long pink-bells, tree geebung and swamp bush pea. The upper catchment (reach 2) has healthy streamside vegetation and diverse in-stream habitat that supports platypus and native fish, including river blackfish, tupong, short-finned eels and mountain galaxias. The lower catchment (reach 6) has been highly modified but still contains patches of remnant vegetation and is a key migration pathway for Australian grayling. It also has healthy platypus populations.

Environmental objectives in the Tarago system	
	Increase populations of native fish, including threatened species (such as the Australian grayling)
	Maintain channel form and structure
	Increase platypus populations
	Increase native streamside and aquatic plant communities on the riverbank and in the channel
	Increase the diversity and biomass of waterbugs to support aquatic foodwebs
	Improve water quality in river pools, ensuring adequate oxygen concentration in the water to support fish, crustaceans and waterbugs

Traditional Owner cultural values and uses

Melbourne Water is working with interested Traditional Owner groups and the Registered Aboriginal Party within the Tarago system – the Bunurong Land Council Aboriginal Corporation – to develop and strengthen relationships and to increase Traditional Owners' involvement in the planning and delivery of water for the environment. As of January 2023, one overarching partnership agreement had been finalised between Melbourne Water and the Gunaikurnai Land and Waters Aboriginal Corporation that frames relations and obligations between the two organisations. Discussions were also occurring with the Bunurong Land Council Aboriginal Corporation to determine whether similar partnership agreements would benefit Bunurong. The intent is for Traditional Owners to be active partners in the planning, delivering and monitoring water for the environment associated with the Tarago and Bunyip rivers.

The Bunurong Land Council Aboriginal Corporation has expressed a desire to be more involved in environmental flows planning and management in the Tarago River.

Melbourne Water and the VEWH will continue to work with the Traditional Owner groups to identify and integrate cultural values and their flow requirements into the environmental watering program on an ongoing basis.

Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.3.1, Melbourne Water considered how environmental flows could support values and uses, including:

- water-based recreation (such as fishing and swimming)
- riverside recreation and amenity (such as cycling, camping, caravanning, short- and long-term visiting and walking)
- community events and tourism (such as visiting and residing in the Glen Cromie Caravan Park)
- socioeconomic benefits (such as for diverters for irrigation, stock needs and domestic use: water levels and water quality can rely on the delivery of water for the environment, particularly in summer).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 3.3.1 with the following icon.

	Watering planned to support peaks in visitation (e.g. camping or other public activities on long weekends or school holidays)

Melbourne Water may time the release of a summer fresh in the Tarago River to coincide with long weekends in January or March, so visitors and long-term residents of the Glen Cromie Caravan Park can enjoy the additional flow in the river.

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Scope of environmental watering

The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.3.1 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

Table 3.3.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Tarago system

Potential environmental watering action	Expected watering effects	Environmental objectives
Tarago River (targeting reach 2)		
Winter/spring low flow (75 ML/day or natural during June to November)	• Prevent the encroachment of terrestrial vegetation in the channel • Wet the banks to promote streamside vegetation growth • Maintain an adequate depth through riffles to allow access to habitats for fish and platypus • Mix pools to maintain water quality and increase habitat for fish and macroinvertebrates during wetter months	
Winter/spring fresh(es) (one to two freshes with a peak of 100-200 ML/day for two days during June to September)	• Flush sediment and scour biofilm from stream substrate and large woody debris to maintain habitat for macroinvertebrates and fish, including river blackfish • Create extra depth to allow greater fish movement between pools and reaches • Cue the downstream migration of species, including eel and tupong • Wet the banks and low benches to maintain the fringing aquatic vegetation	
Spring high flow (one high flow with a peak of 200-300 ML/day for two days in a seven-to-10-day duration during September to October)	• Form and maintain scour holes around large wood • Prevent the encroachment of terrestrial vegetation into the channel • Cue the upstream migration of juvenile diadromous fish (e.g. Australian grayling) from the sea or estuary into the river • Wet the higher benches to maintain the fringing aquatic vegetation and ensure vertical zonation of the fringing vegetation • Encourage female platypus to select a nesting burrow higher up the bank to reduce the risk of greater flow later in the year flooding the burrow when juveniles are present	
Summer/autumn low flow (20 ML/day or natural during December to May)	• Maintain adequate depth through riffles to support waterbugs and allow access to habitats for fish and platypus • Maintain adequate foraging habitat in pools for fish and platypus • Maintain water quality (especially oxygen concentration) in pools	
Summer/autumn freshes (three to five freshes of 75 ML/day for two days during December to May) 	• Flush fine silt from hard substrates and around large woody debris to maintain habitat for native fish in low-flow periods • Allow the localised movement of native fish • Prevent terrestrial vegetation growth on sandbars • Maintain water quality by aeration in times of low flow	
Autumn high flow (one high flow with a peak of 100 ML/day for two days in a minimum seven-day duration during April to May)	• Cue the downstream migration and spawning of diadromous fish (e.g. Australian grayling) • Assist the dispersal of juvenile platypus	

Scenario planning

Table 3.3.2 outlines potential environmental watering and expected water use in a range of planning scenarios.

The Tarago River generally requires similar watering actions every year, although the magnitude of its low flow and the frequency of high flows is less in the drought and dry planning scenarios than in the wet or average scenarios. Natural catchment inflows, passing flow and reservoir spills will meet many of the required watering actions and provide natural flow variation throughout the year, especially in the wet planning scenario. Water for the environment will be used where possible to deliver critical flow components not met by other means. Melbourne Water will monitor water levels and water quality throughout the year and adjust releases as necessary to limit stress on existing plants and animals.

In the drought planning scenario, there will not be enough water to compensate for low passing flow and low natural inflows fully. The highest-priority environmental watering actions will be a series of summer/autumn freshes to protect species, including Australian grayling and platypus, by maintaining water levels and water quality in critical refuge habitat. These freshes will provide relief from long periods of low streamflow and help prevent localised extinctions and fish deaths in the drought planning scenario.

Water for the environment will be used for summer/autumn freshes, winter/spring freshes, an autumn high flow in all other planning scenarios and a spring high flow in the wet scenario. Summer/autumn freshes in all planning scenarios help maintain water quality and habitat for native fish and platypus. In the average and wet planning scenarios, when the natural streamflow increases, the number of freshes increases to five to improve the condition and size of native fish and platypus populations. An autumn high flow is needed to trigger Australian grayling movement and spawning. Australian grayling require favourable breeding conditions in at least two of every three years to maintain and grow their population. Wet conditions have delivered high autumn flows in the Tarago River in each of the last four years, so an additional flow is not essential in 2023-24, but it will be delivered if the available supply allows for the consolidation of recent population increases. Winter/spring freshes are needed to cue and facilitate fish movement, including the downstream migration of tupong and eels, and to support the growth of new fringing vegetation. One winter/spring fresh is planned in the dry planning scenario to maintain the current condition of native fish populations and streamside vegetation, and extra freshes are planned in the average and wet planning scenarios to enhance native fish and plant communities. The spring high flow aims to water vegetation higher up the bank and cue the upstream migration of juvenile fish, including Australian grayling. While it would be good to deliver a spring high flow in the average and wet planning scenarios, there is only likely to be enough supply to deliver it in the wet scenario.

Carryover requirements vary depending on seasonal conditions. Under drought and dry conditions, a greater volume (1,000 ML) is recommended to carry over into 2024-25 to ensure sufficient water is available for summer/autumn freshes to maintain water quality if dry conditions continue. Less carryover is needed in the average and wet planning scenarios because adequate allocation in 2024-25 can be expected under those scenarios.

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Table 3.3.2 Potential environmental watering for the Tarago system in a range of planning scenarios

Planning scenario	Drought[1]	Dry	Average	Wet
Expected conditions	• Very low streamflow • Reduction in passing flow • Irrigation releases likely	• Low streamflow • Some reduction in passing flow • Irrigation releases likely	• Average streamflow • Partial freshes naturally provided • Some irrigation releases likely	• Above-average streamflow • Partial or full freshes naturally provided • Irrigation releases unlikely • Tarago Reservoir spills
Expected availability of water for the environment	• 3,000 ML[2]	• 3,000 ML	• 3,500 ML	• 4,500 ML
Tarago River (targeting reach 2)				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Summer/autumn freshes (five freshes)	• Winter/spring fresh (one fresh) • Summer/autumn freshes (three freshes) • Autumn high flow (one high flow)	• Winter/spring freshes (two freshes) • Summer/autumn freshes (five freshes) • Autumn high flow (one high flow)	• Winter/spring freshes (two freshes) • Spring high flow (one high flow) • Summer/autumn freshes (five freshes) • Autumn high flow (one high flow)
	Tier 1b (supply deficit)			
	• Winter/spring low flow • Winter/spring fresh (one fresh) • Winter/spring high flow (one high flow) • Summer/autumn low flow • Autumn high flow (one high flow)	• Winter/spring low flow • Spring high flow (one high flow) • Summer/autumn low flow • Summer/autumn freshes (two freshes)	• Winter/spring low flow • Spring high flow (one high flow) • Summer/autumn low flow	• Winter/spring low flow • Summer/autumn low flow
Possible volume of water for the environment required to achieve objectives	• 2,000 (tier 1a) • 5,750 (tier 1b)	• 1,850 ML (tier 1a) • 5,900 ML (tier 1b)	• 2,900 ML (tier 1a) • 4,700 (tier 1b)	• 4,200 ML (tier 1a) • 2,150 ML (tier 1b)
Priority carryover requirements for 2024-25	• 1,000 ML	• 1,000 ML	• 500 ML	• 300 ML

1 The drought planning scenario has been added for 2023-24 to demonstrate target actions under conditions where the recommended watering actions for the dry scenario could not be met due to further reduced streamflow.
2 Supply is expected to be the same in the drought as in the dry planning scenario in 2023-24 because of storage levels, and the changes in planned watering actions are driven more by the expected reduction in the natural flow through the system because of drier, hotter conditions.

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3.4 Maribyrnong system

Waterway manager – Melbourne Water

Storage manager – Southern Rural Water

Environmental water holder – Not applicable

System overview

The Maribyrnong catchment is located to the northwest of Melbourne. The main waterways in the catchment are Jacksons Creek, which flows southeast from Mount Macedon, and Deep Creek, which flows south from Lancefield (Figure 3.4.1). These two tributaries join at Keilor North to form *Mirrangbamurn* (Maribyrnong River), which flows south to join *Birrarung* (Yarra River) at Yarraville before flowing into Port Phillip Bay.

