SECTION 5:
Northern region

5.1 Northern region overview

The northern region has six river systems, four major floodplain sites and many wetlands that can receive water for the environment. The Broken, Campaspe, Goulburn, Loddon and Ovens river systems are tributaries of the Murray River. The four major floodplain sites along the Murray River corridor are Barmah Forest, Gunbower Forest, Hattah Lakes and Lindsay, Mulcra and Wallpolla islands. The other wetlands are distributed across the Broken, Goulburn, Loddon and Murray floodplains. The Goulburn Broken, Mallee, North Central and North East CMAs manage the rivers and wetlands in the northern region.

Many of the water systems in the northern region are connected through infrastructure (such as Goulburn Weir and the Waranga Western Channel), which allows water to be physically delivered from the Goulburn River to the Loddon and Campaspe systems. Water trading can also transfer allocation between systems. Within the limitations of each mechanism, water for the environment can be moved between systems for delivery to environmental sites across northern Victoria, although most water for the environment is used to provide benefits in the systems in which the water is held.

Environmental values, objectives and planned actions for each system in the northern region are presented in the following system sections.

Traditional Owners in the northern region

Traditional Owners in the northern 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 Traditional Owner groups in northern Victoria include Barapa Barapa, Bangerang, Dja Dja Wurrung, Duduroa, Dhudhuroa, Latji Latji, Ngintait, Nyeri Nyeri, Taungurung, Tati Tati, Wadi Wadi, Wamba Wemba, Waywurru, Weki Weki, Yorta Yorta and Yaithmathang.

Several formal agreements with the Victorian Government are in place with Traditional Owners in the northern region.

In 2004, the Victorian Government entered into a cooperative management agreement with the Yorta Yorta Nation Aboriginal Corporation to improve collaboration in the management of Yorta Yorta Country, including Barmah State Forest and reserves along the Goulburn River.

In 2010, Yorta Yorta signed the Traditional Owner Land Management Agreement under the *Conservation, Forests and Lands Act 1987* over Barmah National Park, enabling the Yorta Yorta Traditional Owner Land Management Board to manage Barmah National Park jointly. In 2020, the ***Joint Management Plan for Barmah National Park***, prepared by the Yorta Yorta Traditional Owner Land Management Board, was publicly released. The plan guides the strategic management of Barmah National Park to 2030.

In 2013, Dja Dja Wurrung Clans Aboriginal Corporation (trading as DJAARA) on behalf of the Djaara people entered into a Recognition and Settlement Agreement, and in 2020 the Taungurung Land and Waters Council entered into a Recognition and Settlement agreement with the Victorian Government under the *Traditional Owner Settlement Act 2010*.

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***. The VEWH and its program partners are working with Traditional Owners to embed government policy outcomes into 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, they want to manage water on Country on their own terms.

Engagement

Engagement with Traditional Owners, stakeholders, and local communities informs the environmental watering program. Program partners undertake extensive engagement at the local level to understand community priorities for the delivery of water for the environment for 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, provided they do not compromise environmental outcomes. The following system sections present cultural, social, economic and recreational values considered for each system in the northern region.

Engagement through other strategies, plans and processes also informs environmental objectives. These include regional catchment strategies, regional waterway strategies and technical studies (such as environmental flows studies and environmental water management plans). Traditional Owner 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 describe a range of environmental, economic, social and Traditional Owner perspectives and longer-term objectives that influence actions and priorities for water for the environment.

Table 5.1.1 Program partners and stakeholders that engaged with the Goulburn Broken CMA to develop seasonal watering proposals and key documents informing the proposals for the Barmah Forest, Goulburn River, Goulburn wetlands and Broken wetlands, Broken River and upper Broken Creek and lower Broken Creek systems (in alphabetical order)

Partner/ stakeholder	Barmah Forest	Goulburn system	Goulburn wetlands	Broken wetlands	Broken River and upper Broken Creek	Lower Broken Creek
Community groups and environment groups	• Goulburn Broken Environmental Water Wetland Advisory Group members	• Goulburn Valley Environment Group	• Goulburn Broken Environmental Water Wetland Advisory Group members • Goulburn Valley Environment Group • Turtles Australia	• Goulburn Valley Environment Group • Turtles Australia	• Goulburn Valley Environment Group	• Goulburn Valley Environment Group
Government agencies	• Commonwealth Environmental Water Office • Goulburn-Murray Water • Moira Shire Council • NSW National Parks and Wildlife Service • Parks Victorian Environmental Water Holder	• Commonwealth Environmental Water Office • Goulburn-Murray Water • Murray-Darling Basin Authority/ The Living Murray • Parks Victoria • Victorian Environmental Water Holder • Victorian Fisheries Authority	• Goulburn-Murray Water • Greater Shepparton City Council • Parks Victoria • Victorian Environmental Water Holder	• Goulburn-Murray Water • Greater Shepparton City Council • Moira Shire Council • Parks Victoria • Victorian Environmental Water Holder	• Commonwealth Environmental Water Office • Goulburn-Murray Water • Parks Victoria • Victorian Environmental Water Holder	• Commonwealth Environmental Water Office • Goulburn-Murray Water • Parks Victoria • Victorian Environmental Water Holder

Partner/ stakeholder	Barmah Forest	Goulburn system	Goulburn wetlands	Broken wetlands	Broken River and upper Broken Creek	Lower Broken Creek
Landholders/ farmers	• None in Victoria (NSW consults with Bullatale Creek landholders)	• Goulburn Environmental Water Advisory Group	• Landowners who adjoin wetlands that receive water for the environment	• Individual landholders who are on the Broken Environmental Water Advisory Group or Goulburn Broken Environmental Water Wetland Advisory Group	• Individual landholders who are on the Broken Environmental Water Advisory Group	• Individual landholders who are on the Broken Environmental Water Advisory Group
Local businesses		• Local ecotourism operator • Trellys Fishing and Hunting	• Trellys Fishing and Hunting	• Trellys Fishing and Hunting		
Recreational users	• Goulburn Broken Environmental Water Wetland Advisory Group members				• Individual community members on the Broken Environmental Water Advisory Group	• Individual community members on the Broken Environmental Water Advisory Group

Partner/ stakeholder	Barmah Forest	Goulburn system	Goulburn wetlands	Broken wetlands	Broken River and upper Broken Creek	Lower Broken Creek
Technical experts		• Goulburn to Murray Trade Review Scientific Advisory Panel • Scientific leads from the CEWO Monitoring, Evaluation and Research Program – Goulburn River				
Traditional Owners	• Yorta Yorta Nation Aboriginal Corporation	• Taungurung Land and Waters Council • Yorta Yorta Nation Aboriginal Corporation	• Taungurung Land and Waters Council • Yorta Yorta Nation Aboriginal Corporation	• Taungurung Land and Waters Council • Yorta Yorta Nation Aboriginal Corporation	• Taungurung Land and Waters Council • Yorta Yorta Nation Aboriginal Corporation	• Taungurung Land and Waters Council • Yorta Yorta Nation Aboriginal Corporation

Table 5.1.2 Program partners and stakeholders that engaged with the Mallee CMA to develop seasonal watering proposals and key documents informing the proposals for the Hattah Lakes, lower Murray wetlands and Lindsay, Mulcra and Wallpolla islands systems (in alphabetical order)

Partner/ stakeholder	Hattah Lakes	Lower Murray wetlands	Lindsay, Mulcra and Wallpolla islands
Community groups and environment groups	• Mallee CMA Land and Water Advisory Committee • Mid-Murray Field Naturalists • Mildura 4WD Club • Wider community	• Friends of Merbein Common • Mallee CMA Land and Water Advisory Committee • Mid-Murray Field Naturalists • OzFish Unlimited • Wider community	• Mallee CMA Land and Water Advisory Committee • OzFish Unlimited • Wider community
Government agencies	• Commonwealth Environmental Water Office • Department of Energy, Environment and Climate Action • Goulburn-Murray Water • Mildura Rural City Council • Murray-Darling Basin Authority • Parks Victoria • Victorian Environmental Water Holder	• Department of Energy, Environment and Climate Action • Lower Murray Water • Mildura Rural City Council • New South Wales Department of Climate Change, Energy, the Environment and Water • Parks Victoria • Swan Hill Rural City Council • Victorian Environmental Water Holder • Victorian Murray Floodplain Restoration Project Team	• Commonwealth Environmental Water Office • Department of Energy, Environment and Climate Action • Lower Murray Water – Victorian Murray Floodplain Restoration Project Team • Mildura Rural City Council • Murray-Darling Basin Authority • New South Wales Department of Climate Change, Energy, the Environment and Water • Parks Victoria • Victorian Environmental Water Holder
Landholders/ farmers	• Landholders and farmers who live around the Hattah Lakes	• Neighbouring landholders (Bridge Creek, Bullock Swamp North, Burra South Proper, Lakes Powell and Carpul, and Outlet Creek)	• Lindsay Point irrigators

Partner/ stakeholder	Hattah Lakes	Lower Murray wetlands	Lindsay, Mulcra and Wallpolla islands
Local businesses	• Hattah Lakes Store • Mallee Tours • Mildura Visitor Information and Booking Centre • Murray Offroad Adventures • Sunraysia Apiarists' Association • Visit Mildura • Wildside Outdoors	• Mallee Tours • Mildura Visitor Information and Booking Centre • Murray Offroad Adventures • Sunraysia Apiarists' Association • Visit Mildura • Wildside Outdoors	• Lake Cullulleraine Store • Mallee Tours • Mildura Visitor Information and Booking Centre • Murray Offroad Adventures • Sunraysia Apiarists' Association • Visit Mildura • Wildside Outdoors
Recreational users	• Mildura 4WD Club • Sunraysia Bushwalking Club	• Cabarita Community Inc. • Mildura Birdlife Club • Mildura 4WD club • Sunraysia Bushwalkers Inc.	• BirdLife Mildura • Mildura 4WD Club • Sunraysia Bushwalkers Inc.
Traditional Owners	• Cupra Milli • Latje Latje Mumthelang • Munatunga Elders • Pearce Family • Tati Tati Tati Land & Water • Tati Tati Wadi Wadi Land & Water • Wadi Wadi • Weki Weki	• Aboriginal community members • First People of the Millewa-Mallee Aboriginal Corporation • Traditional Owners	• Aboriginal community members • First People of the Millewa-Mallee Aboriginal Corporation

Table 5.1.3 Program partners and stakeholders that engaged with the North Central CMA to develop seasonal watering proposals and key documents informing the proposals for the Gunbower Creek and Forest, central Murray wetlands and Boort wetlands, Campaspe River, Coliban River, Loddon River, Birchs Creek and Guttrum Forest systems (in alphabetical order)

Partner/ stakeholder	Gunbower Creek and Forest	Central Murray wetlands	Campaspe system	Coliban River	Loddon system (including Boort wetlands)	Birchs Creek
Community groups and environment groups	• Individual community members	• Birdlife Australia • Turtles Australia	• Ashbourne Landcare • Strathallan Family Landcare	• Malmsbury and District Landcare Group	• Birdlife Australia • Lake Meran Committee of Management • Turtles Australia	• Tullaroop Catchment Restoration Project
Government agencies	• Campaspe Shire Council • Commonwealth Environmental Water Office • Department of Energy, Environment and Climate Action • Forestry Corporation of NSW • Gannawarra Shire Council • Goulburn-Murray Water • Murray-Darling Basin Authority • Parks Victoria • Victorian Environmental Water Holder • Vic Forests	• Department of Energy, Environment and Climate Action • Goulburn-Murray Water • Parks Victoria • Victorian Environmental Water Holder	• Commonwealth Environmental Water Office • Department of Energy, Environment and Climate Action • Goulburn-Murray Water • Victorian Environmental Water Holder	• Coliban Water • Commonwealth Environmental Water Office • Victorian Environmental Water Holder	• Commonwealth Environmental Water Office • Department of Energy, Environment and Climate Action • Goulburn-Murray Water • Parks Victoria • Victorian Environmental Water Holder	• Department of Energy, Environment and Climate Action • Goulburn-Murray Water • Parks Victoria • Victorian Environmental Water Holder

Partner/ stakeholder	Gunbower Creek and Forest	Central Murray wetlands	Campaspe system	Coliban River	Loddon system (including Boort wetlands)	Birchs Creek
Landholders/ farmers	• Individual landholders • Enhancing Northern Waterways Advisory Group	• Individual landholders and community members • Enhancing Northern Waterways Advisory Group	• Individual landholders and community members, including via the Campaspe Environmental Water Advisory Group	• Coliban Water's Rural Advisory Group • Individual landholders and community members	• Individual landholders and community members, including via the Loddon Environmental Water Advisory Group	• Birchs Environmental Water Advisory Group • Individual landholders and community members • Tullaroop Catchment Restoration Project
Recreational users		• Field & Game Australia	• Game Management Authority • Local canoe clubs • VRFish	• VRFish	• Boort Angling Club • Field & Game Australia	• VRFish
Technical experts	• Vegetation, fish and bird ecologists					
Traditional Owners	• Barapa Barapa and Wamba Wemba Steering Committee • Barapa Country Aboriginal Corporation • Yorta Yorta Nation Aboriginal Corporation	• Barapa Barapa and Wamba Wemba Steering Committee • Barapa Country Aboriginal Corporation • Yorta Yorta Nation Aboriginal Corporation	• Dja Dja Wurrung Clans Aboriginal Corporation • Taungurung Land and Waters Council	• Dja Dja Wurrung Clans Aboriginal Corporation	• Barapa Barapa Traditional Owners • Dja Dja Wurrung Clans Aboriginal Corporation's Kapa Gatjin (Dja Dja Wurrung water knowledge group) • Wamba Wemba Traditional Owners	• Dja Dja Wurrung Clans Aboriginal Corporation's Kapa Gatjin (Dja Dja Wurrung water knowledge group)

Table 5.1.4 Partners and stakeholders engaged by North East Catchment Management Authority in developing the seasonal watering proposal for the Ovens system and other key foundation documents that directly informed the proposal (grouped in alphabetical order)

Partner/ stakeholder	Ovens system
Community groups and environment groups	• Mullinmur Management Committee • Wangaratta Landcare and Sustainability Inc.
Government agencies	• Commonwealth Environmental Water Office • Department of Energy, Environment and Climate Action • Goulburn-Murray Water • Parks Victoria • Rural City of Wangaratta • Victorian Environmental Water Holder
Landholders/ farmers	• Borinya Community Partnership School • Galen Catholic College
Technical experts	• Arthur Rylah Institute • Sally Mann (wetland botanist)
Traditional Owners	• Bangerang Aboriginal Corporation • Taungurung Land and Waters Council • Yorta Yorta Nation Aboriginal Corporation

Integrated catchment management

Altered water regimes are one of many threats to the health of Victoria's waterways. Many of the environmental objectives of water for the environment in the northern region are complemented by simultaneously addressing issues such as barriers to fish movement, high nutrient loads, loss of streambank vegetation and invasive species.

Victorian and Commonwealth government agencies, Traditional Owner groups, community groups and private landholders implement programs to protect and improve the environmental condition and function of land, soils and waterways throughout Victoria's catchments.

The following are examples of complementary programs that support environmental flow outcomes in the northern region.

A strategic action plan to protect floodplain marshes in Barmah Forest is being implemented to address key threats to the delicate floodplain vegetation. Specific actions include removing feral horses and other invasive animals and controlling invasive plants. Parks Victoria and the Yorta Yorta Nations jointly manage Barmah National Park.

Implementation of the native fish recovery plan for the North Central CMA region continues to progress, with the construction of a fishway on Taylors Creek Weir, just north of Kow (Ghow) Swamp. The fishway is another element of a fish 'super highway', allowing native fish to migrate up and down rivers in the region and supporting diverse, healthy populations. It follows on from other projects, including the construction of fishways at Koondrook and Cohuna weirs in Gunbower Creek in 2021, fishways at Box Creek and Kerang weir and fish screens installed in Gunbower Creek to reduce the number of native fish lost to irrigation channels.

An additional 270 km of native fish habitat and refuge was opened up to native fish in the Ovens River with the construction of the Tea Garden Weir fishway in April 2023.

Multiple approaches, including planting native aquatic plants and reintroducing woody habitat (such as snags) in lower Broken Creek, are

helping accelerate the recovery of in-stream vegetation, which provides shelter and foraging habitat for native fish, platypus and other aquatic animals. The creek is being restocked with native fish, including the reintroduction of native catfish, to help recover populations reduced by recent hypoxic blackwater fish death events.

For more information about integrated catchment management programs in the northern region, see the Goulburn Broken, Mallee, North Central and North East CMAs' regional catchment strategies and regional waterway strategies.

Risk management

When developing seasonal watering proposals for the northern region systems, environmental watering program partners assessed risks associated with potential environmental flows for 2024-25 and identified appropriate mitigating strategies. Risks and mitigating actions are continually assessed by program partners throughout the year (see **subsection 1.2.7**).

What is the Basin Plan 2012?

Northern Victoria is a part of the Murray-Darling Basin, and deliveries of water for the environment in the northern region are subject to the requirements of the ***Basin Plan 2012***, also known as the Murray-Darling Basin Plan or just the Basin Plan.