Rosslynne Reservoir is in the upper reaches of Jacksons Creek near Gisborne and is the only major storage in the Maribyrnong catchment. The reservoir has a maximum release capacity of 20 ML per day under ideal conditions, which significantly constrains the environmental outcomes that can be achieved in the Maribyrnong system. Water for the environment is primarily used to support environmental outcomes in Jacksons Creek between Rosslynne Reservoir and the confluence with Riddles Creek (that is, delivery of water for the environment to reach 6, as shown in Figure 3.4.1). Jacksons Creek is a known groundwater-dependent ecosystem on the national *Groundwater Dependent Ecosystems Atlas*. This means ecological components in the system rely on groundwater for at least some period of time.

The VEWH does not hold an environmental entitlement in the Maribyrnong system, and it relies on opportunistic, temporary trade to meet demands. Melbourne Water (as diversion manager) and the VEWH work with local diversion licence holders to purchase unused water when it is available to support environmental outcomes. This arrangement is negotiated each year, is subject to water availability in the bulk entitlement and storage capacity, and only occurs with all parties' agreement.

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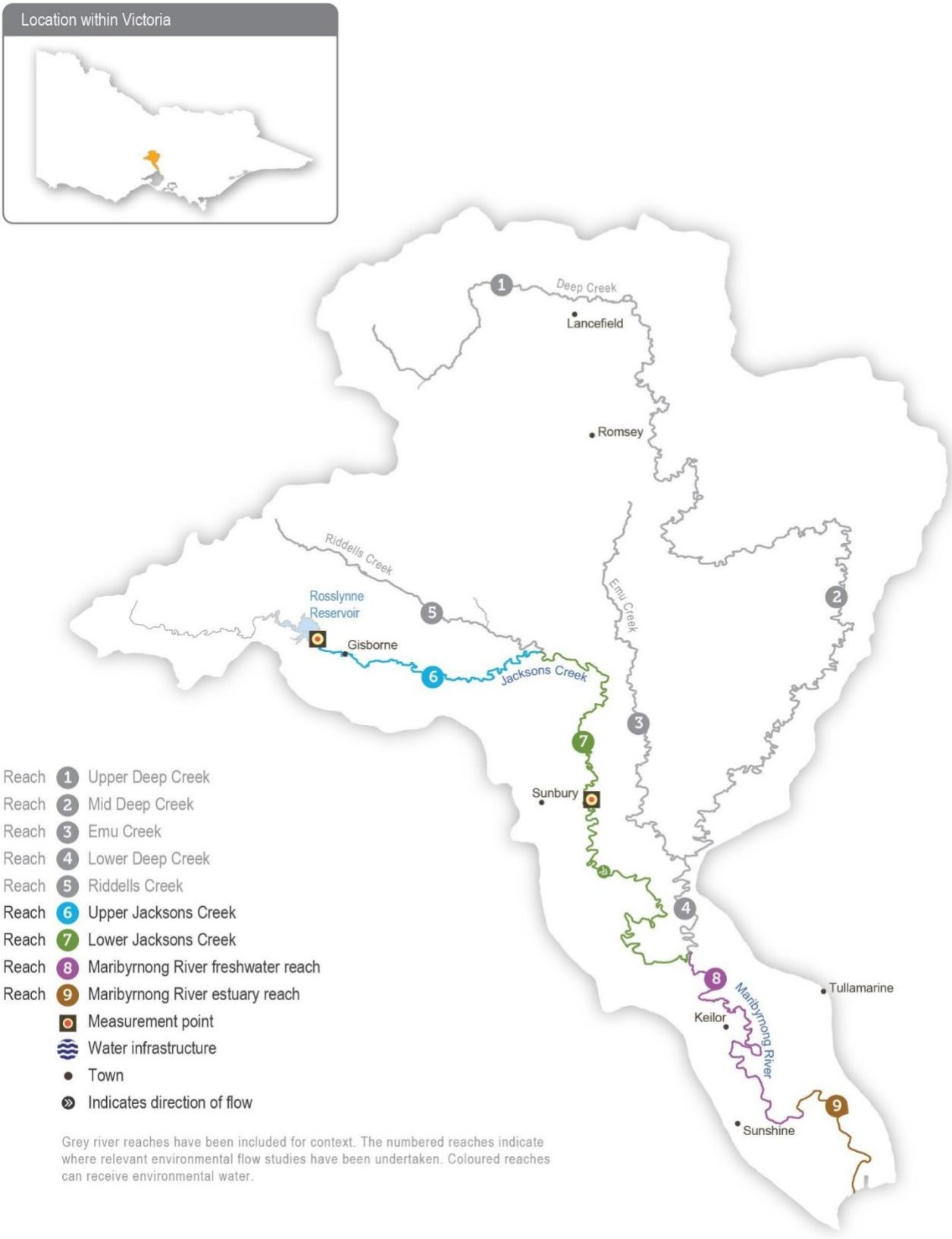
Figure 3.4.1 The Maribyrnong system



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Environmental values

The upper Maribyrnong catchment contains areas of intact streamside vegetation, which provide important habitat for native fish, including migratory short-finned eels, common and ornate galaxias, flathead gudgeon, tupong and Australian smelt.

A large population of waterbugs provides abundant food for a significant platypus population in several reaches of the Maribyrnong system.

Environmental objectives in the Maribyrnong system	
	Protect populations of native small-bodied fish
	Protect platypus populations
	Maintain the condition, abundance, diversity and structure of in-stream and streamside vegetation
	Support a wide range and high biomass of waterbugs to break down dead organic matter and support the river's food chain
	Maintain water quality, particularly oxygen concentrations

Traditional Owner cultural values and uses

Melbourne Water is working with the Registered Aboriginal Parties within the Maribyrnong system — the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation and the Bunurong Land Council Aboriginal Corporation — to strengthen relationships and increase Traditional Owner involvement in the planning and delivery of water for the environment.

There are more opportunities for Melbourne Water and the VEWH to work with Traditional Owner groups to identify and better integrate cultural values and their flow requirements into the environmental watering program on an ongoing basis.

Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.4.1, Melbourne Water considered how environmental flows could support social values such as community connection and amenity by planning flows that will maintain healthy habitat and improve water quality.

Scope of environmental watering

The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.4.1 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

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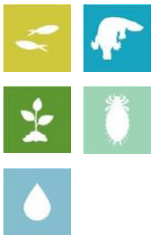
Table 3.4.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Maribyrnong system

Potential environmental watering action	Expected watering effects	Environmental objectives
Jacksons Creek (targeting reach 6)		
Winter/spring low flow (15 ML/day during June to November)	• Maintain depth in pools and riffles to provide habitat for small-bodied native fish, platypus and waterbugs • Prevent terrestrial vegetation encroachment	
Summer/autumn low flow (4-6 ML/day during December to May)	• Maintain pool habitat availability for small-bodied fish and platypus during low-flow periods • Maintain a > 0.1 m median depth over riffles to provide macroinvertebrate habitat and inundate in-stream vegetation • Maintain continuous flow to limit pool stratification and maintain water quality	
Summer/autumn freshes (five freshes of 15 ML/ day for four days every four to six weeks during December to May)	• Increase depth over riffle to provide local movement of small-bodied native fish and platypus during the low flow period • Maintain habitat and food resources for waterbugs • Flush pools to maintain water quality	

Scenario planning

Table 3.4.2 outlines potential environmental watering and expected water use in a range of planning scenarios.

There is no permanent environmental entitlement in the Maribyrnong system, so water for the environment can only be delivered in 2023-24 if other entitlement holders are willing to sell some of their annual allocations to the VEWH.

An adequate low flow throughout the year and summer/autumn freshes are a high priority in all planning scenarios to maintain habitat for native fish and platypus and to prevent poor water quality. In the average and wet planning scenarios, local catchment run-off, tributary inflows and groundwater contributions will likely meet and exceed these flow requirements in lower Jacksons Creek (reach 7). However, in all planning scenarios, the mandated passing flow and water for the environment will be needed to achieve these watering actions in upper Jacksons Creek (reach 6).

The VEWH is unable to carry over water in the Maribyrnong system to support multi-year planning.

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Table 3.4.2 Potential environmental watering for the Maribyrnong system in a range of planning scenarios

Planning scenario	Dry	Average	Wet
Expected river conditions	• Low volumes of unregulated flow • Passing flow may meet some low-flow objectives • Some baseflow from groundwater contributions in Jacksons Creek	• Unregulated flow meets some objectives • Passing flow may meet several low-flow objectives • Groundwater contributions provide baseflow in Jacksons Creek	• Unregulated flow meets most objectives • Passing flow may meet most low-flow objectives • Groundwater contributions provide baseflow in Jacksons Creek
Expected availability of water for the environment	• There is no environmental entitlement in the Maribyrnong system. Water will need to be traded with willing irrigators to support watering actions		
Jacksons Creek (targeting reach 6)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• N/A		
	Tier 1b (supply deficit)		
	• Winter/spring low flow • Summer/autumn low flow • Summer/autumn freshes (three freshes)	• Winter/spring low flow • Summer/autumn low flow • Summer/autumn freshes (three freshes)	• Winter/spring low flow • Summer/autumn low flow • Summer/autumn freshes (three freshes)
Possible volume of water for the environment required to achieve objectives	• 2,400 ML	• 2,400 ML	• 2,400 ML

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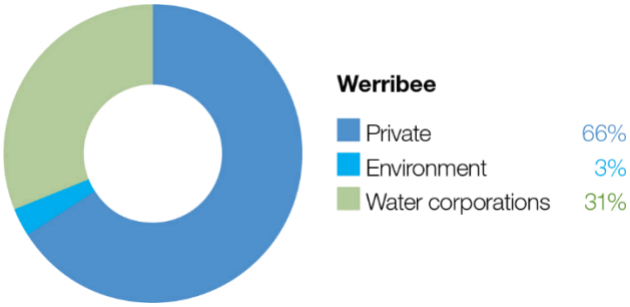
3.5 Werribee system

Waterway manager –Melbourne Water

Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

Proportions of water entitlements in the Werribee basin held by private users, water corporations and environmental water holders on 30 June 2020



System overview

***Wirribi Yaluk* (in Wadawurrung language)/*Weariby Yallok* (in Bunurong language) (Werribee River) flows southeast from the Wombat State Forest near Ballan, through the Werribee Gorge to Bacchus Marsh and then into Port Phillip Bay at Werribee (Figure 3.5.1). The Lerderderg River is a major tributary that joins the river at Bacchus Marsh. The main storages in the Werribee system are Pykes Creek Reservoir, Melton Reservoir and Merrimu Reservoir.**

The four reaches in the Werribee system that can receive water for the environment are Pyrites Creek between Lake Merrimu and Melton Reservoir (reach 6), the Werribee River between Melton Reservoir and the Werribee Diversion Weir (reach 8), Werribee River between the Werribee Diversion Weir and Werribee Park Tourism Precinct (reach 9) and the Werribee River estuary below the Werribee Park Tourism Precinct.