The Murray-Darling Basin Authority developed the Basin Plan under the *Commonwealth Water Act 2007*, and it became law in November 2012. ***The Water Amendment (Restoring our Rivers) Act 2023*** commenced in December 2023 and made some changes to parts of the Commonwealth Water Act and Basin Plan. The Basin Plan sets legal limits on the amount of water that can be taken from the Murray-Darling Basin's surface and groundwater resources. Chapter 8 of the Basin Plan sets out a high-level environmental watering plan, which defines environmental objectives to protect, restore and build the resilience of water-dependent ecosystems and their associated functions. The VEWH's environmental planning and delivery are consistent with the requirements of the Basin Plan. The potential environmental flows outlined in sections 4 and 5 of this seasonal watering plan fulfil Victoria's obligations to identify annual priorities for the delivery of water for the environment for Victoria's water resource areas under section 8.26 of the Basin Plan.

What is River Murray Increased Flows (RMIF)?

River Murray Increased Flows (RMIF) is water for the environment that has been recovered as part of the **Snowy Water Initiative**, established in 2002 to address environmental impacts associated with the operation of the Snowy Mountains Scheme. RMIF is stored in Snowy Hydro Limited's storages and released to maintain and improve environmental values for the Murray River. RMIF held in the Snowy may become available in the Murray when:

- Snowy Hydro Limited releases more than its nominated annual release volume as part of its power-generation operations and/or
- managers of water for the environment request additional RMIF be made available when volumes in Snowy storages exceed specified limits.

The Southern Connected Basin Environmental Watering Committee coordinates the call for and use of RMIF, which must be authorised by the VEWH and NSW Department of Climate Change, Energy, the Environment and Water for delivery.

What is River Murray Unregulated Flows (RMUF)?

River Murray Unregulated Flows (RMUF) is the remaining unregulated water in the Murray system once Victoria and New South Wales have exercised their rights to use unregulated flows. The Murray-Darling Basin Authority formally declares unregulated flow events when there is more water in the river than is needed to meet demands or can be captured in storage at the time. The use of RMUF is coordinated by the Southern Connected Basin Environmental Watering Committee for environmental outcomes.

Northern Victoria and the southern Murray-Darling Basin

Rivers, creeks and floodplains in northern Victoria form part of the southern connected Murray-Darling Basin. Water flows directly from the Victorian rivers and floodplains into the Murray River, which means that environmental flows delivered in northern Victorian systems can achieve environmental objectives at multiple sites throughout the Murray-Darling Basin. For example, water for the environment delivered in the Goulburn River flows into the Murray River and can be managed to ensure it flows all the way to the Lower Lakes and Coorong in South Australia, providing environmental outcomes at Gunbower Forest, Hattah Lakes, Lindsay Island and the Chowilla floodplain along the way.

Planning

The *Basin Plan 2012* and the ***Basin-wide environmental watering strategy*** (second edition, 2019) guide the long-term planning of water for the environment in the Murray-Darling Basin. Under the Basin Plan, environmental objectives are met by achieving outcomes for connectivity, native vegetation, waterbirds and native fish.

Objectives and outcomes under the Basin Plan reflect local site and state-based objectives, though site-based objectives are often broader in scope and cover additional values (such as frogs, turtles, waterbugs and physical processes like sediment movement). Watering actions that support Basin Plan outcomes have significant benefits for many other species that rely on the surrounding landscape (such as squirrel gliders living along the lower Campaspe River or flocks of regent parrots moving into the Hattah Lakes floodplain after watering).

The VEWH coordinates its activities with other environmental water holders and managers in northern Victoria, NSW and South Australia to achieve environmental outcomes at the southern connected Murray-Darling Basin scale. Collaborative planning focuses on how upstream and downstream objectives align and how the broader operation of the Murray River system can help support environmental outcomes. The Murray Lower Darling River Indigenous Nations' ***Statement on environmental water use*** is important for understanding Traditional Owner objectives and desired outcomes.

Annual planning is documented in basin annual environmental watering priorities (by the Murray-Darling Basin Authority under the Basin Plan), in annual portfolio management plans (by the Commonwealth Environmental Water Office) and in the VEWH's annual seasonal watering plan (this document). The Southern Connected Basin Environmental Watering Committee publishes its annual operational scenarios for environmental flows coordination in the Murray River. In Victoria, all water for the environment must be delivered in line with the VEWH's seasonal watering plan, meaning coordination during annual planning is fundamental to successful basin-scale outcomes.

Delivery coordination and monitoring

Environmental water holders and managers in the Murray-Darling Basin increasingly emphasise the coordination of water deliveries to achieve landscape-scale environmental outcomes. Examples include:

- delivering a winter fresh in the Goulburn River, which subsequently passed through to the Lower Lakes in South Australia and through the barrages to the Coorong to trigger upstream migration of fish (such as lamprey)
- delivering a spring flow from Hume Dam to support floodplain sites (such as Barmah-Millewa Forest) that meets downstream tributary flows from the Goulburn, Murrumbidgee and lower Darling rivers to support the river channel from the mid-Murray to the lower Murray all the way to the Lower Lakes and Coorong in South Australia. This event carries carbon and nutrients from the floodplain to the river and transports them through the system, increasing food availability, helping native fish to move and breed and supporting native aquatic plants.

To assess the effectiveness of landscape-scale responses to environmental flows, the Southern Connected Basin Environmental Watering Committee developed the ***River Murray Channel Monitoring Plan 2021-22 to 2025-26***. The plan focuses on productivity and fish indicators to inform the management of environmental flows. This monitoring complements site-based monitoring programs across the Murray system.

Water holder partnerships and collaboration

The VEWH holds Victorian environmental entitlements for water recovered under interstate projects and agreements — Living Murray and RMIF entitlements — and these require coordinated decision-making about where they are used. The primary objective of Living Murray entitlements is to support Murray icon sites, which include the Barmah Forest, Gunbower

Forest, Hattah Lakes and the Lindsay-Mulcra-Wallpolla islands in Victoria. RMIF also supports environmental objectives along the Murray system in Victoria, NSW and South Australia. The Southern Connected Basin Environmental Watering Committee decides where the Living Murray allocation, RMIF and RMUF should be used and guides overall delivery coordination across the southern basin.

The VEWH partners with the Commonwealth Environmental Water Office to optimise the benefits of water for the environment held by the Commonwealth Environmental Water Holder (CEWH) and delivered in Victoria. Delivery of the Living Murray's and the Commonwealth's environmental Water Holdings to meet Victorian environmental flows objectives is included in relevant system sections in the following pages of this plan.

Water for the environment delivered through northern Victorian waterways can often be re-used to achieve further environmental benefits downstream, known as 'return flows'. If return flows are not re-used at Victorian environmental sites, VEWH, the Living Murray and CEWH return flows continue to flow across the border to South Australia, where they will be used to provide environmental benefits along the lower Murray River, floodplain sites and in the Coorong, Lower Lakes and Murray Mouth icon site.

The VEWH may order or authorise relevant waterway managers to order Living Murray and Commonwealth water for the environment for environmental outcomes at downstream (non-Victorian) sites. This occurs under river operating rules that help improve environmental outcomes while maintaining the reliability of entitlements for all water users. In previous years, this has included deliveries to the lower Darling River and Great Darling Anabranch and orders for delivery to the Murray River from Lake Victoria and Hume Reservoir.

Murray system-scale planning and Traditional Owners in the southern Murray-Darling Basin

Environmental water holders and managers in the southern Murray-Darling Basin consider the objectives and cultural values of Traditional Owners in the Murray-Darling Basin and seek to support these values where possible. The health of the Murray-Darling Basin benefits from meaningful partnerships with Traditional Owners and their involvement in water management and planning, coordination and delivery.

In April 2021, a forum on Latji Latji Country in Mildura brought together Traditional Owner representatives from many parts of the southern Murray-Darling Basin to share information about the health of Country and to discuss the preferred outcomes of the management of environmental flows. Participants produced the Murray Lower Darling River Indigenous Nations' ***Statement on environmental water use*** which is important for understanding Traditional Owner objectives and desired outcomes.

Seasonal outlook 2024-25

Climate summary

Northern Victoria experienced warm temperatures (1-2 degrees above average) and average rainfall during 2023-24, but conditions were highly variable from month to month. High river flows through winter generated by average rainfall in June were followed by a dry late winter/early spring. Heavy falls in October caused major storages to spill and inundate floodplains, although not to the extent of 2022-23. Summer storms in January delivered record falls in central Victoria and caused unseasonally high summer flows and floods across the Goulburn, Campaspe and Loddon systems.

Floodplain inundation benefits many native plant and animal species, including river red gums, black box trees, aquatic (wetland) plants, waterbugs, frogs, turtles, native fish and waterbirds. The connections of floodplains and wetlands to river channels facilitate many critical ecological processes (such as the movement of seeds, nutrients and fish) that support riverine ecosystems during drier times.

The unseasonal summer floods triggered low oxygen levels in some waterways, including the Boosey/lower Broken Creek and the Loddon and Goulburn rivers. While no widespread fish deaths were observed in these catchments, these conditions can cause significant stress for aquatic animals. Water quality was less affected in the Ovens and Campaspe rivers, and these systems potentially provided refuges for fish.

Drier conditions from late summer triggered small inter-valley transfers from the Goulburn system to the Murray. Prolonged high inter-valley transfers during the irrigation season can drown streamside vegetation and make the riverbanks more susceptible to erosion. The low volumes of inter-valley transfers over the last three (wet) years have allowed some streamside vegetation to recover.

Water for the environment was managed in line with the average planning scenario across northern Victoria in 2023-24. The natural flow met or exceeded the planned watering actions for many systems in winter and spring, but water for the environment was used in waterways, including the Campaspe, Loddon and Goulburn rivers, to deliver spring freshes and cue fish spawning. Environmental water was also delivered via the irrigation network into the Goulburn River and lower Broken Creek to provide local refuges of better-quality water during low-oxygen events.

As of May 2024, the Bureau of Meteorology's outlook for winter and early spring 2024 predicted a high chance (greater than 80 per cent) of the northern region exceeding median maximum temperatures, a below-average chance (less than 40 per cent) of exceeding median rainfall in north-east Victoria and around a 50 per cent chance of other parts of the northern region exceeding median rainfall. Reliable forecasts beyond spring 2024 were not available at the time of writing.

Water Holdings outlook

The allocation outlook provided by the Northern Victoria Resource Manager in May 2024 indicated all systems would reach 100 per cent high-reliability allocation in 2024-25 in average-to-wet conditions. The Campaspe system holds sufficient water to allocate 100 per cent at the beginning of July. In drier conditions, smaller systems (such as the Broken system) are forecast to reach around 50 per cent high-reliability allocation, with severely low allocations under an extreme dry scenario (3 per cent high-reliability allocation). Larger systems with more reserves to smooth out annual variability are forecast to reach at least 66 per cent allocation to high-reliability water shares, even in an extremely dry scenario.

In May 2024, the Northern Victoria Resource Manager indicated the spill risk to be greater than 90 per cent in the Murray and Goulburn systems and above 70 per cent in the Campaspe system for 2024-25 at the start of July. This spill risk and the high forecast allocations for 2024-25 reduce the need for carryover to meet environmental watering demands in winter and early spring.

Demands outlook

Environmental watering actions across northern Victoria in 2024-25 have been planned to consolidate and, where possible, build on the environmental gains of the natural flooding in the previous two years. The forecast water availability is expected to be sufficient to support the planned watering actions in all planning scenarios.

Most wetlands across the northern region have filled multiple times over the last two years. Many of these wetlands need to draw down to support important dry-phase ecological processes and are not likely to receive water for the environment in 2024-25. This will reduce the total environmental watering demand for the year, but water for the environment will still be used to top up some wetlands that can tolerate or require more frequent inundation to maintain a variety of wetland habitats and foraging habitats for waterbirds across the landscape. These include sites that support native fish populations (such as the endangered Murray hardyhead) and sites that need additional top-ups to help establish native vegetation that naturally recruited during the floods or have been planted since the floods.

The key environmental watering objectives for rivers throughout northern Victoria during 2024-25 will be to maintain the water quality and fish habitat and encourage native fish to disperse and migrate. Bank and in-channel vegetation will also be supported across the region, including in the lower Goulburn, to build on the widespread recovery of bank vegetation in 2023-24.

In the drier planning scenarios, significant deliveries of operational water from Hume Dam or the Goulburn inter-valley trade account may reduce the use of environmental water, potentially limiting opportunities to use return flows for environmental outcomes further downstream in the Murray system and South Australia. In the average or wet planning scenarios, there is a moderate-to-high likelihood that full reservoirs will spill and cause high river flows and floodplain inundation.

5.2 Victorian Murray system

Waterway manager – Goulburn Broken, Mallee, North Central and North East catchment management authorities

Storage managers – Goulburn-Murray Water, Lower Murray Water, Murray-Darling Basin Authority (River Murray Operations), SA Water and Water NSW

Environmental water holders – Victorian Environmental Water Holder (including the Living Murray program) and Commonwealth Environmental Water Holder

The lands and waters of the Murray River system are central to the culture of the many Traditional Owner groups that have lived along the Murray River for tens of thousands of years. Traditional Owners along the Murray have distinct cultural boundaries, languages and cultural practices. The Murray River has many different names in Aboriginal languages; for example, the Yorta Yorta people know the Murray as *Dhungulla*. The Victorian Murray system referred to in this plan includes waterways, storages, weirs, locks and regulators managed under state and Commonwealth Government legislation. This system overlays many Traditional Owner boundaries.

Within the Victorian Murray system, there are many significant floodplains and wetland systems within the areas of the North East, Goulburn Broken, North Central and Mallee CMAs. They are sites of significance for Traditional Owners, with tangible and intangible cultural connections dating back thousands of years and continuing to the present day. The Barmah Forest, Kerang wetlands and the Hattah Lakes are internationally recognised Ramsar-listed sites due to the significance of their wetland types and the abundance and range of waterbird species that use them. Many other wetlands in the system are either nationally or regionally significant.

Water for the environment can be supplied to the Victorian Murray system from various sources. These include entitlements held by the VEWH (a subset of which the VEWH holds on behalf of the Living Murray program), the Commonwealth Environmental Water Holder and re-use of return flows. In some instances, operational water can be delivered to downstream users in a way that helps meet environmental outcomes within the river system en route. The source of water used for individual watering actions and the ability to deliver all watering actions will depend on water availability, water commitments by other environmental water holders and operational requirements. As a result, the following Victorian Murray system sections do not specify the expected availability of water for the environment.

Victorian Murray system water availability

Tier 1 potential environmental watering in each Victorian Murray system subsection is not classified as tier 1a or 1b because the water available for use, including the re-use of supply from upstream watering actions and opportunistic access to unregulated water, is shared across various demands. Consequently, it is not possible to reliably determine the supply specifically available for each Victorian Murray system subsection.

The VEWH works with the Living Murray program and the Commonwealth Environmental Water Holder to supply Victorian Murray system demands, as well as broader southern Murray-Darling Basin demands across other jurisdictions. For more details, see the northern system overview.

5.2.1 Upper Murray wetlands

System overview

The upper Murray wetlands are on the Murray River floodplain between Lake Hume and Lake Mulwala. The wetland system includes the Ryans Lagoon wetland complex, which has two main lagoons: Ryans Lagoon 1 and Ryans Lagoon 2.

The Ryans Lagoon wetland complex is a network of wetlands positioned downstream of Lake Hume and upstream of the Kiewa River confluence with the Murray River.

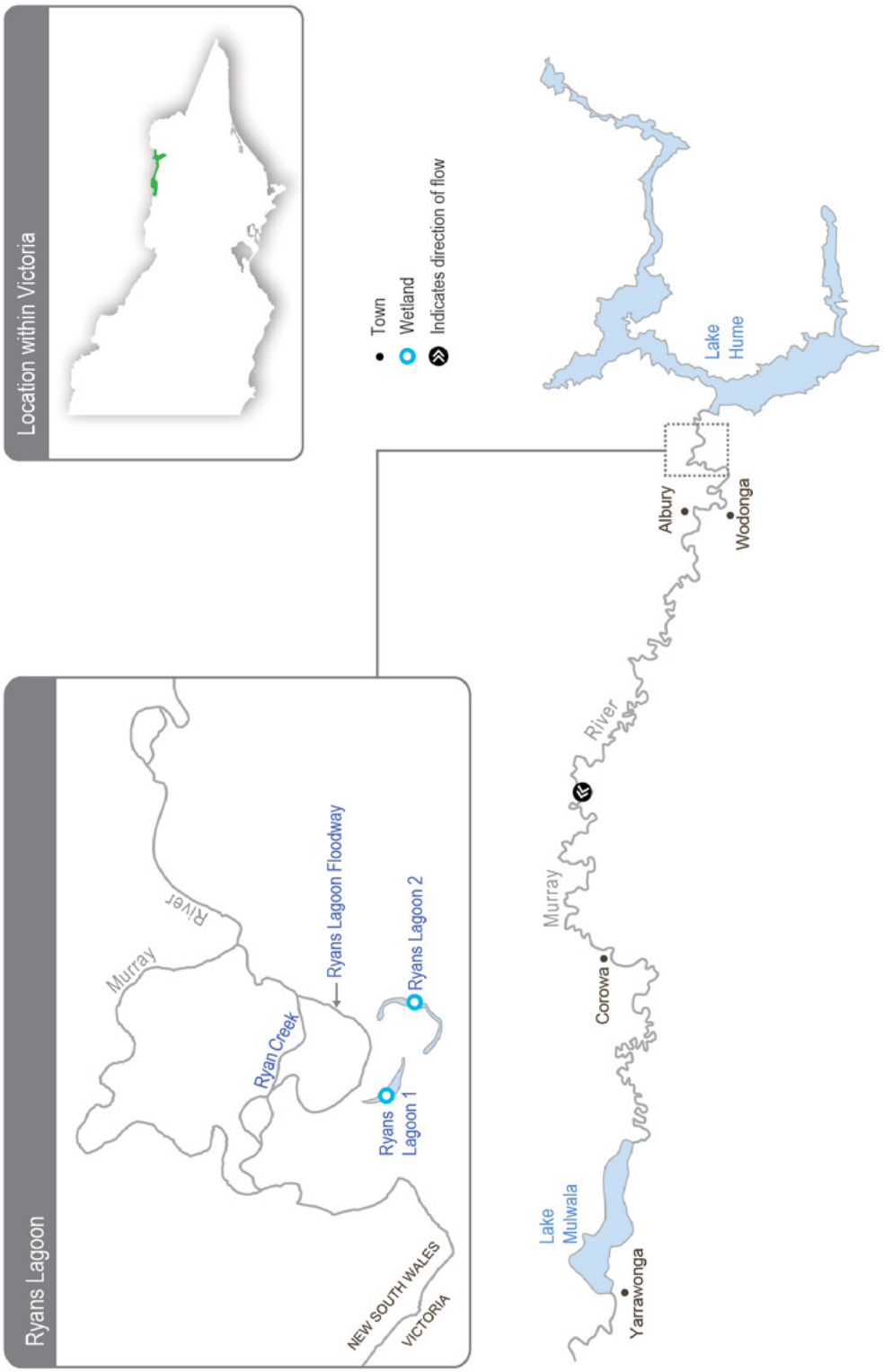
Flows into the complex are mainly influenced by regulated releases from Lake Hume, which travel via Ryans Creek, an anabranch of the Murray River. The complex begins to fill from Ryans Lagoon Floodway through a culvert when the flow in the Murray River at the Heywoods gauge immediately below Lake Hume exceeds 24,000 ML per day, but sustained flows above 25,000 ML per day are needed to fill both lagoons completely.

It is proposed to use temporary pumps to deliver water for the environment to restore the ecological health of the complex by providing a wetting and drying regime closer to the natural flow regime that existed before the Murray River was regulated. Water can be pumped into Ryans Lagoon 2 from the Ryans Lagoon Floodway when the flow in the Murray River exceeds 20,000 ML per day and fills the floodway to a suitable depth for the pumps to operate.

Victoria, NSW and other stakeholders have been exploring the feasibility of a coordinated spring pulse for the Hume-to-Yarrawonga reach of the Murray, which may fill Ryans Floodway to a sufficient height and duration for pumping.

The North East CMA is investigating options to improve watering regimes at other wetlands along the upper Murray floodplain.

Figure 5.2.1 The upper Murray wetlands



Environmental values

The North East CMA's ***North East Waterway Strategy*** recognises the Ryans Lagoon wetland complex as a high-value wetland system, and it is listed as a nationally significant wetland in the ***Directory of Important Wetlands in Australia***. The complex provides habitat for seven bird, three fish, one frog and one perennial plant species listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* and/or the Victorian *Flora and Fauna Guarantee Act 1988*. Ecological surveys conducted at the site since 1975 have recorded 250 species of waterbugs and 29 species of waterbirds, including the Australian white ibis, great egret and rufous night heron. The complex also supports native wetland vegetation communities expected to benefit from a seasonally aligned, more variable watering regime.

Environmental objectives in the upper Murray wetlands

B1 – Provide feeding habitat for a range of waterbird species

CN1 – Restore carbon and nutrient cycling within the wetlands to increase ecosystem productivity

F1 – Increase habitat for native fish and increase their population

MI1 – Increase the abundance and diversity of waterbugs to support aquatic food webs

V1 – Increase the extent of fringing and aquatic vegetation

Traditional Owner cultural values and uses

Traditional Owners have lived on and cared for the upper Murray floodplain for tens of thousands of years. Wetlands in the region have immense cultural value to Traditional Owners. There is no Registered Aboriginal Party for the Ryans Lagoon area, and several Traditional Owner groups are recognised within the upper Murray area, including those represented by the Dhudhuroa and Waywurru Nations, the Dalka Warra Mittung Aboriginal Corporation and the Duduroa Dhargal Aboriginal Corporation. There is no Registered Aboriginal Party for the Ryans Lagoon area.

The North East CMA is building relationships with each Traditional Owner group and aims to collaborate with Traditional Owners on environmental water management at the Ryans Lagoon wetland complex. In the long term, the North East CMA aims to support the defined objectives of Traditional Owners for the complex and Traditional Owners' obligations to Country more broadly.

Traditional Owners from the Duduroa Dhargal Aboriginal Corporation (DDAC) have received funding to assist in managing Ryans Lagoon Nature Conservation Reserve for three years (2023-26) alongside Parklands Albury Wodonga Ltd. The funding has employed a DDAC Elder as a part-time ranger to undertake management activities, including ecological thinning, weed management, pest control and revegetation of native grasses and wetland plants for traditional uses. The ranger will also train First Nations people in cultural burning, cultural harvesting and cultural education activities. DDAC has also received funding to employ two Aboriginal Water Officers to undertake water management activities for self-determined purposes.

The North East CMA and DDAC met on Country at Ryans Lagoon many times in 2023 and 2024. These meetings provided an opportunity for DDAC to explain important cultural values at Ryans Lagoon and some of their objectives for managing Country, including about water.

DDAC wants environmental water delivered to Ryans Lagoon annually and restoring a more-natural water regime. DDAC would like to improve habitat for wetland plants, birds, frogs and fish, including through the planned environmental water deliveries which will support management actions for the ecological and cultural values of the Duduroa Dhargal people.

> "The overall ideological reason (for the on-ground work) is to increase the biomass (meaning increase the native animals and traditional plants in the area for traditional purposes and practices) and create a refuge in the wetlands, ensuring the survival and succession for the future within the catchment."
>
> *– DDAC Program Manager, 2024*

> "We are water people. We lived on the river and lived on the wetlands. We used these waterways for foods, medicines, and resources. When the wetlands dried up, we would have moved on. We moved to where the water was to sustain life. Water in these wetlands is essential to Cultural connection, learning and sharing knowledge with our people. Without water, we wouldn't be here today."
>
> *– DDAC Elders, 2024*

Planned environmental flows may be modified to align with cultural benefits so long as environmental outcomes are not compromised. The North East CMA and DDAC will work together on the planning and delivery of environmental water to Ryans Lagoon in 2024-25. This includes planning the timing of water deliveries and delivering the water, with DDAC assisting with pumping water to Ryans Lagoon.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 water for a particular site, their contribution is acknowledged in **Table 5.2.1** with an icon (as explained in **Figure 1.2.3**). 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

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.2.1**, the North East CMA considered how environmental flows could support values and uses, including:

- recreation and amenity (such as birdwatching)
- community and cultural events (such as visitation by schools, Landcare groups and other community members)
- socioeconomic benefits (such as cultural tours and incidental visitation to local towns and businesses).

Environmental water deliveries will improve the function of the wetland by mimicking the natural flow regime, aiming to improve ecosystem function and provide multiple habitat niches for native plants and animals. This will align with a community benefit for members of the local Landcare group, Parklands Albury Wodonga, who have land management responsibilities and use the site for conservation-based events.

Scope of environmental watering

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

Table 5.2.1 describes the potential environmental watering actions in 2024-25, 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 5.2.1 Upper Murray wetlands potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Ryans Lagoon 1 and Ryans Lagoon 2 (fill in winter/spring)	• Mobilise carbon and nutrients within the wetlands to support wetland processes • Maintain permanent, deep, open-water habitat that supports food resources for waterbirds and native fish • Inundate wetland margins to provide refuge and feeding habitat for small- and large-bodied native fish • Increase soil moisture to promote the growth of fringing vegetation and the surrounding river red gum community • Inundate beds of aquatic and semi-aquatic vegetation to stimulate growth and increase their extent • Prevent the encroachment of river red gum saplings into deep areas of the wetland • Inundate wetland margins to provide habitat for waterbugs and foraging opportunities for waterbirds	B1, CN1, F1, MI1, V1

Scenario planning

Table 5.2.2 outlines potential environmental watering and expected water use in various planning scenarios.

In 2022-23, the upper Murray wetlands were added to the VEWH's seasonal watering plan. However, over the past two years active pumping has not been required because natural floods filled Ryans Lagoon 1 and Ryans Lagoon 2 and other wetlands across the upper Murray floodplain.

The two lagoons would have naturally filled every year before the river was regulated, and they require frequent watering to maintain permanent water that can support native fish and provide a reliable foraging site for waterbirds. For these reasons, the planned winter/spring watering is a high priority in all planning scenarios in 2024-25. Water for the environment, delivered via temporary pumps, will likely be needed to fill both lagoons in drought, dry and average planning scenarios. A high, unregulated flow and natural floods are likely to inundate the wetlands in the wet planning scenario, and water for the environment will only be used in these conditions to top up water levels in each lagoon if they do not fill naturally.

Active pumping is only possible if there is sufficient water depth and duration in Ryans Lagoon Floodway. Therefore, there is a risk that the planned watering actions may not be delivered in drought-to-average scenarios.

Table 5.2.2 Upper Murray wetlands environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• No unregulated flow below Hume Dam • Regulated flow from Hume Dam may connect the Ryans Lagoon Floodway to allow pumping into Ryans Lagoon 1 and 2	• Unregulated flow unlikely below Hume Dam • Regulated flow from Hume Dam may connect the Ryans Lagoon Floodway to allow pumping into Ryans Lagoon 1 and 2 • Possible spring pulse could deliver water to the floodway to allow pumping into Ryans Lagoon 1 and Ryans Lagoon 2	• Unregulated flow is possible below Hume Dam if storages are near capacity • Unregulated flow may achieve partial or complete inundation of Ryans Lagoon 1 and 2 • Regulated flow from Hume Dam may connect the Ryans Lagoon Floodway to allow pumping into Ryans Lagoon 1 and 2 • Possible spring pulse could deliver water to the floodway to allow pumping into Ryans Lagoon 1 and Ryans Lagoon 2	• Periods of unregulated flow below Hume Dam are likely and may provide partial or complete inundation to Ryans Lagoon 1 and 2 • Pumping into Ryans Lagoon 1 and 2 if a complete fill is not achieved could be considered, depending on water levels in the lagoons
Potential environmental watering – tier 1 (high priorities)	• Ryans Lagoon 1 and 2 (fill in winter/spring)			
Possible volume of water for the environment required to achieve objectives	• 170 ML (tier 1)			• 0-170 ML (tier 1)

5.2.2 Barmah Forest

System overview

The Barmah Forest is located within Yorta Yorta's traditional boundaries. The reserve, which includes the Barmah National Park and part of the adjoining Murray Valley Regional Park, is 29,305 ha. It forms the Victorian component of the broader Barmah-Millewa Forest that covers some 66,000 ha across New South Wales and Victoria between Tocumwal, Deniliquin and Echuca (Figure 5.2.2). The Barmah-Millewa Forest is listed under the Convention on Wetlands of International Importance (the Ramsar Convention) and the Directory of Important Wetlands in Australia, and it is one of the six Living Murray icon sites. The forest's Victorian components are the Barmah National Park and part of the River Murray Reserve, which provides legislative protection for river red gum forest and associated wetlands that support significant plant and animal species and culturally significant sites.

Flooding in the Barmah-Millewa Forest depends on the flow in the Murray River. A natural narrowing of the river (commonly called the Barmah Choke) restricts the flow and causes overbank flooding when the flow below Yarrawonga Weir exceeds the channel's capacity. This restriction influences Yarrawonga Weir's operation and the magnitude of environmental flows that can be delivered to the forests. The Yorta Yorta People see this narrow part of *Dhungulla* (Murray River) as a culturally significant creation story, and it provides ecosystem services both from a culturally and environmentally significant viewpoint. The name 'Barmah Choke' is culturally inappropriate for the Yorta Yorta, and it is seen as a negative way to view their traditional lands and waters. Yorta Yorta People refer to this as the 'Pama Narrows', or more simply 'The Narrows'.

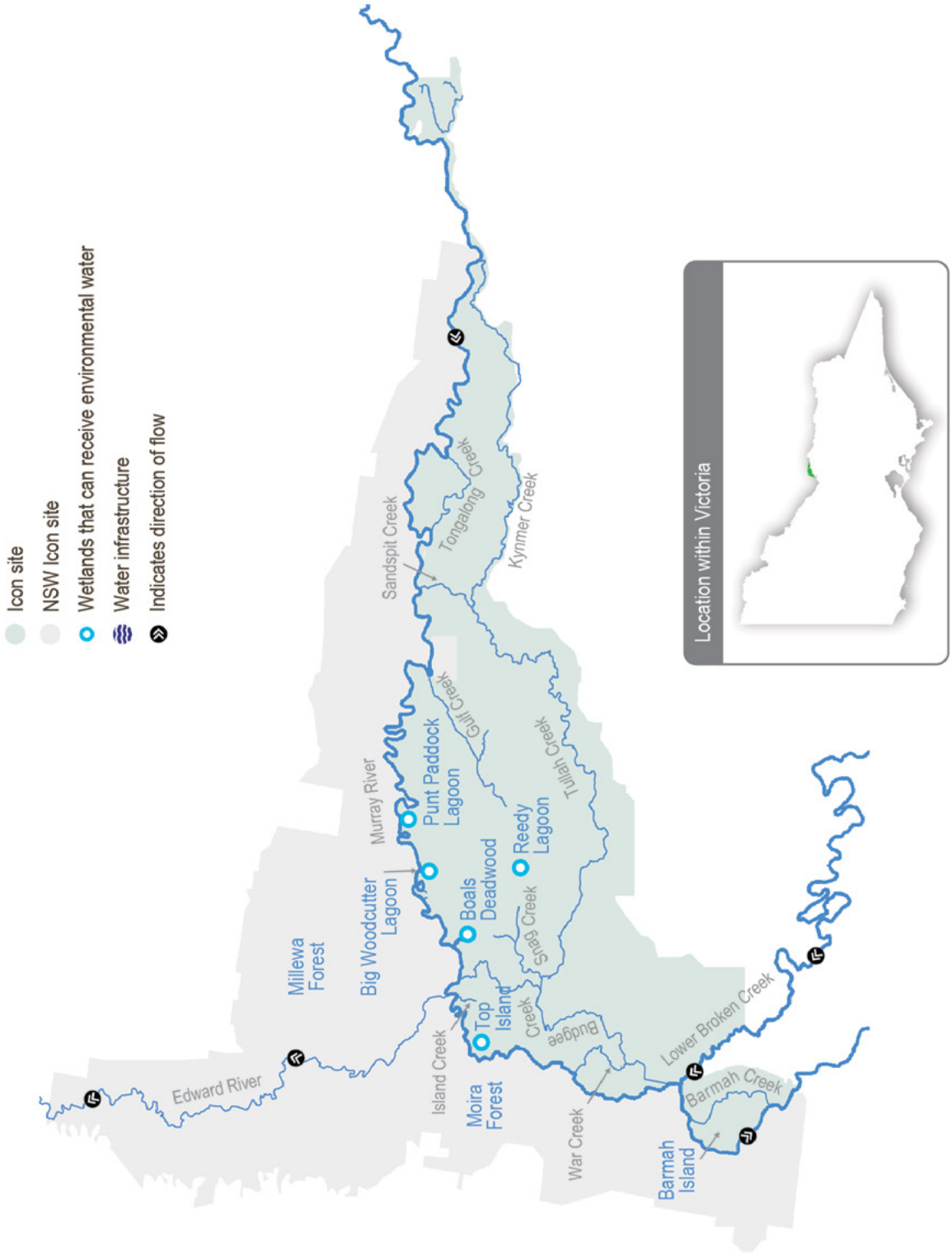
Before the river was regulated, Barmah-Millewa Forest was regularly flooded with high flows from rainfall and snowmelt in winter and spring. These regular floods shaped a rich, productive floodplain. The construction and operation of Hume Dam and Dartmouth Dam have greatly reduced the size and frequency of natural winter/spring floods in Barmah-Millewa Forest.

Operational deliveries that supply water to users downstream of The Narrows can cause unseasonal, low-level floods, which can damage the forest and erode riverbanks, depending on the timing and volume of the flow. Country for the Yorta Yorta People continues to change, but the changes have been rapid post-settlement due to the installation of infrastructure and river regulation. This has changed Country culturally and environmentally for the Yorta Yorta People.