Environmental flows that target environmental objectives in reach 9 and the estuary are delivered from Melton Reservoir and therefore also benefit reach 8. Water for the environment released from Lake Merrimu is re-harvested in Melton Reservoir, where it can be held and released at an appropriate time to achieve environmental objectives in the lower Werribee River.

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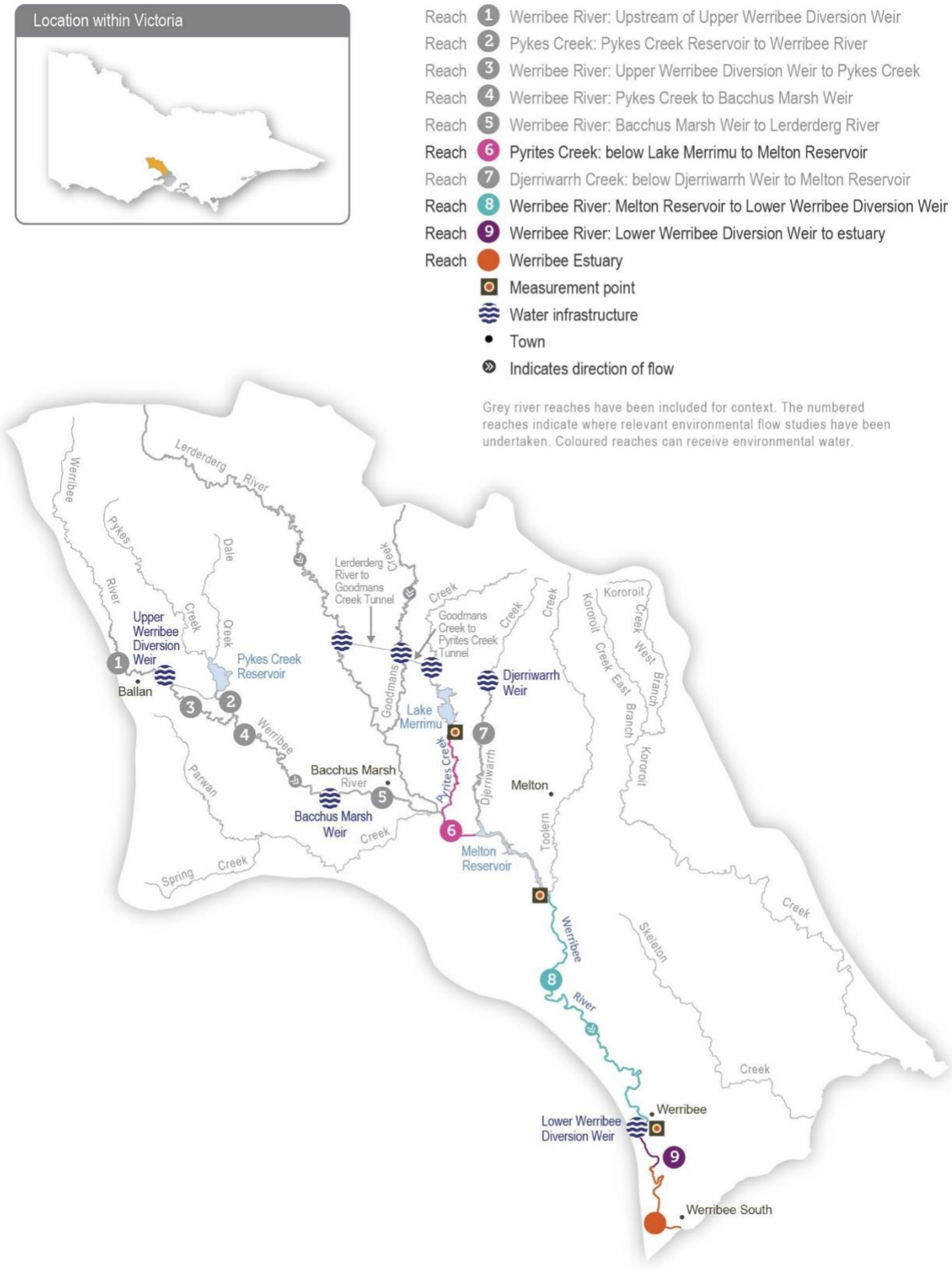
Figure 3.5.1 The Werribee system



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Environmental values

The Werribee system supports a range of native fish, including Australian grayling, river blackfish, flathead gudgeon, short-finned eel, tupong, Australian smelt, several species of galaxiids and a large population of black bream in the estuary. Several species of frogs, a diverse waterbug community and platypus inhabit the upper and lower reaches. The freshwater-saltwater interface of the Werribee River estuary is a regionally significant ecosystem due to the many aquatic plants and animals it supports, and it provides nursery habitat for juvenile freshwater and estuarine fish species (such as black bream).

Environmental objectives in the Werribee system	
	Protect and increase populations of native freshwater fish, including galaxiids and Australian grayling Protect and support populations of black bream in the estuary
	Maintain native frog populations
	Maintain channel beds and pool habitats Maintain clean substrate surfaces to support biological processes
	Maintain the platypus population
	Maintain the health and increase the cover of in-stream, streamside and estuary plants Limit the spread of terrestrial plants, and promote the recruitment of native water-dependent plant species on the banks and benches of waterways
	Maintain and enhance the population of waterbugs, to help break down dead organic matter and support the river's food chain
	Maintain oxygen and salinity levels in pools

Traditional Owner cultural values and uses

Melbourne Water is working with the Registered Aboriginal Parties within the Werribee system – the Wadawurrung Traditional Owners Aboriginal Corporation, the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation and the Bunurong Land Council Aboriginal Corporation – to strengthen relationships and increase Traditional Owners' involvement in the planning and delivery of water for the environment. As of June 2023, an overarching partnership agreement was near completion between Melbourne Water and Wadawurrung Traditional Owners Aboriginal Corporation to frame relations and obligations between the organisations. Melbourne Water was also in discussions with Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation and the Bunurong Land Council Aboriginal Corporation to work towards developing a similar partnership agreement. The intent is for Traditional Owners to be active partners in the planning, delivering and monitoring water for the environment associated with *Wirribi Yaluk/Weariby Yallok* (Werribee River).

All three Registered Aboriginal Parties in the Werribee system were involved in the upper *Wirribi Yaluk/Weariby Yallok* (Werribee River) environmental flows study, completed in 2022-23.

The Bunurong Land Council Aboriginal Corporation is working with Bunurong people to determine the cultural objectives for *Weariby Yallok* (Werribee River) on Bunurong Country. There are concerns about low flow in the lower reaches and that fish of cultural importance to the Bunurong are not supported by the flow and are restricted in movement. This concern may be partially addressed through the implementation of Action 8-10 in the *Central and Gippsland Region Sustainable Water Strategy*, which aims to improve fish passage and the delivery of water for the environment to the lower *Weariby Yallok* (Werribee River) on Bunurong Country.

The Wadawurrung Traditional Owners Aboriginal Corporation has reviewed the environmental values of the *Wirribi Yaluk* (Werribee River) system. It has identified environmental values that also have cultural significance to Wadawurrung Traditional Owners, which the table below shows. However, further work is required to understand how potential environmental watering actions can improve these cultural values.

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Reach	Extent	Key environmental values with cultural significance to the Wadawurrung
8	*Wirribi Yaluk* (Werribee River)	
9	*Wirribi Yaluk* (Werribee River) between Wyndham Vale and Bluestone Ford	
Estuary	Werribee River downstream of Bluestone Ford	

Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.5.1, Melbourne Water considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, fishing, kayaking and swimming)
- riverside recreation and amenity from urban cooling (such as camping, walking, cycling and picnicking)
- community events and tourism (such as Werribee Zoo).

Scope of environmental watering

The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.5.1 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

Table 3.5.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Werribee system

Potential environmental watering action	Expected watering effects	Environmental objectives
Pyrites Creek (targeting reach 6)		
Winter/spring/summer low flow (2 ML/day or natural during June to December)	• Provide sufficient water depth in riffle habitats for macroinvertebrates native fish • Maintain habitat for frogs at the margin of the stream channel • Provide sufficient water depth to support the growth of flood-tolerant vegetation within the stream channel • Provide sufficient water depth to allow for native fish to move between pools	
Winter/spring freshes (three to five freshes of 30-40 ML/day for two days during June to November)	• Drown terrestrial plants that encroach into the waterway • Increase the growth and recruitment of streamside and in-stream vegetation • Transport carbon to drive aquatic food webs • Scour silt, biofilms and algae from substrates to maintain the quality and quantity of food and habitat for waterbugs • Improve water quality and the quantity of food and habitat for waterbugs, frogs and native fish • Wet depressions adjacent to the stream that frogs can use for breeding	

Potential environmental watering action	Expected watering effects	Environmental objectives
Spring high flow (one high flow of 70-130 ML/day for one to two days during September to October)	• Maintain access to food and habitat for waterbugs, native fish and frogs • Increase the growth and recruitment of in-stream vegetation • At 130 ML/day, the effects above plus: • inundate the full width of the channel and high backwaters to flush accumulated organic matter and promote the growth and recruitment of streamside vegetation	
Werribee River (targeting reaches 8, 9 and estuary)		
Winter/spring low flow (80 ML/day during June to November)	• Provide sufficient depth to allow fish to move upstream past natural and artificial barriers • Facilitate the downstream movement of diadromous fish to the estuary • Drown terrestrial plant species and support the growth and recruitment of water-dependent streamside vegetation • Maintain permanent pools and increase the extent of habitat for waterbugs, fish, platypus and frogs • Maintain flow through pool habitats to allow mixing or suppression/dilution of saline groundwater	
Winter/spring freshes (two to four freshes of 350 ML/day for three days during June to October)	• Support the growth and recruitment of water-dependent streamside vegetation • Flush silt and scour biofilms and algae from substrates on the stream bed and maintain pools and channel dimensions • Provide movement cues and enough flow for fish to move upstream past natural and artificial barriers • Maintain water quality and quantity of food and habitat for waterbugs and platypus • Wet depressions adjacent to the stream that frogs can use for breeding	
Summer/autumn low flow (10 ML/day during December to May)	• Maintain habitat for in-stream and water-dependent streamside vegetation • Maintain access to habitat and improve water quality for native fish, frogs, platypus and waterbugs • Maintain flow through pool habitats to allow mixing or suppression/dilution of saline groundwater intrusion	
Summer/autumn freshes (three to five freshes of 135-215 ML/day for one to two days during December to May)	• Increase the growth and recruitment of water-dependent streamside vegetation • Flush silt and scour biofilms and algae from substrates on the stream bed and maintain pools and channel dimensions • Maintain access to habitat and improve water quality for native fish, frogs and platypus • Provide enough flow for native fish to move downstream past natural or artificial barriers • Maintain the quality of water within pools by dispersing azolla and blue-green algae blooms	

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Scenario planning

Table 3.5.2 outlines potential environmental watering and expected water use in a range of planning scenarios.