The delivery of irrigation water during summer/autumn is now managed to minimise the unseasonal flooding of the forest. Regulators along the banks of the Murray River that control the flow between the river and the forest remain closed during summer and autumn to restrict the flow through low-lying flood runners to simulate natural conditions. The delivery of water to Barmah-Millewa Forest is also limited by a flow constraint below Yarrawonga Weir that aims to minimise impacts to adjacent farming operations in NSW. The current constraint limits the regulated flow to a maximum river level of 3.3 m at the Tocumwal gauge (subject to various conditions). Until recently, the 3.3 m limit was met with a flow of about 18,000 ML per day downstream of Yarrawonga Weir, but ongoing sediment accumulation has reduced the river capacity. As a result, the height limit is now met with a flow of about 17,000 ML per day. Regulated flows up to a river level of 3.0 m on the Tocumwal gauge (historically about 15,000 ML per day, now about 14,200 ML per day downstream of Yarrawonga Weir) can be delivered at any time during the year and are not subject to conditions. These constraints mean it is currently not possible to achieve the desired flood depth and duration for floodplain marsh vegetation in both forests at the same time without greater natural flooding. Therefore, environmental watering strategies alternate between the Barmah and Millewa forests each year, aiming to deliver water to low-lying wetlands in each forest at least every second year.

Water management at Barmah-Millewa Forest seeks to build on natural flow and deliver consumptive and operational water to optimise environmental outcomes when possible. As Barmah-Millewa Forest is located towards the upper reaches of the regulated portion of the Murray River, water for the environment that passes through the forest and returns to the river can often be used at sites further downstream as part of multi-site watering events.

Figure 5.2.2 The Barmah Forest



Environmental values

The Barmah-Millewa Forest is the nation's largest river red gum forest and the most intact freshwater floodplain system along the Murray River. The forest supports important floodplain vegetation communities, including the threatened Moira grass plains. It is an important feeding and breeding site for waterbirds, including bitterns, ibis, egrets, spoonbills and night herons. Significant populations of native fish, frogs and turtles also live in the forest's waterways. Barmah Forest is known to support 74 plant and animal species protected under state and national legislation.

Environmental objectives in the Barmah Forest

A1 – Increase the frog population

B1 – Support the successful recruitment of colonial nesting waterbirds

CN1 – Enable carbon and nutrient cycling between the floodplain and river through connectivity

F1 – Increase habitat for native fish and increase their population

G1 – Protect forest waterways from increased erosion

T1 – Increase the turtle population

V1 – Enhance the health of river red gum communities and aquatic vegetation in the wetlands and watercourses

V2 – increase the extent and improve the condition of floodplain marsh vegetation communities, particularly Moira grass

WQ1 – Reduce the risk of low-oxygen events in summer

Traditional Owner cultural values and uses

> "We are the First People of this place. We were here even before the Murray River flowed through Barmah."
>
> – *Uncle Des Morgan, Yorta Yorta Elder, Joint Management Plan for Barmah National Park*

The Yorta Yorta Nation Aboriginal Corporation (YYNAC) manages Barmah National Park with Parks Victoria under a Traditional Owner Land Management Agreement with the State of Victoria. The ***Joint Management Plan for Barmah National Park*** and the ***Yorta Yorta Whole-Of-Country Plan 2021-2030*** inform environmental water management in Barmah National Park. Ongoing interaction about land and water management at Barmah also occurs with Yorta Yorta through the Living Murray Indigenous Partnerships Program.

YYNAC continues to pursue the Yorta Yorta People's inherent rights to water for Country. Rights to water will address their spiritual, cultural, environmental, social and economic needs, in line with the ***Yorta Yorta Whole-Of-Country Plan 2021-2030***.

Yorta Yorta values encompass an inherent and living connection to land (*woka*), water (*wala*) and caring for Country. Examples of Yorta Yorta cultural values and uses in Barmah Forest that are supported through deliveries of water for the environment include:

- maintaining refuges that protect turtles, an important totemic species for the Yorta Yorta People
- watering to support floodplain marsh vegetation, which includes important food, fibre and medicinal plants (such as old man weed and weaving sedge)
- improving the health of river red gums, which has benefits for important Yorta Yorta sites and significant markings (such as a scar tree) and furthers connections to Country
- broader restoration to achieving healthy Country.

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

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.2.3**, the Goulburn Broken CMA and the Yorta Yorta and/Parks Victoria joint managers consider how environmental flows could support or affect values and uses, including:

- water-based recreation (such as boating, fishing, kayaking and canoeing)
- riverside recreation and amenity (such as birdwatching, picnicking, photography, camping and the general physical, mental and social benefits of communing with nature)
- community events and tourism
- socioeconomic benefits (such as for apiarists, and including better water quality).

For example, if environmental or operational flows cause creek crossings to be blocked, land managers will erect signs and post notices on the Parks Victoria website to notify site users and the broader public of road closures or restrictions to 4WD only. Water managers also publicise the benefits of flows for fish recruitment and wetland health.

Scope of environmental watering

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

Table 5.2.3 describes the potential environmental watering actions in 2024-25, 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 5.2.3 Barmah Forest potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Winter/spring forest low flow to various waterways in Barmah Forest (variable flow rates and duration during July to December 2024 and June 2025)	• Provide a gradual connection of waterways with the Murray River to minimise erosion within those waterways • Provide flow in forest waterways to ensure adequate refuge pools persist for native fish and turtles • Provide adequate depth and connection between floodplain waterways and the river to facilitate the movement of native fish • Remove accumulated organic matter from waterways to cycle carbon to the river system and create a throughflow to minimise the risk of hypoxic blackwater	F1, G1, T1, CN1, WQ1
Winter/spring/ summer low flow in the Murray River (greater than 7,500 ML/day below Yarrawonga Weir during August to December)	• Maintain a sufficient water level in the Murray River main channel to prevent Murray cod from abandoning their nests, increase juvenile survival and improve dispersal opportunities	F1
Spring/summer fresh(es) in the Murray River channel (one to three freshes that increase the flow by at least 500 ML/day and maintain it for two to eight days during November to December)	• Provide variable water levels once water temperatures exceed 22°C to trigger the spawning of native fish species, primarily silver perch	F1
Spring/summer/ autumn freshes to Gulf and Boals creeks (100 ML/ day for three to five days as required during November to April)	• Maintain critical refuge pools to provide habitat for native fish and turtles • Flush refuge pools to maintain water quality	F1, T1, WQ1

Potential environmental watering action	Expected watering effects	Environmental objectives
Spring/summer/ autumn low flow to floodplain waterways, including Sandspit, Gulf, Big Woodcutter, Boals and Island creeks and Punt Paddock Lagoon (200 ML/day for 30 to 60 days during November to April)	• Replenish refuge pools in permanent waterways to maintain water quality, fish and turtle populations • Maintain connectivity between the forest and the river • Remove accumulated organic matter, cycle carbon to the river system and minimise the risk of hypoxic blackwater	F1  T1  CN1 WQ1
Fill or top-up of Boals Deadwood, Harbours Lake, Reedy Lagoon and Top Island wetlands (200-400 ML/day for four and a half months during September to February)	• Provide a cue to initiate waterbird breeding and maintain a depth of at least 0.5 m beneath reed bed nesting breeding colonies • Maintain wetting duration and depth to grow the wetland vegetation	 V1  B1
Spring wetting of floodplain marshes (variable flow rates between 8,300-17,000[1] ML/day below Yarrawonga Weir for three months during September to December)	• Inundate open plains to a sufficient depth and for a sufficient duration to allow the growth of floodplain marsh vegetation • Inundate forest wetlands and low-lying floodplain areas to create foraging opportunities for waterbirds and increase available habitat for turtles, frogs and small-bodied native fish • Support waterbird breeding by maintaining a depth of at least 0.5 m beneath reed bed nesting breeding colonies	F1 A1  T1  V2  B1
Autumn/winter low flow in the Murray River (4,000-5,000 ML/day downstream of Yarrawonga during May to June)	• Increase water depth in the Murray River channel to provide habitat for large-bodied native fish in the Murray River and unregulated anabranches in Barmah-Millewa Forest	F1

1 The maximum flow constraint is a level of 3.3 m at the Tocumwal gauge in the Murray River, estimated at 17,000 ML per day downstream of Yarrawonga Weir. The maximum flow rate delivered may vary for this action to target the level.

Scenario planning

Table 5.2.4 outlines potential environmental watering and expected water use in various planning scenarios.

Widespread flooding in 2023-24 inundated more of Barmah-Millewa Forest than can be watered by environmental flows under current delivery constraints. The potential watering actions in this plan are required in most or all years to support the identified environmental values and objectives. For these reasons, the proposed watering actions in each planning scenario are similar to those outlined in previous plans.

The ecological objectives for Barmah-Millewa Forest require a sustained flow in the Murray River through winter and spring. Flow-control structures are used to direct water from the Murray River channel into the forest and to facilitate the later return of most of that water back to the river, transporting carbon and nutrients for use downstream. Current flow constraints mean environmental watering will primarily target Barmah Forest in 2024-25, aiming to meet the depth and duration targets for wetlands. Millewa Forest will still receive a flow, but depth and duration targets for some forest wetlands may not be fully met. These arrangements alternate between the Barmah and Millewa forests each year.

Three tier 1 potential watering actions are required in all climate scenarios. Winter-spring forest low flows enable a gradual and variable connection of the waterways within Barmah Forest to the Murray River to maintain habitat and provide movement opportunities for aquatic animals (such as native fish). Regulators are opened to allow water to move in and out of the forest during winter and spring in response to variations in the flow of the Murray River. The spring/summer freshes in the Murray River specifically aim to trigger silver perch spawning when the water temperature exceeds 22°C and are achieved by varying the flow below Yarrawonga Weir. Spring/summer/autumn freshes to Gulf and Boals creeks are delivered to maintain water quality in forest waterways. Forest regulators are usually closed in summer and autumn (and sometimes in spring if water availability is low) to keep unnaturally high river flows out of the forest and allow a natural drying phase. These freshes to Gulf and Boals creeks may be needed to maintain critical refuge by improving dissolved oxygen levels for aquatic species (such as native fish) using only a small volume of water.

Potential watering actions required in the dry-to-wet planning scenarios include spring/summer/autumn low flows to floodplain waterways that maintain habitat in the forest by providing connectivity to replenish refuge pools and protect water quality. Waterbird breeding is expected in the dry-to-wet planning scenarios, and water for the environment can be delivered to fill or top up wetlands to support colonial nesting species to the end of their breeding event. In dry conditions, colonies are expected only in Boals Deadwood, where ibis and spoonbill nest in most years. In average-to-wet conditions, waterbirds are expected to breed in more locations within the forest, including Harbours Lake, Reedy Lagoon and Top Island wetlands.

Some potential watering actions are only required in the average-to-wet conditions when a greater frequency, duration and volume of unregulated flow events is expected. These actions require large volumes of water that are likely to be partially met by the unregulated flow and are important for building resilience in the system by enhancing environmental responses. An autumn/winter low flow in the Murray River increases habitat for native fish to reduce predation and increase food availability ahead of the breeding season, while winter/spring/summer low flows in the Murray River maintain a higher minimum in-channel flow to support Murray cod nesting. Spring wetting of floodplain marshes maintains an overbank flow to the forest in spring (within operational delivery constraints) to support the health of the river red gum forest and the recovery of wetland habitat, including critical species (such as Moira grass).

Larger watering actions for Barmah Forest benefit the environment both locally and downstream, as most of the water delivered returns to the river. Water for the environment is measured, with use (loss) in the forest deducted and the remaining water shepherded downstream to be re-used for other environmental outcomes. As a result, larger Barmah Forest watering actions can also be delivered as part of a broader Murray River flow event in the drought and dry scenarios (tier 2 actions) when water availability is high. The Barmah Forest benefits by fully or partially achieving environmental objectives for actions, such as spring wetting of floodplain marshes and autumn/winter low flows in the Murray River that are desirable to achieve every year but may not be possible in drier scenarios when there is less water available. Improved local outcomes in Barmah Forest, such as spring/summer/autumn low flows to better maintain the health of forest waterways in drought conditions and fill or top up

additional forest wetlands for native vegetation and waterbird outcomes in a dry scenario, may also be achieved with additional water availability. All tier 2 watering actions are possible in 2024-25, subject to coordination planning led by the Southern Connected Basin Environmental Watering Committee, as water availability is expected to be high following a period of consecutive wet years leading into 2024-25.

Table 5.2.4 Barmah Forest environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Unregulated flow periods are unlikely • Flow in the Murray River will remain within the channel all year	• Some small, unregulated flow in late winter/spring • Low chance of overbank flow in late winter/spring	• Likely chance of small-to-medium unregulated flow in winter/spring • Likely chance of overbank flow in winter/spring	• High probability of moderate to large unregulated flow in winter/spring • Expected large overbank flow
Potential environmental watering – tier 1 (high priorities)	• Winter/spring forest low flow • Spring/summer fresh(es) in the Murray River (one to three freshes) • Spring/summer/autumn freshes to Gulf and Boals creeks	• Winter/spring forest low flow • Spring/summer fresh(es) in the Murray River (one to three freshes) • Spring/summer/autumn freshes to Gulf and Boals creeks • Spring/summer/autumn low flow to floodplain waterways • Fill or top up Boals Deadwood	• Winter/spring forest low flow • Winter/spring/summer low flow in the Murray River • Spring/summer fresh(es) in the Murray River (one to three freshes) • Spring/summer/autumn fresh(es) to Gulf and Boals creeks • Spring/summer/autumn low flow to floodplain waterways • Fill or top up Boals Deadwood, Harbours Lake, Reedy Lagoon and Top Island wetlands • Spring wetting of floodplain marshes • Autumn/winter low flow in the Murray River	• Winter/spring forest low flow • Winter/spring/summer low flow in the Murray River • Spring/summer fresh(es) in the Murray River (one to three freshes) • Spring/summer/autumn fresh(es) to Gulf and Boals creeks • Spring/summer/autumn low flow to floodplain waterways • Fill or top up Boals Deadwood, Harbours Lake, Reedy Lagoon and Top Island wetlands • Spring wetting of floodplain marshes • Autumn/winter low flow in the Murray River

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)[1]	• Spring/summer/autumn low flow to floodplain waterways • Spring wetting of floodplain marshes • Autumn/winter low flow in the Murray River	• Fill or top up additional wetlands (such as Harbours Lake, Reedy Lagoon and Top Island wetlands) • Spring wetting of floodplain marshes • Autumn/winter low flow in the Murray River		
Possible volume of water for the environment required to achieve objectives[2]	• 9,000 ML (tier 1)	• 19,000 ML (tier 1)	• 267,000 ML (tier 1)	• 168,000 ML (tier 1)

1 The volume of water for the environment required to deliver the tier 2 watering actions in drought and dry planning scenarios will depend on demands for multi-site environmental events or operational transfers and is therefore not estimated in **Table 5.2.4**.

2 The possible volumes of water for the environment required in Barmah Forest are estimates and highly variable, depending on factors such as seasonal conditions and the contributions of operational and/or unregulated flows. Much of the water for the environment delivered to Barmah Forest is returned to the Murray River — around 80 percent in the dry-to-wet planning scenarios — and can be re-used at downstream sites.

5.2.3 Gunbower Forest and Creek

System overview

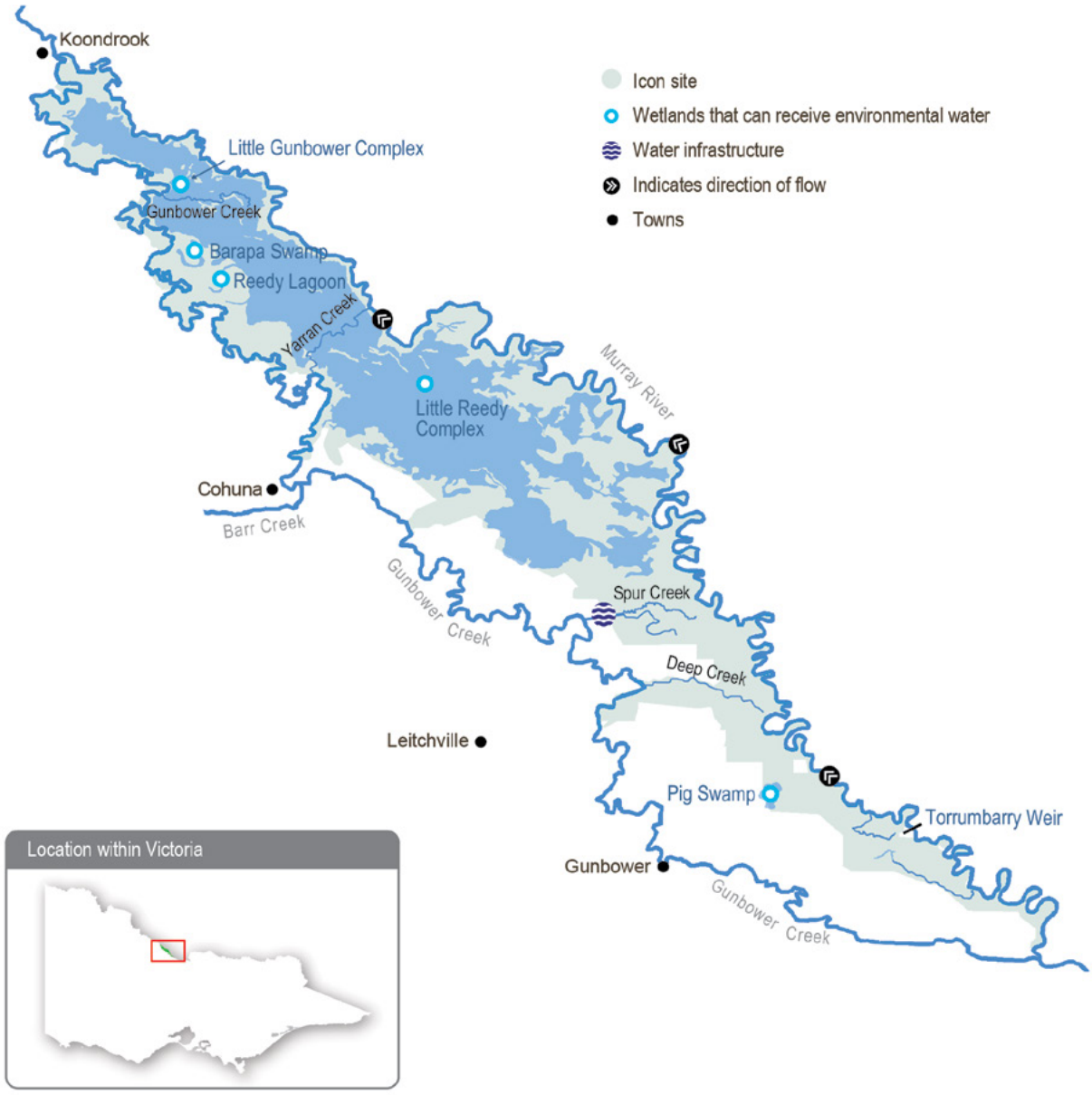
Gunbower Forest is a large, flood-dependent forest situated on the Murray River floodplain in northern Victoria between Torrumbarry and Koondrook (Figure 5.2.3)

Gunbower Forest, which covers 19,450 ha, is bounded by the Murray River to the north and Gunbower Creek to the south. It is an internationally significant site under the Ramsar Convention and forms part of the Living Murray Gunbower-Koondrook-Perricoota Forest Icon Site. Regulation of the Murray River and water extraction has reduced the frequency, duration, and magnitude of flood events in Gunbower Forest over the long term. This has affected the extent and condition of floodplain habitats and the health of native plant and animal communities (such as river red gum and black box communities, native fish, birds, platypus, frogs and turtles) that depend on those habitats.

Gunbower Creek is a natural creek that has been modified to supply irrigation water from the Murray River to the Torrumbarry Irrigation Area. There are 12 lagoons, located mainly in the upper reaches of the creek system, that are permanently or seasonally connected to Gunbower Creek. Water for the environment is used in Gunbower Creek to improve habitat for native fish, especially Murray cod.

The Living Murray environmental works program in the middle and lower forest was completed in 2013-14. The works allow up to 4,500 ha of the wetlands and floodplain to be watered with considerably less water than would be required if the watering infrastructure was not in place. The works enable efficient watering through Gunbower Creek and the forest to maintain the wetland and floodplain condition and provide connectivity between the creek, forest floodplain and the Murray River. Frequent connections between the river and floodplain habitats allow animals to move between habitats and support critical ecosystem functions (such as carbon exchange).

Figure 5.2.3 The Gunbower Forest and Gunbower Creek system



Environmental values

Gunbower Forest contains many important environmental values. It includes rare and diverse wetland habitats and large areas of remnant vegetation communities (such as river red gum forest and woodlands). It is home to vulnerable and endangered plants and animals, including river swamp wallaby grass, wavy marshwort, Murray-Darling rainbowfish and eastern great and intermediate egrets. Gunbower Forest also supports internationally recognised migratory waterbird species.

Gunbower Creek provides important habitat for native fish (such as Murray cod, golden perch and freshwater catfish). It is a valuable refuge for native fish and provides a source of fish to recolonise surrounding waterways.

Environmental objectives in Gunbower Forest and Creek

	A1 – Increase the diversity and abundance of native frog species within the forest
	**B1** – Provide feeding, breeding and refuge habitat for waterbirds, including colonial nesting species (such as egrets, cormorants and herons)
	**CN1** – Support carbon and nutrient cycles in the forest and wetlands and periodically deliver carbon and nutrients from the forest to adjacent waterways to support riverine food webs
	F1 – Provide feeding, breeding and refuge habitat for native fish (such as Murray-Darling rainbow fish) in Gunbower Forest wetlands **F2** – Improve the small-bodied native fish population in the Gunbower Forest wetlands **F3** – Improve the small- and large-bodied native fish (such as Murray cod) population in Gunbower Creek
	**T1** – Maintain the freshwater turtle population
	**V1** – Improve the health and increase the abundance of native vegetation in permanent and semi-permanent wetlands **V2** – Improve the health of river red gums on the floodplain
	WQ1 – Maintain water quality in Gunbower Creek

Traditional Owner cultural values and uses

Gunbower Forest is recognised as the traditional lands of the Yorta Yorta Nation in the upper area and the Barapa Barapa First Nations People (Barapa Barapa) in the middle and lower areas.

The following text presents knowledge and objectives developed with and provided by Barapa Barapa. The North Central CMA remains committed to working with the Yorta Yorta Nation to support Yorta Yorta People at Gunbower Forest and ensure environmental watering actions are culturally informed and able to support their aspirations for looking after Country.

Barapa Barapa have expressed their aspirations for an active role in the management of land and water to fulfil custodianship obligations and contribute to improvements in the health of Country. Barapa Barapa have partnered with the North Central CMA to deliver the Water for Country project in Gunbower Forest since 2015. The Water for Country project builds on the work of the previous Barapa Barapa Cultural Heritage Mapping of Lower Gunbower Forest project, delivered in 2013-14, to map a catalogue of cultural heritage assets in the forest. The Water for Country project aims to investigate how cultural and spiritual values may be better represented in water management. In 2018, the Water for Country group expanded to include Wamba Wemba First Nations people and continues to focus on Gunbower Forest.

The Barapa Barapa Water for Country project led to the development of the 2017 Barapa Barapa Cultural Watering Objectives Framework, a guiding document to ensure cultural priorities and outcomes are considered and incorporated into environmental watering through seasonal watering proposals. The framework was used for the first time in 2018 to assist with developing cultural objectives for proposed environmental watering actions included in the 2018-19 seasonal watering proposal for Gunbower Forest and Creek and is now used annually to help inform seasonal watering proposal planning. Applying elements of the framework during seasonal watering proposal engagement with Barapa Barapa ensures environmental watering activities incorporate Barapa Barapa's cultural objectives and that water managers are culturally informed when delivering environmental water.

The cultural objectives that can be supported in 2024-25 have been informed by the Cultural Watering Objectives Framework, seasonal watering proposal engagement and engagement with Barapa Barapa throughout the year. The cultural objectives that can be achieved will depend on which environmental water actions are implemented, depending on climatic conditions.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 5.2.6** with an icon (as explained in **Figure 1.2.3**). The use of this icon is not intended to indicate that these activities are meeting all the Cultural Objectives 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

The table below explains how environmental water can support cultural objectives at Gunbower Forest and Creek in 2024-25. The objectives are derived from the 2017 Barapa Barapa Cultural Watering Objectives Framework (2017) as well as discussions with Barapa Barapa First Nations people through annual engagement.

Table 5.2.5 Barapa Barapa cultural objectives and how delivery of environmental water may address these in 2024-25 at Gunbower Forest and Gunbower Creek

Cultural objective	Indicator	Measure	How environmental water can support cultural values
• **Promote and maintain healthy and abundant native fish communities in Gunbower Creek and Gunbower Forest**	• Murray cod and yellow belly are breeding • Trout cod and catfish are present	• Fish surveys showing a range of ages, including young of year (less than one year)	• Barapa Barapa have expressed the ongoing survival of fish and freshwater mussel populations as standing food resources. • Continuing in 2024-25, Barapa Barapa put a high priority on protecting and restoring native fish populations in Gunbower Creek, as well as avoiding any further fish deaths due to hypoxic blackwater. • Delivering the native fish hydrograph will support the recovery of native fish populations in Gunbower Creek, including Murray cod breeding. Gunbower Creek is not known to provide suitable conditions for yellow belly breeding, but recruitment into the creek will be targeted by delivering recolonisation flows. Delivering habitat diversity flows will also improve habitat for trout cod. • The winter baseflow component of the native fish hydrograph is important to maintain stable water levels in the lagoons for catfish. However, a project in 2023-24 to better understand how catfish populations can be supported has involved engagement with Barapa Barapa. The results of this project will inform future proposals. • Maintaining fish populations (as hosts for the larval stage of the mussel lifecycle) and water in wetlands will support the survival of adult billabong mussels.

Cultural objective	Indicator	Measure	How environmental water can support cultural values
• **Maintain permanent water refuges**	• Open water in Barapa Swamp and Reedy Lagoon in summer • Healthy water • Water enters fishponds associated with mounds	• The presence of remnant pools of sufficient quality water in summer • No further invasion of river red gums or giant rush	• Providing drought refuges and maintaining areas with healthy wetland habitat is a high priority for Barapa Barapa. Delivering wetland top-ups to Barapa Swamp[1] (Black Swamp) and Reedy Lagoon in spring 2024 will support this value. • Another Barapa Barapa priority is restoring high-value wetlands (such as Green Swamp) by undertaking revegetation and other activities like carp control. The wetland drawdown and top-ups in 2024-25 will help improve the health of wetland habitat and provide refuge areas for culturally significant animals in high-priority wetlands (such as Barapa Swamp and Reedy Lagoon). The planned drawdown at Green Swamp will enable access to the wetland to undertake restoration works before refilling it.
		• Water test kit — salinity and dissolved oxygen levels suitable for plants and animals • Groundwater bore levels appropriate -TBD	• Topping up Reedy Lagoon and Barapa Swamp in spring 2024 will help maintain water quality in these high-value wetlands in summer.
		• The presence of water in fishponds (cultural sites) during floods	• Barapa Barapa aspire to reintroduce traditional fish traps into natural creeks within Gunbower Forest and trial them as a carp-control method. The floodrunners around the Little Gunbower complex have been identified in previous years as potential trial sites, so overtopping the complex in spring 2024 will support this objective. Another opportunity identified is to trial traditional fish trap designs for carp control in wetlands (such as Green Swamp). Opportunities to implement these trials may be pursued in 2024-25.

Cultural objective	Indicator	Measure	How environmental water can support cultural values
• **Promote and maintain healthy cultural plants and resources**	• An abundant, healthy old man weed population • Healthy river red gums with little dieback and new annual growth • Abundant populations of water ribbons in spring in wetlands and creek • Abundant healthy populations of nardoo	• Cultural harvest, plant surveys, seed collection and photo points	• This value will be supported by allowing wetlands to draw down naturally in autumn/winter 2024. Allowing slow drawdowns in cool seasons promotes the growth and survival of mudflat plants, including old man weed, which will provide opportunities for cultural practices to continue.
			• Extending natural flooding will support objectives for healthy river red gums and provide significant resources to enable abundant harvests of culturally significant plants (such as basket sedge). It will also increase the area of habitat on the floodplain for culturally significant animals (such as waterbirds, turtles and mussels). Topping up and overtopping wetlands will support these values over smaller areas. However, drawing down wetlands will help them to reset and improve the health of aquatic habitat and resources when refilled. These watering actions will provide opportunities for cultural practices to continue.
• **Promote healthy waterbird populations**	• Waterbird breeding	• Waterbird surveys, spring/summer surveys for eggs	• Little Gunbower complex and Barapa Swamp have supported significant numbers of breeding waterbirds over the past 2-3 years. Delivering water to these wetlands in spring 2024 will provide habitat for waterbirds in summer while the Little Reedy complex continues to draw down. While this watering may not trigger large numbers of waterbirds to breed, breeding is more likely if there is unregulated flooding. If so, extending unregulated flooding and providing wetland top-ups will support waterbirds to breed.
• **Barapa Barapa share culture and caring for Country** • **Protect and preserve culturally significant sites through appropriate flow regimes**	• No new erosion or exposure of cultural sites • Live scar trees are healthy • Dead scar trees remain standing	• Photo points at inflow and outfall points, circumference measure/photo points of dead scar trees, tree health scores of live scar trees	• Barapa Barapa value periodic flooding to maintain the health of scar trees and culturally significant trees. Tangible cultural heritage sites (such as scar trees, culturally significant trees, earth mounds and middens) should be recorded and surveyed. • In 2023-24, registered cultural sites were monitored before, during and after watering to measure the risk of harm to cultural values from delivering environmental water. Protection works were also undertaken at sites considered at greater risk of harm. Extending the duration of natural flooding and topping up and overtopping wetlands is anticipated to support the health of live scar trees and culturally significant trees.

Cultural objective	Indicator	Measure	How environmental water can support cultural values
• **Cultural practices**	• N/A	• N/A	• Barapa Barapa have indicated that a smoking ceremony should be a regular activity each year when water is delivered. It is what their ancestors would have done when the floodwaters arrived and would represent the restoration of an important cultural practice.

1 Barapa Swamp, an alternative placename for Black Swamp, has been adopted by the North Central CMA in discussion with the Barapa Barapa Traditional Owners and subsequently used throughout the *Gunbower Forest and Creek Seasonal Watering Proposal 2024-25* and in this seasonal watering plan.

Social, recreational and economic values and uses

In planning the potential watering actions in **Table 5.2.6**, the North Central CMA considers how environmental flows could support social, recreational and economic values and uses, including:

- water-based recreation (such as boating, hunting, canoeing and fishing)
- recreation and amenity (such as birdwatching, camping, photography and walking)
- community events and tourism (such as park visitation, tour, and activity operators)
- socioeconomic benefits (firewood harvesting, tourism, and education opportunities).

Planned environmental flows may be modified to align with a community benefit so long as environmental outcomes are not compromised. If natural flooding occurs, there is an action to extend the duration of unregulated flooding in the lower forest wetlands and floodplain during winter/spring 2024. If this watering action is delivered, it will not continue beyond November, achieving ecological outcomes while also reducing the likelihood that tracks will be inundated during the peak summer visitation period. This is acknowledged in **Table 5.2.6** with the following icon (as explained in **Figure 1.2.3**).

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

Scope of environmental watering

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

Table 5.2.6 describes the potential environmental watering actions in 2024-25, 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 5.2.6 Gunbower Forest and Creek system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Gunbower Forest		
Top-up and spill Little Gunbower complex and Barapa Swamp in spring	• Promote the growth of river red gums and understorey vegetation on the floodplain • Provide diverse feeding and breeding habitat for waterbirds, small-bodied native fish, frogs and turtles in wetlands and the surrounding floodplain	A1  B1 F1, F2  T1  V2
Top-up Reedy Lagoon in spring *Trigger: presence of uncommon, small-bodied native fish*	• Maintain water quality and available habitat for uncommon small-bodied native fish species over summer	F1, F2
Top-up and spill Little Gunbower Complex, Barapa Swamp, Reedy Lagoon, and the Little Reedy complex in autumn/ winter	• Support wetland vegetation growth, recruitment and restoration works following an extended drawdown phase (from summer 2024 to autumn 2025) in the Little Reedy complex • Promote the growth of river red gums and understorey vegetation on the floodplain • Provide diverse feeding habitat for waterbirds	 B1  V1, V2
Top-up Little Gunbower complex, Little Reedy complex, Barapa Swamp and Reedy Lagoon in spring/ summer *Trigger: waterbird breeding*	• Maintain adequate water levels in breeding and feeding habitats to allow breeding waterbirds to fledge their chicks successfully	 B1

Potential environmental watering action	Expected watering effects	Environmental objectives
Extend the duration of unregulated flooding in the lower forest wetlands and floodplain during winter/spring (ceasing delivery by November)  *Trigger: natural flooding that cannot be excluded from the Little Reedy complex*	• Promote the growth of river red gums and understorey vegetation on the floodplain • Provide diverse feeding and breeding habitat for waterbirds, small-bodied native fish, frogs and turtles in wetlands and the surrounding floodplain	A1  B1 F1, F2  T1  V1, V2
Winter/spring fresh in Yarran Creek (variable flow rates and duration based on water levels in Gunbower Forest and flows in the Murray River and Gunbower Creek)	• Connect Gunbower Creek, Gunbower Forest and the Murray River through the Yarran Creek and/or Shillinglaws regulators to increase flowing habitat for the lateral movement of native fish, carbon and nutrients	 CN1 F1, F2, F3
Gunbower Creek (targeting Cohuna Weir)		
Autumn/winter low flow (200 ML/day during July to August 2024 and April to June 2025)	• Maintain connectivity through the length of Gunbower Creek and between lagoons during the off-irrigation period and prevent sections from drawing down to isolated pools • Provide access to food resources over the cooler months and reduce predation pressure on juvenile fish	F3
Spring/summer/autumn high flow (300-400 ML/day during September to March)	• Maintain habitat and food resources for native fish and support breeding and larval survival (such as Murray cod) by minimising large variations in the water level during the irrigation season and achieving about 1.5 m depth in deeper pools and 30 cm depth in the shallow connecting the littoral zone to the maintain habitat • A greater area of habitat will be inundated at the upper magnitude	F3
Year-round opportunistic fresh(es) (300-500 ML/day for one to four weeks)	• Increase flowing habitat in Gunbower Creek to provide preferred flow conditions for native fish	 F3

Potential environmental watering action	Expected watering effects	Environmental objectives
Gunbower Creek (targeting Koondrook Weir)		
Spring/summer/ autumn opportunistic fresh(es) (200-500 ML/day for one to four weeks, as required)	• Promote the exchange of carbon between Gunbower Creek and the Murray River • Provide a natural cue to attract native fish (such as Murray cod and golden perch) in spring to recolonise Gunbower Creek, maximising the effects of the fishways at Koondrook and Cohuna weirs	 CN1 F3
Trigger-based spring/summer fresh (50-300 ML/ day as required during September to February)	• Dilute the low dissolved oxygen return flows from Gunbower Forest at Three Corner Hole to improve water quality (oxygen concentrations) in lower Gunbower Creek if required	WQ1

Scenario planning

Gunbower Forest

Table 5.2.7 outlines potential environmental watering and expected water use in various planning scenarios.