The Pyrites Creek catchment downstream of Merrimu Reservoir relies on passing flow, operational releases and environmental flows for virtually all of its flow. Recommended watering actions through reach 6 do not vary significantly between planning scenarios due to the need to move water for the environment to Melton Reservoir to support outcomes in the lower reaches of the Werribee River and because this reach relies on releases to maintain any flow. Water for the environment will provide a low flow to maintain enough pool and riffle habitat to allow existing fish, macroinvertebrate and aquatic vegetation communities to persist. Freshes and a high flow will help to achieve geomorphological objectives, improve the condition of in-stream and streamside vegetation and help grow populations of native fish and frogs. The forecast available supply will not be sufficient to deliver all the required flow in the dry planning scenario, so the winter/spring/summer low flow will be delivered for a shorter duration to conserve water for freshes and a high flow. Pyrites Creek is naturally ephemeral, and the freshes are considered more important to maintain and regularly flush pools that will support native fish and frogs.

The lower Werribee River relies on passing flow, operational deliveries and environmental flows to provide a low flow and freshes, but unregulated spills from Melton Reservoir, downstream tributary inflows and local run-off, including stormwater from urbanised areas of Werribee provide a greater flow, especially in wet years. Passing flow and operational deliveries for irrigation customers are expected to partially meet low-flow requirements in the lower Werribee River in all planning scenarios. Water for the environment will be used to top up the low flow when needed throughout the year and to deliver summer/autumn freshes to manage water quality and control potential algal blooms. In all planning scenarios, there is insufficient water for the environment to meet the low-flow demands year-round in the lower Werribee River. In the dry and average planning scenarios, the demands are so large compared to the predicted supply that the demands would not be fully met even if all available water was prioritised for this purpose. For this reason, 'partial compliance' of low flow is the target under tier 1a. A low flow will be topped up as needed to manage water quality or provide longitudinal connectivity for fish and platypus. More work to define critical triggers for action has been identified as a priority area for monitoring in the lower Werribee River. Winter/spring freshes will be used to support the movement and recruitment of native fish and platypus and to support streamside vegetation in the average and wet planning scenarios. More freshes could be delivered in the average and wet planning scenarios than in the dry scenario.

In all scenarios, a minimum of 400 ML is planned to be carried over to ensure high-priority flows can be delivered to Pyrites Creek (reach 6) and the lower Werribee River in 2024-25. Maintaining sufficient carryover in Lake Merrimu and Melton Reservoir will be prioritised over the delivery of tier 1b potential environmental watering actions in 2023-24.

Table 3.5.2 Potential environmental watering for the Werribee system in a range of planning scenarios

Planning scenario	Dry	Average	Wet
Expected conditions	• Regulated flow conditions below Melton Reservoir year-round • Minimal passing flow to reach 6, possible operational water transfers during summer • Consumptive releases out of storage into reach 8 in summer/autumn	• Some spills from Melton Reservoir in winter/spring and periods of unregulated flow in reaches 8 and 9 and the estuary • Most low flow in reach 6 met by passing flow • Consumptive releases out of storage into reach 8 in summer/autumn	• Regular large spills from Melton Reservoir in winter/spring and lengthy periods of unregulated flow in reaches 8 and 9 and the estuary • All low flow in reach 6 provided by passing flow • Consumptive releases out of storage into reach 8 in summer/autumn
Expected availability of water for the environment	• 1,280 ML	• 2,530 ML	• 3,760 ML
Pyrites Creek (targeting reach 6)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Winter/spring/summer low flow (partial compliance) • Winter/spring freshes (three freshes) • Spring high flow	• Winter/spring/summer low flow • Winter/spring freshes (four freshes) • Spring high flow	• Winter/spring/summer low flow • Winter/spring freshes (five freshes) • Spring high flow
	Tier 1b (supply deficit)		
	• Winter/spring/summer low flow (full compliance)	• N/A	• N/A

Planning scenario	Dry	Average	Wet
Werribee River (targeting reaches 8, 9 and estuary)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Summer/autumn low flow (partial compliance) • Summer/autumn freshes (three freshes)	• Winter/spring freshes (two freshes) • Summer/autumn low flow (partial compliance) • Summer/autumn freshes (five freshes)	• Winter/spring freshes (four freshes) • Summer/autumn low flow • Summer/autumn freshes (five freshes)
	Tier 1b (supply deficit)		
	• Winter/spring low flow • Winter/spring freshes (two freshes) • Summer/autumn low flow (full compliance)	• Winter/spring low flow • Winter/spring freshes (two freshes) • Summer/autumn low flow (full compliance)	• Winter/spring low flow
Possible volume of water for the environment required to achieve objectives	• 880 ML (tier 1a) • 18,720 ML (tier 1b)	• 2,130 ML (tier 1a) • 8,100 ML (tier 1b)	• 3,360 ML (tier 1a) • 1,000 ML (tier 1b)

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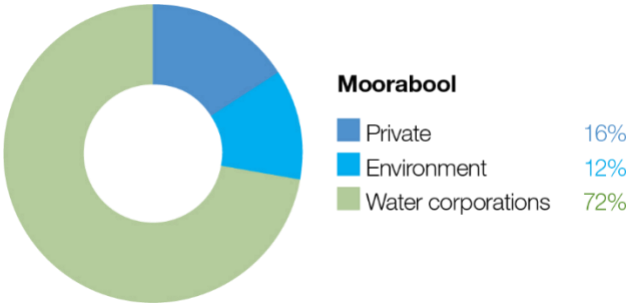
3.6 Moorabool system

Waterway manager – Corangamite Catchment Management Authority

Storage manager – Central Highlands Water

Environmental water holder – Victorian Environmental Water Holder

Proportions of water entitlements in the Moorabool system held by private users, water corporations and environmental water holders on 30 June 2020



System overview

***Moorabool Yulluk* (Moorabool River) is a tributary of the Barwon River. It flows south from the Central Highlands between Ballarat and Ballan to join the Barwon River at Fyansford, just north of Geelong (Figure 3.6.1). The Moorabool catchment is highly regulated with major storages, including Lal Lal, Moorabool and Bostock reservoirs.**

The lower section of the Moorabool River between She Oaks and Batesford has nine private diversion weirs that are significant barriers to fish. These barriers have increased the extent of slow-flowing habitat and reduced habitat diversity.

Water allocated to the Moorabool River environmental entitlement is stored in Lal Lal Reservoir. The entitlement references passing flow, a significant component of annual streamflow and helps maintain a low flow through winter. Water use is limited by inflows to the reservoir and by a use cap specified in the entitlement. The priority reaches for deliveries of water for the environment are between Lal Lal Reservoir and She Oaks Weir (reaches 3a and 3b, as shown in Figure 3.6.1), as that is where the small amount of available water can have the most benefit. Environmental flows may also benefit flow-dependent values in the reach between She Oaks Weir and the confluence with the Barwon River.

The Moorabool system is a water supply catchment for Barwon Water and Central Highlands Water. Releases from Lal Lal Reservoir for urban water supply contribute to environmental outcomes in reach 3a and 3b (above Barwon Water's diversion point at She Oaks) and allow more efficient delivery of water for the environment to reach 4. Barwon Water and the Corangamite CMA coordinate operational and environmental releases, where possible, to optimise these benefits.

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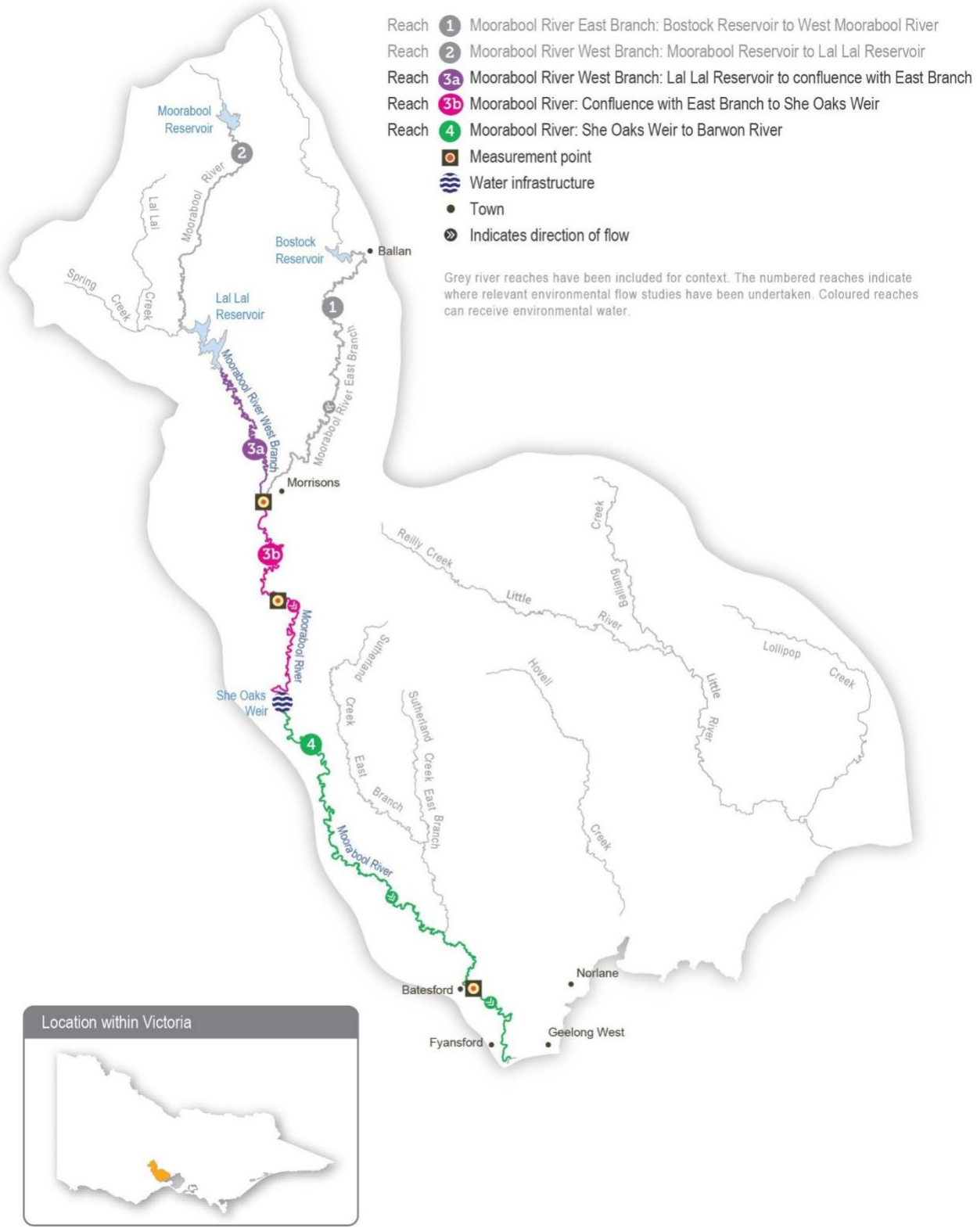
Figure 3.6.1 The Moorabool system