Wet conditions in winter and spring 2022 triggered the largest flood in Gunbower Forest since 1993. Smaller floods in July and October 2023 and January 2024, along with environmental water deliveries in July and September through early October 2023, inundated parts of the floodplain and maintained high water levels in permanent and semi-permanent wetlands.

The wet conditions have had mixed effects on vegetation communities throughout the forest. Annual monitoring has demonstrated that river red gums and associated understorey vegetation on the floodplain are in the best-reported condition since monitoring began in 2005, but the condition of vegetation communities in some wetlands has declined since the 2022 floods. The decline in wetland vegetation is possibly due to the deep inundation experienced during the natural flood events and the high numbers of carp in the wetlands.

In the drought-to-average planning scenarios, maintaining floodplain and waterbird habitat and recovering wetland vegetation are prioritised by the delivery of a water regime that includes a mix of filling and drawdown. The regulating structures that control the flow into the forest from the Murray River may be closed to facilitate wetland drawdown if low-level flooding is predicted.

Different watering regimes will be applied to the wetlands within Gunbower Forest to achieve specific vegetation outcomes at each wetland and create connected habitats that can support fish, frogs, turtles and waterbirds in different stages of their lifecycles. Providing a variety of foraging habitats for waterbirds is especially important to support juvenile birds that hatched and fledged during recent natural floods.

Little Gunbower complex and Barapa Swamp will draw down through to the end of winter 2024 to facilitate drying of the adjoining floodplain and the shallower parts of the wetlands. Environmental water will then be used to re-fill and overtop them in spring. They will be allowed to draw down again in summer and may be topped up again in autumn 2025, subject to an assessment of the climatic conditions, water depth and ecological conditions in early 2025.

Reedy Lagoon is a permanent wetland with high-quality aquatic vegetation, and it supports diverse and abundant small-bodied native fish, including southern pygmy perch, which were reintroduced in 2023. Fish monitoring surveys are planned for autumn 2024. If those surveys detect large numbers of uncommon small-bodied native fish, water for the environment may be delivered in spring 2024 and autumn 2025 to maintain adequate water quality and depth to support the fish.

The semi-permanent Little Reedy complex will be allowed to draw down through to the end of summer 2025 to reduce carp numbers and allow planned revegetation activities to occur. Water for the environment may be delivered to the wetland complex in autumn 2025 once the water level has contracted to small pools.

Waterbird populations across northern Victoria have still not recovered from the Millennium Drought. Therefore, supporting natural breeding events in places such as Gunbower Forest is a high priority and may cause the planned watering actions described here to be modified. If significant waterbird breeding is detected at any of the wetlands described, water for the environment may be used in spring/summer to maintain water levels at breeding colonies. Such actions may mean that the planned draw-down phases are interrupted or that planned autumn watering is unnecessary.

In a wet scenario, it is highly likely that the Murray River will flood and inundate large parts of Gunbower Forest and prevent planned draw-down actions at particular wetlands. In this planning scenario, environmental water may be used to extend the duration of forest flooding to optimise benefits for river red gums and the flood-dependent understorey and sustain feeding, breeding and foraging habitat for waterbirds, small-bodied native fish, frogs and turtles. This will be achieved by closing the Murray River regulators on the tail end of the flood to avoid rapid draining of the forest and then using the lower landscape regulators to deliver environmental water to maintain water levels in selected parts of the forest, including low-lying areas of river red gum floodplain. Environmental watering of the floodplain will not continue beyond November to allow wetlands to draw down following a natural seasonal pattern and avoid scorching the mudflat vegetation. It will also allow wetlands to have a drying phase before they are topped up in autumn/winter/spring 2025. This will also benefit forest users, enabling forest access during the summer peak season. Water for the environment may be used to deliver a flow through Yarran Creek in the wet planning scenario if there is sufficient difference in water levels between Gunbower Creek and the Murray River to create a hydraulic head that will allow a flowing habitat to be created in Yarran Creek. This flow would allow fish and other aquatic animals to move between the Murray River and Gunbower Creek, disperse plant seeds or propagules and facilitate the exchange of carbon and nutrients.

Gunbower Creek

The flow in Gunbower Creek is highly influenced by irrigation demands, which can cause significant fluctuations in the creek's water level during the irrigation season and provide little or no flow from late autumn to the end of winter. Water for the environment is primarily used to smooth out these flow fluctuations to provide suitable habitat, breeding and dispersal opportunities for native fish.

Over the last two years, natural flooding has contributed to several poor water quality events in Gunbower Creek that are likely to have harmed the native fish community. Delivering a mix of low flows, stable high flows and littoral zone flows throughout the year will be a high priority in all planning scenarios to provide suitable conditions for native fish to feed and breed, helping those populations recover.

The low-flow recommendations for Gunbower Creek are based on the irrigation and non-irrigation seasons. The recommended autumn/winter low flow of 200 ML per day (measured at Cohuna Weir) during the non-irrigation season is considered the minimum flow required to maintain fish habitat within the main channel of Gunbower Creek and the connections between the main channel and the upper lagoons, which support freshwater catfish. For two reasons, the recommended autumn/winter low flow is smaller than the flow that would naturally occur at that time of year and is smaller than the recommended low flow during the irrigation season. First, it is considered sufficient to maintain viable habitat and ecological function and can be met with the available supply of environmental water. Second, providing a lower flow during the non-irrigation season relieves some of the stress imposed on the channel form and its banks by a prolonged near-capacity flow during spring, summer and autumn.

During the irrigation season, high flows of between 300 and 400 ML per day will generally be delivered. The Murray cod breeding season extends from about September to December, depending on the weather and water temperature. The aim will be to maintain stable high flows close to 400 ML per day during this period. Littoral zone flows of at least 300 ML per day during summer/autumn will maintain important nursery habitat to support the recruitment of native fish, particularly Murray cod. From autumn, the flow will gradually be reduced from 300 ML per day to provide a smooth transition between the irrigation and

non-irrigation seasons. All low-flow targets will be subject to the environment's share of channel capacity.

Other opportunistic or trigger-based watering actions may be delivered in Gunbower Creek during 2024-25. In a wet planning scenario, there is a risk that unregulated flows will flood parts of Gunbower Forest and carry water with high concentrations of dissolved organic carbon from the floodplain into lower Gunbower Creek, causing low dissolved oxygen conditions in the creek. If this happens, a trigger-based dilution flow of 50-300 ML per day may be delivered past Koondrook Weir to prevent fish deaths.

In all planning scenarios, opportunistic freshes targeting Cohuna Weir or Koondrook Weir may also be delivered if they can be accommodated within the irrigation operations. These freshes aim to temporarily increase the amount of flowing habitat, which some fish prefer, and encourage fish to move into the system from the Murray River. These freshes are more likely to be delivered during spring and autumn when fish commonly disperse. Ideally, they will coincide with a flow pulse in Murray River to take advantage of system-wide cues for native fish movement.

Gunbower Creek's channel capacity has declined in recent years, and the magnitude of planned environmental flows has dropped accordingly to achieve the target physical and ecological responses without inundating private land. The relationship between the flow over Cohuna Weir and the downstream water level will continue to be monitored and reviewed in 2024-25 and beyond so that environmental flow targets in Gunbower Creek can meet ecological objectives while also adapting to changes in the channel's capacity.

In Gunbower Creek, a carryover target of 4,000 ML has been identified in all planning scenarios as guaranteeing sufficient supply to maintain a low flow in Gunbower Creek during the 2025-26 irrigation shutdown season. About 20,000 ML of carryover is required to enable top-ups to the wetlands at Gunbower Forest during winter and spring 2024.

Table 5.2.7 Gunbower Forest and Creek system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Natural inflows into Gunbower Forest are unlikely	• Natural inflows into Gunbower Forest are unlikely • Some run-off-producing rainfall is expected, with inflows into storages unlikely to cause spills and unregulated flow	• Natural inflows into Gunbower Forest during winter/spring are possible and could result in inundation of low-lying creeks and wetlands	• Overbank flow is likely in winter and/or spring • High inflows into full storages in autumn, winter and/or spring 2024 will likely result in spilling events and unregulated flooding

Planning scenario	Drought	Dry	Average	Wet
Gunbower Forest				
Potential environmental watering – tier 1 (high priorities)	• Top-up and spill Little Gunbower complex and Barapa Swamp in spring • Top-up Reedy Lagoon in spring in response to fish surveys • Top-up Little Gunbower complex, Little Reedy complex, Barapa Swamp and Reedy Lagoon in spring/summer in response to bird breeding • Top-up and spill Little Gunbower complex, Barapa Swamp, Reedy Lagoon and the Little Reedy complex in autumn/winter • Top-up Little Gunbower complex, Barapa Swamp and Reedy Lagoon in spring/summer			• Extend the duration of unregulated flooding in the lower forest wetlands and floodplain • Top-up Little Gunbower complex, Barapa Swamp and Reedy Lagoon and Little Reedy complex in spring/summer • Top-up and spill Little Gunbower complex, Barapa Swamp, Reedy Lagoon, and the Little Reedy complex in autumn/winter • Winter/spring fresh in Yarran Creek
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 25,000 ML	• 25,000 ML	• 25,000 ML	• 34,400 ML
Gunbower Creek targeting Cohuna Weir				
Potential environmental watering – tier 1 (high priorities)	• Autumn/winter low flow • Spring/summer high flows • Spring/summer/autumn opportunistic freshes			

Planning scenario	Drought	Dry	Average	Wet
Gunbower Creek targeting Koondrook Weir				
Potential environmental watering – tier 1 (high priorities)	• Spring/summer/autumn opportunistic freshes			• Spring/summer/ autumn opportunistic freshes • Trigger-based spring/summer fresh
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 23,000 ML	• 18,000 ML	• 18,000 ML	• 19,000 ML
Priority carryover requirements for 2025-26	• 24,000 ML			

5.2.4 Central Murray wetlands

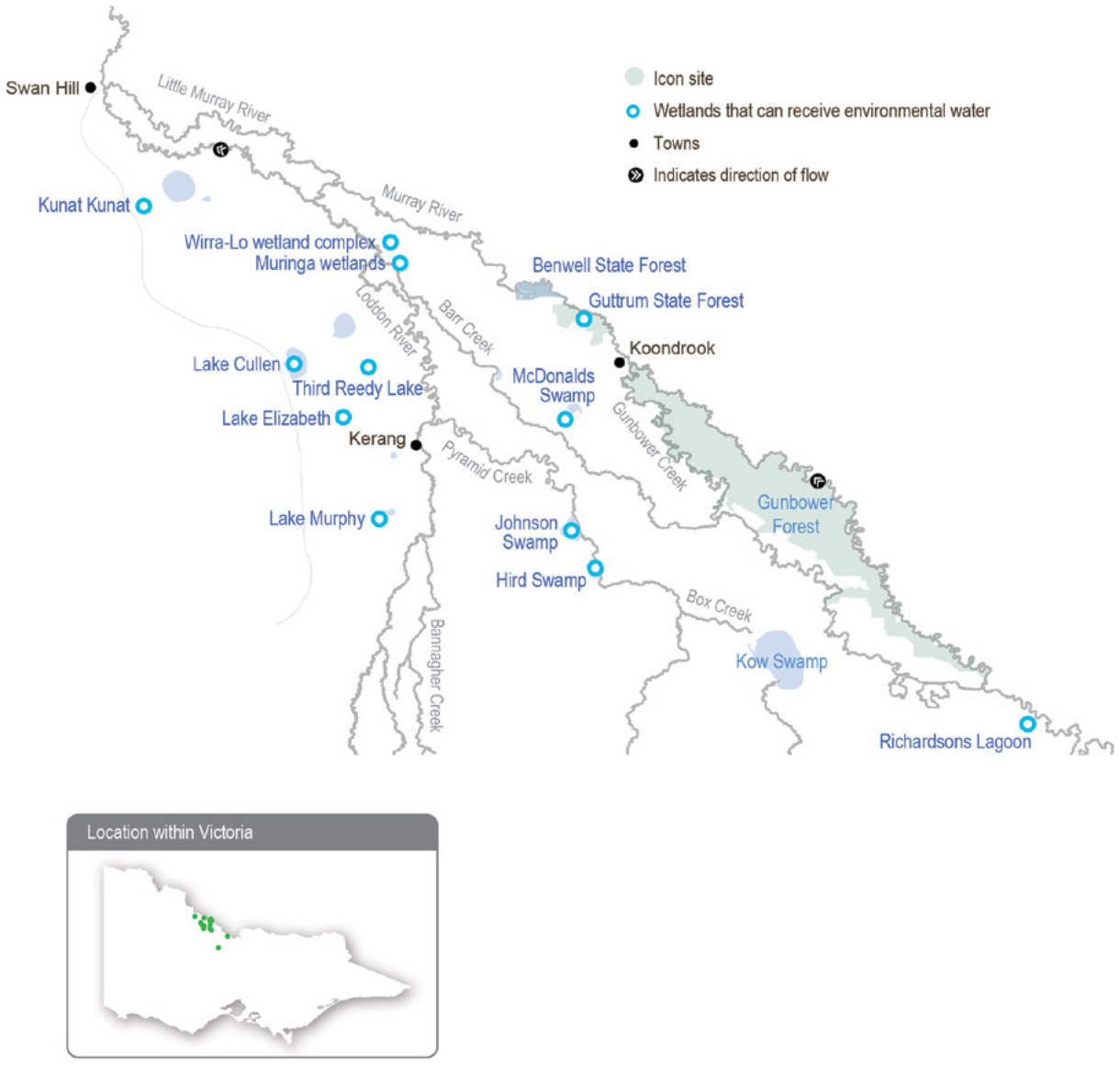
System overview

The central Murray wetlands are located on the lower Loddon River and Murray River floodplains (Figure 5.2.4). The wetland system includes Guttrum state forest, Hird Swamp, Johnson Swamp, *Kunat Kunat* (Round Lake), Lake Cullen, Lake Elizabeth, Lake Murphy, McDonalds Swamp, Richardson Lagoon and Third Reedy Lake. Muringa wetlands and the Wirra-lo wetland complex have previously received water for the environment, but these wetlands are on private land, and those landowners are currently managing their water regimes. Therefore, they are not included in this year's seasonal watering plan.

The central Murray wetlands are almost wholly contained within the Torrumbarry Irrigation Area and are all wetlands of regional or international significance. The area has experienced dramatic changes since European settlement with the construction of levees, roads and channels. Most of the wetlands are now cut off from natural flow paths and are rarely filled, except by large natural floods. They rely on water for the environment to support their ecological character and health.

Nine of the central Murray wetlands can receive water for the environment from permanent infrastructure: Hird Swamp, Johnson Swamp, Kunat Kunat, Lake Cullen, Lake Elizabeth, Lake Murphy, McDonalds Swamp, Richardson's Lagoon and Third Reedy Lake. Temporary pumps are currently used to deliver water for the environment from the Murray River to Reed Bed Swamp in Guttrum Forest when required. More permanent water delivery infrastructure for Guttrum Forest is proposed as part of the Victorian Murray Floodplain Restoration Project.

Figure 5.2.4 The central Murray wetlands system



Environmental values

The central Murray wetlands support numerous listed threatened species ranging from vulnerable to critically endangered, including the Australasian bittern, Murray hardyhead, Australian painted snipe, growling grass frog and the southern purple spotted gudgeon, which was presumed extinct in Victoria until it was found at Third Reedy Lake in spring 2019. When the wetlands receive environmental water, they can attract prolific birdlife and provide feeding and breeding habitat for many threatened and endangered bird species (including the eastern great egret and white-bellied sea eagle) listed under legislation and international agreements. Lake Cullen, Hird Swamp, Third Reedy Lake and Johnson Swamp are internationally recognised under the Ramsar Convention, while the other wetlands in the central Murray system have bioregional significance.

Environmental objectives in the Central Murray wetlands

	A1 – Maintain the native frog (such as barking marsh frog, Peron's tree frog and spotted grass frog) population
	**B1** – Provide resting, feeding and breeding habitat for a variety of waterbirds and threatened species (such as Caspian tern, Australasian bittern, little bittern and brolga)
	F1 – Maintain the small-bodied native fish population, including threatened species (such as Murray hardyhead and purple spotted gudgeon)
	**MI1** – Increase the diversity and biomass of waterbugs
	**T1** – Maintain the native turtle population (such as the Murray River turtle and the eastern long-necked turtle)
	**V1** – Restore the extent of wetland trees (such as river red gum and black box) **V2** – Restore the extent of mudflat vegetation communities (such as tall marsh, herblands, rushes and sedges) **V3** – Restore the extent of native aquatic vegetation species (such as tassel, foxtail stonewort, milfoil and pondweed) **V4** – Maintain the extent of native aquatic vegetation species (such as tassel, foxtail stonewort, milfoil and pondweed) **V5** – Reduce the extent and density of invasive plant species **V6** – Support a mosaic of wetland plant communities across the region

Traditional Owner values and uses

The wetlands and surrounding land in the central Murray region hold great significance for the Traditional Owners, the Barapa Barapa, Wamba Wemba and Yorta Yorta peoples. Their traditional knowledge is a living culture evident throughout the landscape in scar trees, significant cultural sites and cultural tools for cultural practices. The rivers and floodplains are a food and fibre source and contain many sites of significance (such as campsites and meeting places).

Environmental watering supports values including native fish, waterbirds and turtles, and it promotes the growth of culturally important plants that provide food, medicine and weaving materials for Traditional Owner groups. The presence of water itself can be a cultural value, as well as the quality of the water: healthy water promotes healthy Country. The cultural benefits that can be achieved in 2024-25 have been informed by seasonal watering plan engagement in February 2024 with Barapa Barapa and Wamba Wemba Traditional Owners and formal and informal engagement with Traditional Owners throughout the year.

The following table shows the cultural benefits of delivering environmental water for Barapa Barapa and Wamba Wemba Traditional Owners at the central Murray wetlands in 2024-25.

Table 5.2.8 Barapa Barapa and Wamba Wemba cultural values and uses, central Murray wetlands

Values, uses, objectives & opportunities	How this opportunity will be considered in environmental watering in 2024-25
Cultural plants and cultural practices	• Water in wetlands from environmental watering and natural flooding supports culturally important plants and allows the continuation of cultural practices, including harvesting food, medicine and weaving plants. Examples include harvesting cotton weed (foxtail stonewort) at *Kunat Kunat* for starting fires and harvesting black swans for cultural practices. • Watering actions will support cultural plants that Barapa Barapa and Wamba Wemba Traditional Owners value and provide opportunities for cultural practices to continue. • Barapa Barapa and Wamba Wemba Traditional Owners recognise the value of resources that occur on the drawdown after wetlands are inundated, providing food for animals as well as cultural plants (such as old man weed). These benefits can be realised by allowing wetlands to draw down naturally after receiving water to expose mudflats. • Having diverse habitat and vegetation responses is a priority for Barapa Barapa and Wamba Wemba Traditional Owners. They note the importance of having a range of water depths to create a more diverse vegetation response, which results in various resources becoming available over a longer timeframe. • Barapa Barapa Traditional Owners have undertaken revegetation activities as part of the Decision Support Tool Wetland Revegetation Project at McDonalds Swamp and separate planting works at Third Reedy Lake. Opportunities to have Traditional Owners involved with monitoring and revegetation at some wetlands will be sought throughout 2024-25. The Traditional Owners are keen to be involved in flood recovery revegetation works. • Environmental water deliveries can be managed so revegetated areas have an appropriate water regime — plants receive water but are not drowned — to ensure their ongoing survival and provide opportunities for natural recruitment. • The delivery of water for the environment can support the preservation and improvement of cultural animals: totem species. Additionally, the delivery of environmental water will aim to ensure that culturally important animals (food sources such as black swans) are supported and can continue to breed and thrive.

Values, uses, objectives & opportunities	How this opportunity will be considered in environmental watering in 2024-25
Healthy Country	• Providing drought refugia and maintaining areas with healthy habitat are high priorities for Barapa Barapa and Wamba Wemba Traditional Owners. Without natural inflows, they see it as important to ensure water is delivered to healthy areas (such as Hird and McDonalds swamps), which elicit a good vegetation response and can support wetland animals. • Environmental watering actions will ensure there is water in high-priority wetlands regardless of whether flooding occurs. This will provide refuge habitat for waterbirds, woodland birds, turtles and frogs and ensures high-quality habitat is available.
Cultural heritage	• Cultural heritage artefacts are common at the wetlands, which have been important gathering sites for Traditional Owners. The loss of fringing trees and changes to natural watering regimes have exposed sediments around these wetlands for prolonged periods, resulting in some cultural artefacts being uncovered. • Environmental water can support the growth of fringing red gum trees and tall marsh, reduce erosion at these wetlands and help keep cultural heritage artefacts covered.

Barapa Barapa and Wamba Wemba input to watering actions for Guttrum Forest in 2024-25

Delivery of water for the environment to Guttrum Forest during 2024-25 has been planned in conjunction with the Barapa Barapa and Wamba Wemba people, for whom the wetlands and surrounding forest are places of high cultural significance. Traditional Owners are an important part of Guttrum Forest planning and management and have been directly involved in delivering environmental flows to Reed Bed Swamp in 2019-20 and 2021-22. In 2023-24, no environmental water was delivered to Reed Bed Swamp due to large-scale natural flooding.

Barapa Barapa and Wamba Wemba collaborate with waterway managers to ensure that during watering events, their cultural heritage is protected and that the hydrological needs of important cultural values (such as food and medicinal plant species, scar trees and ring trees) are supported through the timing and duration of planned watering actions to the forest.

The following table shows the cultural benefits of delivering environmental water for Barapa Barapa and Wamba Wemba Traditional Owners at Guttrum Forest in 2024-25.

Table 5.2.9 Barapa Barapa and Wamba Wemba cultural values and uses, Guttrum Forest

Value/use	Considerations
Food, fibre and medicinal plants	• The response of wetland vegetation in previous years in Reed Bed Swamp saw a marked improvement in the growth and diversity of culturally important plants. In winter 2021, revegetation of plants characteristic of tall marsh, spike-sedge wetland and aquatic herbland included several culturally important plants. In addition to the revegetation, many plants regenerated naturally, including some small individuals or patches of cumbungi, nardoo, joyweed and giant rush. Old man weed was also observed in abundance on the drawdown. While the Traditional Owners noted that most of these plants are not yet abundant enough to allow for harvesting, they are on a good recovery trajectory. With more frequent annual watering, harvesting will likely be possible within a few years.
Cultural heritage	• The watering of Reed Bed Swamp supports fringing large old trees, including a couple of ring and scar trees. The condition of these trees has improved after previous watering.
Spiritual wellbeing	• The improvement in the condition of the wetland and the presence of water and moisture contribute to a sense of spiritual wellbeing.
Sharing cultural knowledge	• The Traditional Owners provide support and advice about what environmental values to target: that is, they provide information about what the wetland used to look like and what values it previously supported. • Traditional Owners have been present during the set-up of infrastructure and have been able to advise about avoiding impacts on their cultural heritage.
Employment opportunities	• Traditional Owners want to become more involved in managing their Country through increased employment opportunities (such as ecological and cultural monitoring). This has occurred as part of previous watering of Reed Bed Swamp.
Cultural landscape	• Maintaining the open-water habitat and mudflats underneath will be difficult if the river red gum saplings that germinated in recent floods are not removed. Removing them is important for maintaining the cultural landscape and access to food and medicines.
Cultural practice	• The Traditional Owners have indicated they want to see a smoking ceremony to welcome water back to the forest and consider it should be a regular activity each year when water is delivered. It is what their ancestors would have done when the floodwaters arrived and would represent the restoration of an important cultural practice. • Another priority in 2024-25 is to provide more opportunities for women to return to Country and undertake cultural practices (such as weaving, emu egg carving and discussion of the wetlands' health as it relates to women's business). This was a popular conversation topic during the Traditional Owner engagement day.

Planned environmental flows may be modified to align with cultural benefits so long as environmental outcomes are not compromised.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 water for a particular site, their contribution is acknowledged in **Table 5.2.10** with an icon (as explained in **Figure 1.2.3**). 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

Social, recreational and economic values and uses

The proposed watering actions in **Table 5.2.10** aim to optimise positive environmental outcomes for each wetland and have been informed by environmental water management plans, monitoring results and discussions with wetland ecologists with local knowledge. Watering actions also consider any shared benefits that may be achieved as identified through engagement with locals, interested stakeholders and Traditional Owners. The potential watering actions for 2024-25 include:

- waterway recreation (such as canoeing, fishing, kayaking, swimming and water sports)
- waterway recreation and amenity (such as birdwatching, duck hunting, camping, cycling, running and walking)
- community events and tourism (such as visitation during the hunting and fishing seasons, Breakfast with the Birds events [hosted annually by the North Central CMA] and supporting Aboriginal cultural heritage and history-based tours)
- socioeconomic benefits (such as ecosystem services like groundwater recharge, flood mitigation, nutrient treatment, carbon storage and stock and domestic uses).

Scope of environmental watering

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

Table 5.2.10 describes the potential environmental watering actions in 2024-25, 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 5.2.10 Central Murray wetlands system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Hird Swamp (partial fill in autumn) **McDonalds Swamp (partial fill in autumn)**	• Drown terrestrial weeds to limit their growth and reduce their extent • Promote the germination and establishment of aquatic vegetation • Inundate the wetland body and fringe to provide habitat for waterbirds, frogs and turtles and provide conditions suitable for macroinvertebrates that are food for waterbirds, frogs and turtles • Support the growth of planted river red gums and other aquatic and herbland vegetation	A1, B1, MI1, T1, V1, V2, V3, V5, V6
Kunat Kunat (Round Lake) (fill in spring, top up as required) **Lake Elizabeth (fill in spring, top up as required)**	• Maintain salinity within 15,000-80,000 EC and water depth to support suitable habitat and breeding conditions for Murray hardyhead and growing conditions for submerged aquatic plants that provide habitat for Murray hardyhead • Maintain water depth to provide permanent feeding, foraging and refuge habitat for waterbirds	B1, F1, V4, V5
Reedbed Swamp (partial fill in autumn/winter 2025)	• Wet the fringing adult river red gums to support their growth and drown river red gum saplings within the wetland bed to maintain open-water habitat • Increase the biomass of waterbugs as a food source for waterbirds • Promote the growth and reestablishment of aquatic vegetation and tall marsh vegetation at various depths across the wetland • Maintain the depth of the wetland to support frogs, turtles and waterbirds feeding and breeding	A1, B1, MI1, T1, V2, V3, V5, V6
Third Reedy Lake (partial fill in autumn)	• Drown terrestrial weeds and support the growth of planted river red gums • Increase biomass of waterbugs as a food source for waterbirds • Provide wetland habitat for waterbirds and frogs over autumn and winter	A1, B1, MI1, V1, V2, V3, V5

Scenario planning

Table 5.2.11 outlines potential environmental watering and expected water use in various planning scenarios.

Extensive flooding in 2022-23 and 2023-24 means that most wetlands in the central Murray region have been full or nearly full for at least two years. As of autumn 2024, most of the central Murray wetlands that have historically received water for the environment were at least partially full. McDonalds Swamp was the only wetland that was dry.

Individual wetlands within the central Murray system have different physical characteristics and support different environmental values. As a result, they have different water requirements and, except in flood years, should be in different stages of their wetting and drying cycles to create a mosaic of habitats for waterbirds, frogs and turtles. Providing habitat and food resources for young waterbirds, particularly at sites near recent colonial breeding sites, is a key consideration in developing central Murray wetlands watering strategies. In 2024-25, some wetlands will be allowed to draw down to initially provide shallow foraging habitat for waterbirds and then support dry-phase ecological processes. Other wetlands will be topped up to maintain deep water habitats in the landscape. The proposed watering actions to achieve this strategy are consistent across all planning scenarios in 2024-25, although the volume required to achieve them will potentially be greater in the drier planning scenarios compared to the average and wet scenarios.

The proposed watering actions for Lake Elizabeth and *Kunat Kunat* (Round Lake) — fill in spring and top up in autumn — are needed yearly to maintain permanent habitat for the endangered Murray hardyhead.

McDonalds Swamp, Hird Swamp, Third Reedy Lake and Reed Bed Swamp (in Guttrum Forest) are planned to have a dry phase ahead of partial fills in autumn 2025. Deliveries to McDonalds Swamp, Hird Swamp and Third Reedy Lake will support recently planted vegetation and drown terrestrial weeds. In Reed Bed Swamp, the partial fill will maintain open-water habitat by drowning red gum saplings. Environmental watering will also provide habitat and resources for macroinvertebrates, frogs, turtles and waterbirds.

Lake Cullen, Lake Murphy, Johnson Swamp and Richardson's Lagoon are not expected to receive water for the environment in 2024-25, with the latter two likely to remain dry through 2025-26. Lake Cullen is expected to retain water into autumn, when it will provide good shorebird habitat. Drying will facilitate dry-phase processes (such as nutrient cycling) and help prevent the spread of tall marsh at Johnson Swamp.

Water availability in the Murray system is expected to be high in 2024-25, and supply for the central Murray wetlands is assured in all planning scenarios. Capacity constraints in the Torrumbarry irrigation network mean deliveries must be carefully managed, particularly under the drought and dry scenarios. Reed Bed Swamp deliveries occur via a temporary pump rather than irrigation channels and will depend on repairs to the pump site being completed as planned by autumn 2025.

Carryover of 6,800 ML is essential in dry and drought scenarios to ensure water is available to maintain habitat for endangered fish in Lake Elizabeth and *Kunat Kunat* (Round Lake) and for spring top-ups that build on partial fills planned for autumn. The average and wet planning scenarios require less carryover: 6,200 ML and 1,600 ML, respectively.

Table 5.2.11 Central Murray wetlands system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Catchment run-off and natural flow into the wetlands are highly unlikely	• Catchment run-off and natural flow into the wetlands are unlikely	• Catchment run-off and natural flow into the wetlands are possible, particularly in winter/spring	• Catchment run-off and natural flow into the wetlands are likely, with potential flooding in some wetlands, particularly in winter/spring
Potential environmental watering – tier 1 (high priorities)	• Kunat Kunat (Round Lake) (fill in spring, top up as required) • Lake Elizabeth (fill in spring, top up as required) • Hird Swamp (partial fill in autumn) • McDonalds Swamp (partial fill in autumn) • Third Reedy Lake (partial fill in autumn) • Reed Bed Swamp (partial fill in autumn/winter 2025)			
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 6,950 ML	• 6,100 ML	• 5,500 ML	• 0-5,150 ML
Priority carryover requirements for 2025-26	• 6,800 ML		• 6,200 ML	• 1,600 ML

5.2.5 Hattah Lakes

System overview

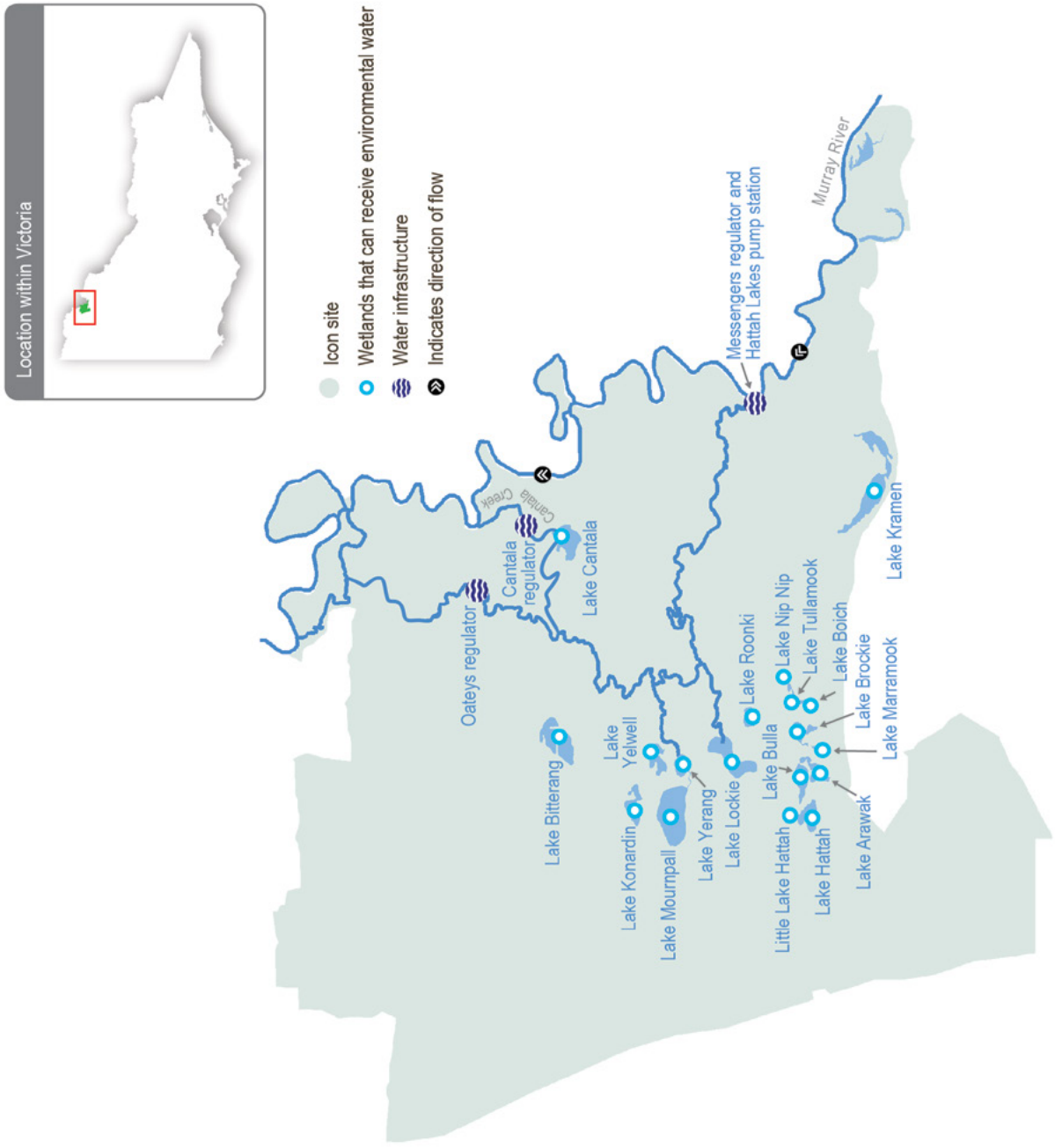
The Hattah-Kulkyne National Park is in north-west Victoria, adjacent to the Murray River (Figure 5.2.5). The national park contains a complex of more than 20 semi-permanent freshwater lakes known collectively as the Hattah Lakes.