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Environmental values

The Moorabool River is a highly flow-stressed system, but it retains significant environmental values. The river is home to native fish species, including the Australian grayling, river blackfish, Australian smelt, flat-headed gudgeon, southern pygmy perch, short-finned eel, spotted galaxias and tupong. The system also contains extensive areas of endangered remnant vegetation, including streambank shrubland and streamside woodland ecological vegetation communities. Platypus, rakali (water rats) and a range of waterbugs are also present. The Moorabool River flows into the Barwon River, connecting it to the Ramsar-listed lower Barwon wetlands.

Environmental objectives in the Moorabool system	
	Increase the distribution, abundance and diversity of migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey and Australian grayling) Increase the distribution, abundance and diversity of non-migratory species (flat-headed gudgeon, Australian smelt, southern pygmy perch and river blackfish)
	Maintain channel form and processes Maintain diverse physical habitat
	Maintain a self-sustaining breeding population of platypus and support the dispersal of juveniles and the movement of adults
	Maintain in-stream macrophyte communities Maintain streamside vegetation communities and promote recruitment
	Maintain the abundance and diversity of waterbug communities
	Maintain water quality Prevent hypoxic blackwater events

Traditional Owner cultural values and uses

The Wadawurrung are the Traditional Owners of the land of *Moorabool Yulluk* (Moorabool River) and parts of the Barwon, Leigh and Yarrowee rivers.

Wadawurrung Traditional Owners have a strong connection to *Moorabool Yulluk* (Moorabool River) and place high cultural value on it. The Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) is a key partner in advocating for additional water recovery to help support a healthy river and associated cultural water objectives.

In 2020, WTOAC released *Paleert Tjaara Dja Let's make Country good together 2020 – 2030 Wadawurrung Country Plan*. The plan identifies waterways, rivers, estuaries and wetlands – Yulluk – as key values to look after.

In 2019, the WTOAC partnered with the Corangamite CMA to complete an environmental flows study for the upper Barwon, Yarrowee and Leigh rivers. Environmental flows studies are essential technical references for river managers that identify the types of flows needed to support environmental values in a river system. The 2019 flows study also identified cultural values in all waterways within Wadawurrung Country, including *Moorabool Yulluk* (Moorabool River).

The values include:

- significant aquatic species such as *wad-dirring/peridak* (platypus), *buniya* (short-finned eel), *turrpurt* (tupong), *ware-up* (river blackfish), *tark* (common reed) and *bal-yan* (bull rush), which are traditional sources of food, materials and medicines
- waterway confluences and deep pools, which are places for meeting, ceremonies, trade and marking clan boundaries.

In early 2023, a meeting was held between the Corangamite CMA and WTOAC to discuss proposed 2023-24 environmental flows in the *Moorabool Yulluk* (Moorabool River). WTOAC supports the proposed environmental flows and may partner with the Corangamite CMA to coordinate the delivery of summer/autumn freshes and some winter/spring freshes to coincide with cultural events.

Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.6.1, the Corangamite CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as camping, fishing, kayaking and swimming)
- riverside recreation and amenity (such as birdwatching, bushwalking, camping, picnicking and lookouts), community events and tourism.

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If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 3.6.1 with the following icon.

Watering planned to support peaks in visitation (e.g. camping or other public activities on long weekends or school holidays)

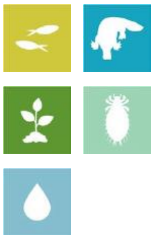
Summer/autumn freshes provide a freshening flow in the Moorabool River and are planned to coincide with school and public holidays where possible. This freshened flow improves riverside and water-based recreation opportunities, particularly camping and fishing.

Scope of environmental watering

The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.6.1 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

Table 3.6.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Moorabool system

Potential environmental watering action	Expected watering effects	Environmental objectives
Moorabool River (targeting reach 3a)		
Winter/spring low flow (5-60 ML/day during June to November)	• Maintain in-stream vegetation • Maintain connectivity and allow fish movement through the reach • Maintain pool and riffle habitat for platypus and native fish • Reduce intrusion by terrestrial vegetation into the stream bed	
Autumn/winter/spring freshes (two to three freshes of 80-90 ML/day for five to 10 days during May to November)	• Maintain pool and riffle habitats and provide connectivity to support fish and platypus movement through the reach • Trigger downstream spawning migration of tupong (May-August) and upstream migration of juvenile *turrpurt* (galaxias), tupong, *buniya* (short-finned eel) and Australian grayling (September-November) • Temporarily inundate the lower part of the riverbank to maintain species diversity of the fringing vegetation and promote the growth and recruitment of streamside vegetation • Flush silt, scour pools and remove biofilms from hard substrates and the stream bed to maintain waterbug communities and transport organic matter to prevent blackwater events	
Summer/autumn low flow (5-40[1] ML/day during December to May)	• Maintain refuge pools and riffle habitat for fish, waterbugs and platypus and submerged aquatic vegetation • Maintain water quality for aquatic life by reducing periods of low oxygen, high temperature and high salinity	
Small summer/autumn fresh (one fresh of 30-60 ML/day for three days during February to March) 	• Maintain pool and riffle habitat and the condition of streamside vegetation and water-fringing marginal zone vegetation, and promote recruitment • Allow fish movement through the reach	

Potential environmental watering action	Expected watering effects	Environmental objectives
Large summer/autumn fresh(es) (one to two freshes of 60-80 ML/ day for five days during December to May) 	• Trigger the downstream spawning migration of adult *buniya* (short-finned eel) (January-February), tupong (May-August), Australian grayling (April-May) and short-headed lamprey • Maintain pool and riffle habitat and the condition of streamside vegetation, and promote recruitment • Allow fish and platypus to move through the reach to access habitat • Flush silt and scour biofilms and algae from the stream bed and substrates to improve habitat quality for waterbugs • Maintain water quality by reducing periods of low oxygen, high water temperature and salinity	
Year-round freshes (trigger-based, of 30 ML/ day for three days) *Triggers: oxygen below 5 mg/L; electrical conductivity above 10,000 µs/cm; water temperature above 25°C*	• Maintain water quality by reducing periods of low oxygen, high water temperature and salinity	

1 The flow will generally target between 5 and 20 ML per day at the compliance point, but 40 ML per day could be achieved in combination with Barwon Water's transfer to She Oaks Weir and passing flow.

Scenario planning

Table 3.6.2 outlines potential environmental watering and expected water use in a range of planning scenarios.

There is limited variation in the proposed watering regime year to year due to high confidence in the water made available by the *Moorabool River Environmental Entitlement 2010*. Up to 7,086 ML can be stored, but a maximum of 7,500 ML can be used over three consecutive years. Use in 2023-24 will be restricted to 2,500 ML where possible to ensure sufficient water can be delivered in subsequent years.

The Moorabool River requires a continuous low flow throughout the year and periodic freshes in all planning scenarios to achieve the intended environmental outcomes.

In the drought and dry planning scenarios, the main objective is to provide sufficient habitat to maintain existing populations of native fish and platypus, and the flow can therefore be at the lower end of its recommended size range and frequency to ensure connecting flows are maintained for as long as possible. Water for the environment may be added to operational transfers at times to increase flow variability downstream of Lal Lal Reservoir and to maintain some flow in the reaches downstream of She Oaks Weir once operational water is diverted. Even with these proposed watering actions, sections of the Moorabool River are likely to periodically cease flowing in the dry or drought planning scenarios, which would reduce the river's environmental condition and the size of plant and animal populations. In the drought planning scenario, water quality will be regularly monitored to inform the delivery of trigger-based, year-round freshes as needed.

In the average and wet planning scenarios, most of the recommended flow is expected to be provided through a combination of the natural flow, passing flow and operational releases, which will mean water for the environment can be used to deliver additional freshes to improve environmental conditions and increase populations of native plants and animals. Delivering one large summer/autumn fresh in April/May will be a high priority in all planning scenarios to trigger Australian grayling migration and spawning. In the average and wet planning scenarios, a second large summer/autumn fresh is proposed for January/ February to maintain and grow Australian grayling populations. Two large summer/autumn freshes occurred in the Moorabool system in 2021-22 and 2022-23.

Although environmental flows in the Moorabool River primarily target outcomes in reaches 3a and 3b, deliveries will be planned where possible to also provide benefits in reach 4.

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Table 3.6.2 Potential environmental watering for the Moorabool system in a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Little rainfall with no inflow to Lal Lal Reservoir • Regular periods of no flow	• Below-average rainfall and inflow to Lal Lal Reservoir • Cease-to-flow events	• Average rainfall and moderate inflows to Lal Lal Reservoir, especially during winter and spring • Low flow over summer and high peaks in winter months	• Lal Lal Reservoir is likely to fill and spill • Continuous flow year-round • Overbank flow in some parts during winter/spring
Expected availability of water for the environment	• 2,500 ML[1]			
Moorabool River (targeting reach 3a)				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Winter/spring low flow (5 ML/day) • Summer/autumn low flow (5 ML/day) • Large summer/autumn fresh (one fresh of 60 ML/day) • Year-round fresh(es) (one or two freshes if required)	• Winter/spring low flow (5 ML/day) • Autumn/winter/spring fresh (one fresh for five days of 80 ML/day) • Summer/autumn low flow (5 ML/day) • Large summer/autumn fresh (one fresh of 60 ML/day)	• Winter/spring low flow (5-10 ML/day) • Autumn/winter/spring fresh (one fresh for five days of 80 ML/day) • Summer/autumn low flow (5 ML/day) • Small summer/autumn fresh (one fresh of 30 ML/day) • Large summer/autumn freshes (two freshes of 60 ML/day)	• Winter/spring low flow (of greater than 10 ML/day) • Autumn/winter/spring freshes (three freshes) • Summer/autumn low flow (of greater than 10 ML/day) • Small summer/autumn fresh (one fresh of 30 ML/day) • Large summer/autumn freshes (two freshes of 60 ML/day)
	Tier 1b (supply deficit)			
	• Autumn/winter/spring freshes (two freshes for five days of 80 ML/day)	• Autumn/winter/spring fresh (one fresh for five days of 80 ML/day)	• Autumn/winter/spring freshes (two freshes for five days of 80 ML/day)	• N/A
Potential environmental watering – tier 2 (additional priorities)	• Tier 1a and 1b watering actions delivered at the upper end of the recommended magnitude range			
Possible volume of water for the environment required to achieve objectives	• 2,493 ML (tier 1a) • 1,130 ML (tier 1b) • 2,440 ML (tier 2)	• 2,508 ML (tier 1a) • 565 ML (tier 1b) • 2,440 ML (tier 2)	• 2,510 ML (tier 1a) • 990 ML (tier 1b) • 14,900 ML (tier 2)	• 780 ML (tier 1a) • 0 ML (tier 1b) • 9,400 ML (tier 2)
Priority carryover requirements for 2024-25	• The environmental entitlement for the Moorabool system caps use at 7,500 ML over three years. Use in 2023-24 will be capped at 2,500 ML, which will leave sufficient allocation to support watering actions in 2024-25 and 2025-26			

1 Up to 7,086 ML can be stored under the *Moorabool River Environmental Entitlement 2010*. However, the entitlement is subject to delivery rules – a maximum of 7,500 ML over three consecutive years – which restricts available water to an average of 2,500 ML per year.

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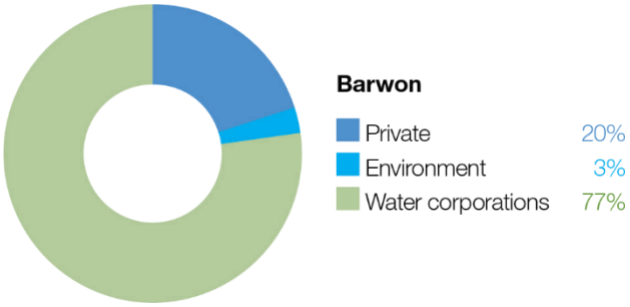
3.7 Barwon system

Waterway manager – Corangamite Catchment Management Authority

Storage manager – Barwon Water

Environmental water holder – Victorian Environmental Water Holder

Proportions of water entitlements in the Barwon basin held by private users, water corporations and environmental water holders on 30 June 2020



The Barwon system includes the upper Barwon River and lower Barwon wetlands.

The Barwon River flows east from the Otway Ranges, passing the towns of Forrest, Birregurra, Winchelsea and Inverleigh and the City of Geelong before discharging into Bass Strait at Barwon Heads. The Leigh and Moorabool rivers are major tributaries, joining the Barwon River at Inverleigh and Fyansford, respectively. Other tributaries, including Birregurra, Boundary, Callahan, Dewing, Matthews, Pennyroyal, Deans Marsh and Gosling creeks, flow into the Barwon River above Winchelsea. The main storages in the Barwon River catchments are the West Barwon and Wurdee Boluc reservoirs.

The Barwon estuary contains a Ramsar-listed system of wetlands and lakes collectively called the lower Barwon wetlands. Water for the environment can be used to manage the flow in the upper Barwon River and manage water levels in Reedy Lake and Hospital Swamps, which connect to the lower Barwon River.

3.7.1 Upper Barwon River

System overview

The operation of the West Barwon Reservoir regulates flows in the upper Barwon River. Water can be released directly from the reservoir into the west branch or into the east branch via a diversion tunnel. The junction of the two branches is near Boundary Creek. Downstream of the reservoir, operational water can be diverted into the Wurdee Boluc inlet channel, a 57 km concrete-lined channel that transfers water to Wurdee Boluc Reservoir.

Barwon Water releases passing flow in the order of 1-5 ML per day in both the upper east and west branch from the West Barwon Reservoir. These releases may increase to 15 ML per day in September in a wet year. When the reservoir holds more than 40,000 ML, all the natural flow is passed down the east branch between January and March. Flood spills from the reservoir and natural inflows from unregulated and regulated tributaries add to the passing flow in the west branch. Regulated and unregulated tributaries add to the passing flow in the east branch.

The *Upper Barwon River Environmental Entitlement 2018* enables water for the environment to be made available from the West Barwon Reservoir. The entitlement provides an average of 1,000 ML per year and up to 2,000 ML of the total storage capacity at full supply. Water for the environment was first delivered to the upper Barwon River in 2018-19. The current entitlement provides only enough water to meet the highest-potential environmental watering actions in the upper Barwon east branch (reach 4) and the upper Barwon west branch (reach 3) under particular climatic conditions.

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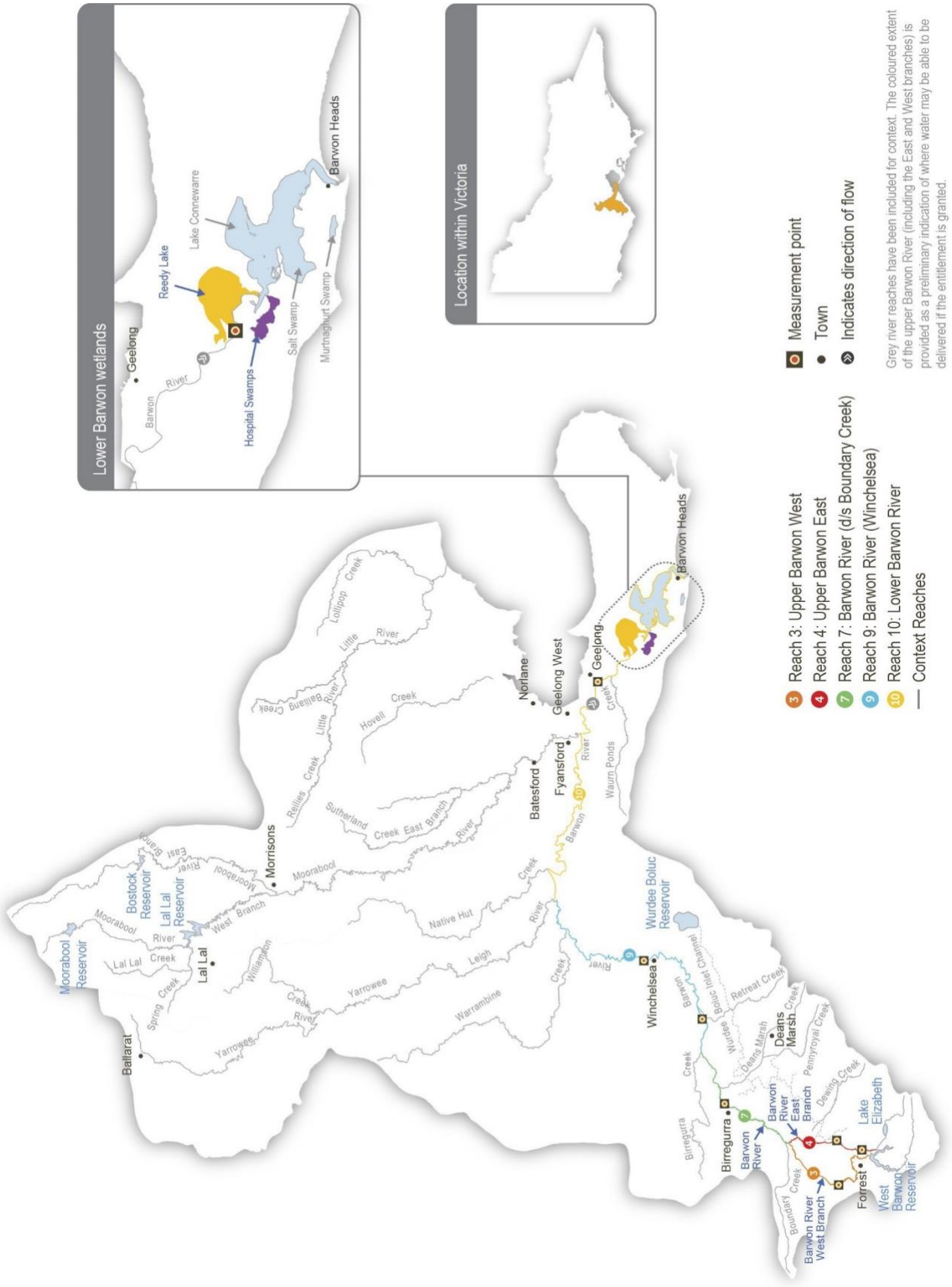
Figure 3.7.1 The Barwon system



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Environmental values

The upper Barwon River is home to native fish species, including the Australian grayling, river blackfish, short-finned eel, southern pygmy perch, Australian smelt and various galaxias. The system retains some submerged aquatic vegetation, undercut banks, overhanging vegetation and riffle-pool sequences, which provide important habitat for fish and other aquatic animals.

Long-term environmental objectives for the upper Barwon system are based on delivering watering actions recommended in the *Upper Barwon, Yarrowee and Leigh rivers Environmental FLOWS Study*. These include improving the breeding and recruitment of various fish, platypus and macroinvertebrate species, as well as improving the condition, extent and diversity of in-stream, emergent, streamside and floodplain vegetation. However, due to the limited entitlement to water for the environment and channel constrictions, the recommended flow magnitudes have been modified to less than the known channel constraints. It is unlikely that there will be significant improvements in the river's ecological condition by delivering the watering actions in this plan. Until works are carried out to address channel constraints and other factors (such as unrestricted livestock access and weed infestation), this plan's potential environmental watering actions aim to maintain the current ecological condition and prevent cease-to-flow events.

Environmental objectives in the upper Barwon River	
	Maintain the abundance of migratory fish species, including short-finned eels, Australian grayling and tupong Maintain the abundance of resident freshwater fish, including several species of galaxias, Australian smelt, big-headed gudgeon, Yarra pygmy perch, southern pygmy perch and river blackfish
	Maintain the abundance of platypus populations
	Maintain the condition and extent of in-stream vegetation to provide structural habitat for waterbugs and various fish species Maintain the condition, extent and diversity of emergent macrophyte vegetation and streamside vegetation to provide structural habitat and stabilise the channel and lower banks
	Maintain the abundance of waterbugs as a food source for fish, frog and platypus populations
	Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals

Traditional Owner cultural values and uses

The reaches of the Barwon River that can be most influenced by water delivered from the West Barwon Reservoir sit on Eastern Maar Country.

In February 2020, the Eastern Maar Aboriginal Corporation (EMAC) received Registered Aboriginal Party (RAP) status under the Victorian *Aboriginal Heritage Act 2006* over a large portion of land in south-west Victoria, including the Barwon River upstream of Winchelsea. In 2023 Eastern Maar gained formal recognition of their rights under the Commonwealth *Native Title Act 1993* for over half of the RAP area, adding to initial recognition in 2011 under the Native Title Act, though further areas remain in negotiation. Native Title determination acknowledges Eastern Maar's ongoing connection and intrinsic relationship to Country across south-west Victoria, including parts of the Barwon River catchment.

Eastern Maar obligations to Country and objectives for Country are described in the Eastern Maar Country Plan *Meerreengeeye Ngakeepoorryeeyt*. Eastern Maar assertions for parreeyt (water) are further documented in Eastern Maar's Nation Statement *(Water is Life: Traditional Owner Access to Water Roadmap 2022)*.

In early 2023, a meeting was held between the Corangamite CMA and EMAC to discuss proposed 2023-24 environmental flows in the upper Barwon River. EMAC also reviewed and provided feedback about the Corangamite CMA's upper Barwon seasonal watering proposal, which outlined proposed environmental flows for the year ahead.

The Corangamite CMA is also working with Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) to understand opportunities to provide for cultural values and uses and other aspirations for the management of water for the environment in the Barwon River downstream of Winchelsea, on Country where WTOAC holds Registered Aboriginal Party status. In early 2023, the Corangamite CMA met with WTOAC to discuss environmental flows management in the Barwon River.

EMAC and WTOAC have formal plans for how to heal Country in the region, and the Corangamite CMA continues to work with them to identify their cultural objectives and associated values and uses that align with environmental flows.

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Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.7.1, the Corangamite CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, kayaking, swimming and fishing, particularly for river blackfish)
- riverside recreation and amenity (such as birdwatching, camping and walking)
- socioeconomic benefits (such as for diverters for stock needs and domestic use: water levels and water quality can rely on the delivery of water for the environment, particularly in summer).

Scope of environmental watering

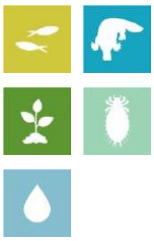
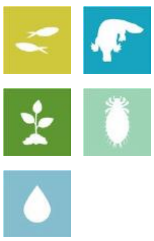
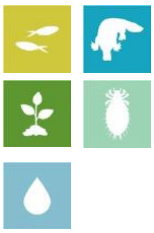
The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.7.1 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

Table 3.7.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the upper Barwon River

Potential environmental watering action	Expected watering effects	Environmental objectives
Upper Barwon River (targeting reach 3 – west branch)		

Winter/spring low flow (3-30 ML/day during June to November)
Summer/autumn low flow (3-30 ML/day during December to May)
	• Maintain permanent water in the channel/pools to provide habitat to support resident and migratory fish, platypus and waterbugs
	• With a low flow of 30 ML/day:
	  • maintain an adequate depth of permanent water in the channel to promote the recruitment of aquatic and streamside plants and to limit the encroachment of terrestrial species
	  • provide minimum velocity to mix and flush pools
		

Upper Barwon River (targeting reach 4 – east branch)		
Winter/spring low flow (1-9 ML/day during June to November)	• Maintain an adequate depth of permanent water in the channel and pools to provide habitat to support resident and migratory fish, platypus and waterbugs • Maintain an adequate depth of permanent water in the channel to promote the recruitment of aquatic and streamside plants and to limit the encroachment of terrestrial species • Provide sufficient flow velocity to mix pools	
Summer/autumn low flow (0.5-5 ML/day during December to May)	• Maintain an adequate depth of permanent water in the channel/pools to provide habitat to support resident and migratory fish, platypus and waterbugs • Reduce encroachment by terrestrial plants into the aquatic zone • Provide minimum velocity to mix pools	
Summer/autumn freshes (two to three freshes of 6-9 ML/day for two days during December to May)	• Increase the water depth in the channel and pools to provide habitat to support resident and migratory fish, platypus and waterbugs • Provide a mosaic of wetted areas to improve emergent and streamside vegetation • Provide minimum velocity to mix pools • With freshes of 9 ML/day: • provide longitudinal connectivity where the water depth exceeds 0.2 m over riffles to allow platypus to move between pools to breed, feed and find new habitats	

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Scenario planning

Table 3.7.2 outlines potential environmental watering and expected water use in a range of planning scenarios.

Planned watering actions for the upper Barwon River are derived from recommendations in the *Upper Barwon, Yarrowee and Leigh rivers Environmental FLOWS Study*. Many of the flow magnitudes recommended in the study cannot be delivered due to the size of the environmental entitlement and the risk of inundating private land.

The planned watering actions presented in Table 3.7.2 are deliberately less than the known channel capacity constraints and would provide a lower environmental benefit. Given the limitation described above, the primary aim of watering actions is to deliver enough flow through the system to maintain pool habitat and food – waterbugs – for aquatic animals. A low flow will aim to prevent or limit cease-to-flow events, and small freshes will be delivered as needed to manage potential water quality issues. The magnitude of these freshes will vary in different planning scenarios, depending on supply. The overall approach to environmental flows in the upper Barwon River in 2023-24 will help maintain existing populations, and it relies on natural events to deliver the greater flow needed to facilitate the movement and potential breeding of fish and platypus.

The Corangamite CMA will monitor conditions during deliveries of water for the environment in 2023-24 so that release rates can be promptly adjusted to avoid inundating private land and affecting streamside landholders. The Corangamite CMA will continue to work with relevant agencies and landholders to investigate options that will allow future deliveries of water for the environment to be closer to their recommended magnitude, without affecting private land. The Upper Barwon Flagship Project is a newly established, integrated catchment management project working with stakeholders to address flow restrictions through streamside management and to improve the overall health of the upper Barwon River.

The carryover reserve for 2024-25 for the upper Barwon River is 500 ML, the drought reserve amount agreed upon with the Upper Barwon Surface Water Advisory Group.

Table 3.7.2 Potential environmental watering for the upper Barwon River in a range of planning scenarios

Planning scenario	Dry	Average	Wet
Expected conditions	• Disconnected pools during summer and autumn • Cease-to-flow events	• Low flow in summer and autumn • Peak flow in winter and spring	• Continuous flow throughout the year • Reservoir spills are likely, especially during winter and spring
Expected availability of water for the environment	• 2,500 ML	• 3,000 ML	• 3,500 ML
Upper Barwon River (targeting reach 3 – west branch)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Summer/autumn low flow (delivered at a lower magnitude in the range)	• Summer/autumn low flow (delivered at a lower magnitude in the range)	• Summer/autumn low flow
	Tier 1b (supply deficit)		
	• Winter/spring low flow • Summer/autumn low flow (delivered at a higher magnitude)	• Winter/spring low flow • Summer/autumn low flow (delivered at a higher magnitude)	• Winter/spring low flow
Potential environmental watering – tier 2 (additional priorities)	• N/A		

Planning scenario	Dry	Average	Wet
Upper Barwon River (targeting reach 4 – east branch)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Summer/autumn low flow • Summer/autumn freshes (two freshes)	• Summer/autumn low flow • Summer/autumn freshes (two freshes)	• Summer/autumn low flow • Summer/autumn freshes (three freshes) • Winter/spring low flow
	Tier 1b (supply deficit)		
	• Winter/spring low flow	• Winter/spring low flow	
Potential environmental watering – tier 2 (additional priorities)	• N/A		
Possible volume of water for the environment required to achieve objectives	• 1,947 (tier 1a) • 6,697 (tier 1b)	• 2,513 (tier 1a) • 4,308 (tier 1b)	• 2,986 (tier 1a) • 2,896 (tier 1b)
Priority carryover requirements for 2024-25	• 500 ML		

3.7.2 Lower Barwon wetlands

System overview

The estuarine reach of the Barwon River contains a system of wetlands and lakes, including Lake Connewarre, Reedy Lake and Hospital Swamps, Salt Swamp and Murtnaghurt Lagoon. For thousands of years, the system has been a place of great significance to the Wadawurrung Traditional Owners. *Paleert Tjaara Dja Let's make Country good together 2020 – 2030 Wadawurrung Country Plan* acknowledges the special place the system has in their Dreaming: '*The chain of ponds from the Barwon River to Reedy Lake, Hospital Lake, Lake Connewarre and Estuary Bay is connected through water and our Connewarre (Black Swan) Dreaming*'.

Water for the environment can be used to manage water levels in Reedy Lake and Hospital Swamps, which connect to the Barwon River. The environmental entitlement for the lower Barwon wetlands does not provide access to water held in storage. Instead, it allows water to be diverted from the Barwon River into Reedy Lake and Hospital Swamps when river levels are above 0.7 m AHD. High water levels in the Barwon River can also result in the natural wetting of the wetlands.

Environmental values

Reedy Lake and Hospital Swamps form part of the internationally recognised Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site, which is used by many thousands of migratory birds from around the world. The wetlands support 47 known threatened plant and animal species and communities. These include some of Victoria's rarest species (such as the brolga, orange-bellied parrot, Australasian bittern, growling grass frog, Australian grayling and dwarf galaxias) and subtropical and temperate coastal saltmarsh communities. Reedy Lake also supports a range of vegetation communities, including coastal saltmarsh, herbfields and reed beds.

Reedy Lake was naturally a partly ephemeral system, but river regulation meant the lake was nearly permanently wet from the 1970s until 2016. This long-term wetting resulted in a decline in biodiversity, so wetting and drying regimes are now recommended to maintain the lake's ecological character and diverse habitats.

Following a four-year (2016-17 to 2019-20) watering regime trial at Reedy Lake, the Lower Barwon Review in 2020 proposed to implement a long-term, seasonally adaptive water regime that avoids complete drying. At Reedy Lake, this means having the wetland full for a quarter of all years and having a partial drawdown in summer and autumn in three-quarters of all years. The review's recommendations informed 2023-24 watering actions and future directions.

Hospital Swamps comprises five wetland basins that support important ecological processes and significant ecological values, including large areas of threatened coastal saltmarsh and diverse waterbird communities. Hospital Swamps has retained a more natural wetting and drying pattern. As a result, the swamp's vegetation community has remained largely unchanged since the 1980s.

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Environmental objectives in the lower Barwon wetlands	
	Provide habitat for fish breeding and growth and improved conditions for migration and dispersal when wetlands are connected to the Barwon River Reduce carp populations
	Maintain nutrient cycling and improve lake productivity Improve soil health
	Increase the diversity of ecological vegetation communities in the wetlands and increase the recruitment of aquatic vegetation Increase the growth and extent of coastal saltmarsh, herbfields and lignum shrubland ecological vegetation communities Retard colonisation of tall reed in low-lying areas and increase open-water habitat Provide varying water levels and conditions to promote soil salinisation and support the persistence and growth of threatened, salt-dependent ecological vegetation communities
	Provide suitable feeding and breeding habitat for waterbirds, including mudflats and shallow water for wading birds, flooded vegetation and wetland fringes Maintain waterbird breeding events
	Increase the waterbug population and its biomass
	Provide flushing inflows to remove accumulated salts Maintain surface water and groundwater interactions

Traditional Owner cultural values and uses

The Corangamite CMA works with the Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) during the development of plans to deliver water for the environment for the lower Barwon wetlands. This is part of an ongoing conversation to respect and incorporate Wadawurrung knowledge and culture in decision-making, with the aim of meeting watering requirements for culturally significant species.

In early 2023, a meeting was held between the Corangamite CMA and WTOAC to discuss the proposed 2023-24 management of environmental flows in the lower Barwon wetlands. WTOAC supports the proposed watering.

WTOAC is a member of the Lower Barwon Community Advisory Committee.

WTOAC released *Paleert Tjaara Dja Let's make Country good together 2020 – 2030 Wadawurrung Country Plan* in 2020. Important cultural values and recommendations identified for the lower Barwon wetlands include:

- culturally significant wetland species such as *porronggitj* (brolga), *toolim* (black duck), *kunuwarra* (black swan), *buniya* (short-finned eel), *tark* (common reed) and *bal-yan* (bull rush)
- recognition of wetlands as meeting, ceremony and trade places
- maintaining water holes and refuge pools
- maintaining access to culturally important story places and ceremonial places
- protection of artefact sites
- use of appropriate Wadawurrung language for places of cultural importance
- increased opportunities for the Wadawurrung to be involved in monitoring and evaluation activities
- inclusion of the Wadawurrung in all communication about releases of water for the environment and other wetland-related activities.

Paleert Tjaara Dja acknowledges the special place Reedy Lake and Hospital Swamps have in Wadawurrung Dreaming: *"The chain of ponds from the Barwon River to Reedy Lake, Hospital Lake, Lake Connewarre and Estuary Bay is connected through water and our Connewarre (Black Swan) Dreaming"*.

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Social, recreational and economic values and uses

In planning the potential environmental watering actions in Table 3.7.3, the Corangamite CMA consulted widely with stakeholders to ensure it considered shared benefits, including social, economic and recreational values relevant to environmental flows management in the lower Barwon wetlands. Opportunities for social, recreational and economic values and uses are incorporated into planning and watering decisions if they do not compromise environmental outcomes.

Expert advice (such as the 2012 environmental flows study for the lower Barwon wetlands and the 2020 Lower Barwon Review) emphasised that the entire lower Barwon recommended watering regime – providing a fill to the wetlands and allowing water levels to draw down at the right times – would have to be implemented to improve biodiversity and protect the long-term health of the wetlands. This may mean it is not possible to meet some community expectations for shared benefits that don't maintain or improve environmental outcomes. However, the Corangamite CMA, where possible, manages water levels in the wetlands to meet ecological requirements and also support a range of social, economic and recreational values and uses, including:

- water-based recreation (such as boating, duck hunting and fishing)
- wetlands recreation and amenity (such as birdwatching and spending time outdoors)
- community events and tourism (such as community events and Traditional Owner events)
- socioeconomic benefits (such as commercial fishing).

The Corangamite CMA works with its community advisory group and stakeholders and seeks to accommodate their interests where possible while maintaining the overall health of the wetlands.

Scope of environmental watering

The term 'environmental watering' refers to the active delivery of water for the environment to support particular environmental objectives by altering the flow in a river or the water level in a wetland. While other terms are also used to describe the delivery of water for the environment, 'environmental watering' is deliberately used here and in seasonal watering statements to ensure consistency in the legal instruments that authorise the use of water for the environment in Victoria.

Table 3.7.3 describes the potential environmental watering actions in 2023-24, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

Table 3.7.3 Potential environmental watering actions, expected watering effects and associated environmental objectives for the lower Barwon wetlands

Potential environmental watering action	Expected watering effects	Environmental objectives
Reedy Lake		
Autumn/winter/spring fill (April to November) and top-ups as required (year-round) (targeting 0.8 m AHD)	• Maintain a mosaic of water depths and resources across the wetland to support waterbird breeding events • Inundate fringing wetland vegetation to provide foraging habitat for waterbirds • Maintain a sufficient depth of water around wetland vegetation to provide fish breeding habitat • Temporarily inundate the outer edges of the wetland to initiate the growth and recruitment of diverse vegetation communities while permanently inundating the inner wetland vegetation communities • Allow fish to move between the river, lake and estuary • Stimulate waterbug communities to breed for waterbird feeding • Dilute soil and surface water salts and initiate the decomposition of organic matter	

Potential environmental watering action	Expected watering effects	Environmental objectives
Summer/autumn drawdown (December to May) (targeting 0.3 m AHD)	• Dry out wetland fringing vegetation to reduce potential waterlogging of saltmarsh communities to support germination • Expose mudflats and margins to provide feeding habitat for wading/ migratory waterbirds • Manage reed colonisation of low-lying areas by allowing drying and saline groundwater intrusion to reduce reed growth • Support a drying phase for vegetation communities that require drying to grow and recruit • Restrict carp movement and access to habitat • Allow vegetation to decay and soils to oxidise and release nutrients to improve lake productivity and maintain biogeochemical processes • Enable surface water/groundwater interaction by allowing saline groundwater to discharge to the wetland bed	
Hospital Swamps		
Autumn/winter/spring fill (April to November) and top-up as required (year-round) (targeting 0.5 m AHD)	• Maintain a mosaic of water depths and resources across the wetland and inundate various vegetation communities and create nesting, breeding and feeding opportunities for waterbirds, fish and waterbugs • Increase water levels to trigger fish spawning and waterbird breeding; high water levels will allow fish to access the wetland from the river • Increase freshwater to dilute the salt in the soil and surface water over winter • Initiate the decomposition of organic matter • Inundate the outer edges and margins to initiate the growth and maintain the condition of important wetland vegetation communities	
Summer/autumn drawdown (December to May) (targeting 0.1-0.3 m AHD)	• Dry out the wetland fringing vegetation and expose mudflats and margins to support the feeding of wading/migratory waterbirds • Manage reed colonisation of low-lying areas by allowing drying and saline groundwater intrusion to reduce reed growth • Support a drying phase for vegetation communities that require drying to grow and recruit • Restrict carp movement and access to habitat • Allow vegetation to decay and soils to oxidise and release nutrients to improve lake productivity and maintain biogeochemical processes • Enable the interaction of surface water and groundwater by allowing saline groundwater to discharge to the wetland bed	

Scenario planning

Table 3.7.4 outlines potential environmental watering and expected water use in a range of planning scenarios.

As explained under ‘Environmental values’ above, a four-year watering regime trial was conducted at Reedy Lake from 2016-17 to 2019-20, and an independent review of the trial was completed in 2020. That review concluded that the wetting and drying regimes for Reedy Lake and Hospital Swamps were largely appropriate, but the timing of planned drawdowns should be adapted to avoid disrupting significant waterbird breeding events.

Wet conditions in recent years have prevented the target drawdown at Reedy Lake since 2019-20 and are expected to prevent the target drawdown in Hospital Swamps in 2022-23. Therefore, partial summer/autumn drawdowns are a priority at both sites in all planning scenarios in 2023-24.

Drawdowns at Reedy Lake and Hospital Swamps support waterbird breeding and provide muddy margins for migratory shorebirds that actively forage in mudflats during summer and early autumn before returning to the Northern Hemisphere. The planned summer/autumn drawdown will be delayed if there is significant waterbird breeding. The planned wetland drying may be difficult to implement in the wet planning scenario, especially if there are multiple high-flow events in the Barwon River during summer and autumn. The planned wetland fill might also be difficult to achieve in the drought-dry planning scenario due to the wetland’s potential disconnection from the Barwon River for long periods.

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Table 3.7.4 Potential environmental watering for the lower Barwon wetlands in a range of planning scenarios

Planning scenario	Drought-Dry	Average	Wet
Expected conditions	• Limited to no flow from the Barwon River in winter/spring • Disconnection between wetlands and the Barwon River for a long period • Natural drawdown may begin earlier than planned	• Some natural inflow from the Barwon River in winter/spring • More gradual lowering of water levels during drawdown	• Overbank flow from the Barwon River is likely to fill the wetlands • Stormwater inflow and local rain/run-off will provide regular top-ups • Extensive drying of the wetland is unlikely
Reedy Lake			
Potential environmental watering	• Reedy Lake fill[1] and top-up (as required) • Reedy Lake drawdown	• Reedy Lake fill and top-up (as required) • Reedy Lake drawdown	• Reedy Lake fill and top-up (as required) • Reedy Lake drawdown[2]
Hospital Swamps			
Potential environmental watering	• Hospital Swamps fill[1] and top-up (as required) • Hospital Swamps drawdown	• Hospital Swamps fill and top-up (as required) • Hospital Swamps drawdown	• Hospital Swamps fill and top-up (as required) • Hospital Swamps drawdown[2]

1 The planned wetland fill might be difficult to achieve in the drought-dry planning scenario due to the wetland's potential disconnection from the Barwon River for long periods.
2 The planned wetland drying may be difficult to implement in the wet planning scenario, especially if there are multiple high-flow events in the Barwon River during summer and autumn.

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