The Murray River's flooding regimes strongly influence the Hattah Lakes' environment and the surrounding floodplain. The system fills when there is a high flow in the Murray River, and some lakes hold water for several years after floods recede. Regulation of the Murray River has significantly reduced the frequency and duration of small to medium natural floods in the Hattah Lakes system. Over time, this has degraded vegetation communities and reduced the diversity and abundance of animals that use the vegetation and wetlands for habitat and food.

The Hattah Lakes complex can be broadly divided into the southern Hattah Lakes, which contain permanent to semi-permanent wetlands, and the higher-elevation northern Hattah Lakes, which are mostly episodic wetlands.

The Messenger, Oateys and Cantala regulators allow water to flow between the Murray River and the Hattah Lakes. When the flow in the Murray River is about 26,000 ML per day, water begins to flow through the Messengers regulator into Chalka Creek and through the Hattah Lakes complex. A permanent pump station can deliver up to 1,000 ML per day to the southern Hattah Lakes through Chalka Creek independently of the flow in the Murray River. The regulators and pump station are used in combination with several small constructed levees to deliver a pattern of flooding to the lakes system that is recommended to improve environmental outcomes. Lake Kramen is in the southeast of Hattah-Kulkyne National Park and is disconnected from the main Hattah Lakes complex. The Hattah Lakes pump station can deliver up to 145 ML per day to Lake Kramen. New infrastructure proposed under the Victorian Murray Floodplain Restoration Project will allow water to reach additional wetlands and floodplain areas in the northern Hattah Lakes.

Figure 5.2.5 Hattah Lakes



Environmental values

Hattah Lakes is home to a diverse range of flood-dependent vegetation that changes with the landscape's topography. Vegetation types range from wetland communities in low-lying areas that require almost annual flooding to lignum and black box communities situated higher on the floodplain that only need flooding once every four to five years (on average).

A combination of natural flooding and the delivery of environmental flows since 2010 has improved tree canopy health and recruitment of black box and river red gum communities throughout the Hattah Lakes. Woodland birds, including the endangered regent parrot, have benefitted from improved tree health.

Hattah Lakes provides important waterbird breeding sites in an arid landscape. A total of 34 species of waterbirds are known to breed at the lakes when conditions are suitable. Another six species of waterbirds breed in the surrounding floodplain.

Wetland drought refuge sites are limited in the region, making the Hattah Lakes critically important for water-dependent plants, waterbirds and terrestrial animals during dry periods.

The Hattah Lakes support large-bodied native fish species (such as golden perch) and small-bodied wetland species (such as carp gudgeon). Fish move between the lakes and the Murray River when the flow is suitable. They also persist in wetlands that retain water in the Hattah Lakes during dry years before re-dispersing during floods.

Environmental objectives in the Hattah Lakes

	F1 – Maintain the small- and large-bodied native fish populations at the Hattah Lakes
	**CN1** – Improve the function of water-dependent ecosystems by 2030 by improving productivity linkages between the river and floodplain/wetland habitats
	**V1** – Increase the species richness and abundance of native water-dependent floodplain and wetland aquatic vegetation by 2030 **V2** – Maintain the extent and improve the condition of river red gum, black box and lignum, compared to 2006 baseline levels by 2030
	**B1** – Maintain the regional waterbird population by providing conditions for breeding and fledging at least three times every 10 years **B2** – Maintain the regional waterbird population by providing refuge during droughts
	**G1** – Maintain a variety of freshwater ecosystem types within the Hattah Lakes icon site, including semi-permanent lakes, persistent temporary wetlands, floodplain woodlands, shrublands and episodic wetlands

Traditional Owner cultural values and uses

The Hattah Lakes system is part of a highly sensitive region for Aboriginal cultural values and lies on the border of two documented language groups, the Latji Latji and the Jari Jari. Groups with an interest in the Hattah Lakes include Latji Latji, Latji Latji Mumthelang, Tati Tati Kaiejin, Tati Tati Land and Water, Wadi Wadi Land and Water, Murray Valley Aboriginal Corporation, Gilby, Dadi Dadi Weki Weki, Culpra Millee, Nyeri Nyeri and Munatunga Elders.

More than 1,000 Aboriginal archaeological sites at the Hattah Lakes are registered on the Aboriginal Cultural Heritage Register and Information System, with the freshwater lakes and wetlands providing focal points for trade and cultural exchanges among the region's Traditional Owners. Local Aboriginal communities maintain strong connections to the land and its resources, such as native species used for food and medicine.

In October 2023, Mallee CMA and Traditional Owners held a Talk Water event at Hattah Lakes. Present were Cupra Milli, Munatunga Elders, Gilby Corpration, Latje Latje Mumthelang, Tati Tati Land & Water, Tati Tati Wadi Wadi, Wadi Wadi and Dadi Dadi Weki Weki. People discussed seasonal watering planning for Hattah Lakes and their water delivery history, including the recent floodwaters receding to the lakes and then to the Murray River. They examined maps of the recent flood extent at its peak, illustrating the inundation of the Hattah Lakes. Discussion about the seasonal watering proposal for the Hattah Lakes and north of Hattah-Kulkyne National Park included where Traditional Owners want to see water delivered, cultural plant and animal values at these sites and activities they have undertaken or want to undertake.

Discussions covered reasons why drying and drawdown might benefit the landscape. Traditional Owners asked for more background about the drawing down phase for wetlands and its part in environmental water management, planning and delivery. They also noted that water is important for all areas and wetlands and covered the 'circle of life': that water attracts fish, birds and other animals that come to feed off them, which provides hunting opportunities for those Aboriginal people who still hunt for food.

In March 2024, the Mallee CMA and Traditional Owner groups met to discuss 2024-25 seasonal watering proposals for Hattah Lakes with Traditional Owners agreeing on a collective list of values across all sites:

Cultural activities; native birds, reptiles, frogs, kangaroos, possums, turtles and fish; fishing; bush foods; endangered plants and animals; changing carp control to carp eradication; scar trees; clay balls; plants of cultural significance; and aquatic vegetation.

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

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.2.12**, the Mallee CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as fishing, kayaking and swimming)
- riverside recreation and amenity (such as birdwatching, camping, photography and walking)
- community events and tourism (educational opportunities, including bushwalking, birdwatching and bug hunting; local school education programs; Melbourne-based schools' educational excursions; and tours involving kayaking, bike riding and camping)
- socioeconomic benefits (such as commercial beekeepers who rest bees away from horticultural orchards in native flowering trees around the lakes, multiple ecotourism operators who benefit directly when the lakes contain water, social wellbeing from connecting with nature, and social gatherings).

The Hattah Lakes are a high-profile site for the local tourism industry, providing important recreation, amenity and cultural opportunities for tourists and locals. They are recommended and promoted as a destination by the Mildura Information Centre, on the Visit Mildura website and through Parks Victoria, the land manager.

The condition of the Hattah Lakes icon site directly affects social and economic outcomes for businesses, locals and visitors alike. When environmental conditions deteriorate, as they did during the Millennium Drought, values for the community also deteriorate. Recreation and tourism-based industries suffered as visitor numbers dropped, as did amenity and other social and cultural values derived from the Hattah Lakes. The improvement in environmental conditions through the delivery of environmental water outside times of natural flooding helps improve social and economic outcomes by improving amenity, recreational opportunities and tourism jobs and income.

Scope of environmental watering

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

Table 5.2.12 describes the potential environmental watering actions in 2024-25, 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 5.2.12 Hattah Lakes potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Southern Hattah Lakes (top up selected wetlands to 42.5 m AHD during spring)	• Stimulate the growth and improve the condition of river red gums that fringe wetlands • Provide feeding habitat for waterbirds • Stimulate new growth of aquatic vegetation • Inundate dry areas of wetlands to release carbon and nutrients to increase food web productivity • Provide spawning and recruitment habitat for small-bodied native fish and maintain sufficient water depth to provide open-water habitat for large-bodied native fish (such as golden perch) • Inundate a variety of types of wetlands at different elevations across the Hattah Lakes to increase habitat diversity	F1, CN1, V1, V2, B1, B2, G1

Scenario planning

Table 5.2.13 outlines potential environmental watering and expected water use in various planning scenarios.

Major floods in spring 2022 inundated the entire Hattah Lakes and the surrounding floodplain. Most wetlands in the higher-elevation northern Hattah Lakes and Lake Kramen have been allowed to draw down for 12-18 months to allow native plants within lake-bed herbland communities to grow on exposed soils and provide foraging habitat for wading shorebirds.

Minor flooding in spring 2023 refilled most of the semi-permanent wetlands in the southern Hattah Lakes and eliminated the need for planned environmental watering in autumn 2024.

In 2024-25, a drawdown period for the northern Hattah Lakes and Lake Kramen will continue, but it is essential to retain some water in the semi-permanent wetlands in the south to maintain native fish populations and provide foraging habitat for waterbirds. Up to 10,000 ML of environmental water may be used in spring 2024 in the dry or average scenario to top up the semi-permanent wetlands within the southern Hattah Lakes system to 42.5 m AHD. This top-up will be timed for the end of an 8-12 month drawdown period, allowing the shallower lakes to release carbon and nutrients to stimulate food production for fish and birds.

If natural flooding occurs in an average planning scenario but is only minor, water for the environment may be pumped into the lakes to achieve the target water level of 42.5 m AHD. Final decisions about this potential watering action will be based on the timing and extent of natural flooding, particularly considering the extent of drawdown achieved before flooding.

In the wet climate scenario, large-scale natural floods are expected to inundate large parts of the Hattah Lakes and floodplain. This may happen at any time of year but is most likely during winter or spring.

No active watering is proposed in the drought planning scenario. Water from natural inundation in 2022 and 2023 is likely to persist in some of the Hattah Lakes throughout 2024-25 without additional top-ups and will provide a regional refuge habitat for waterbirds and for fish that moved into the Hattah Lakes during the floods. There is little value in trying to deliver extra water in the drought planning scenario to trigger plant and animal growth and reproduction because there may not be sufficient resources within the landscape to sustain new life.

Table 5.2.13 Hattah Lakes environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Low flow year-round in the Murray River and no natural inflow to the Hattah Lakes; substantial wetland drying will occur	• Rare high-flow events in the Murray River and no natural inflow to the Hattah Lakes	• Short periods of high flow in the Murray River with minor spills from storages, most likely in late winter/spring, providing minor natural inflow to the Hattah Lakes	• Lengthy periods of high flow in the Murray River with major spills from storages resulting in widespread wetting of the Hattah Lakes and floodplain

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering – tier 1 (high priorities)	• N/A	• Southern Hattah Lakes spring top-up to 42.5 m AHD targeting semi-permanent wetlands	• Southern Hattah Lakes spring top-up to 42.5 m AHD targeting semi-permanent wetlands • If natural inflows are minor, water for the environment will be pumped into the lakes to achieve the target water level of 42.5 m AHD as per the dry planning scenario	• All structures will be opened to allow natural flow to fill Hattah Lakes and the floodplain
Possible volume of water for the environment required to achieve objectives	• N/A	• 10,000 ML	• 0-10,000 ML	• 0 ML
Priority carryover requirements for 2025-26	• Nil			

5.2.6 Lower Murray wetlands

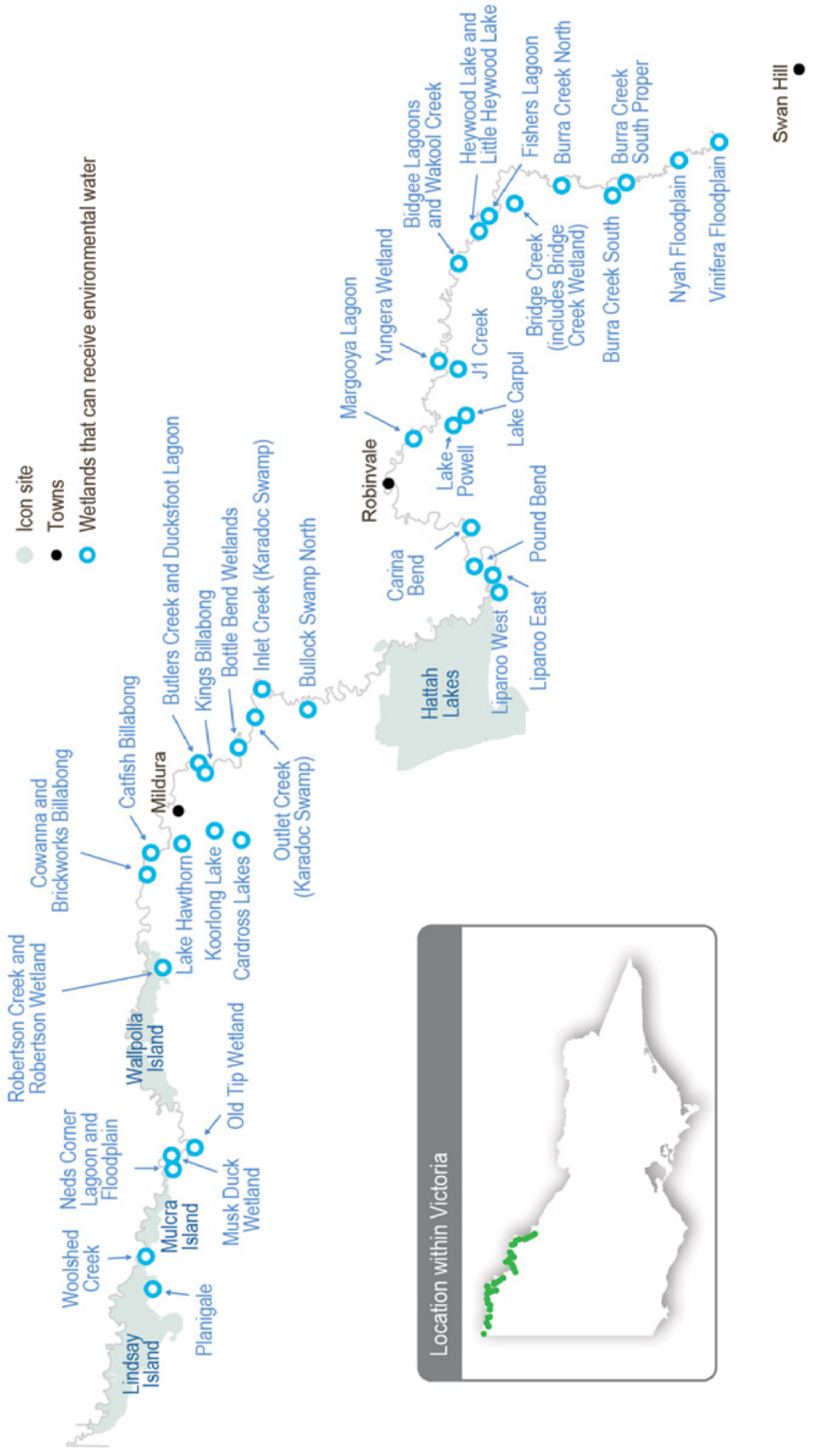
System overview

The lower Murray wetlands are dispersed across the Murray River floodplain between Swan Hill and the South Australian border. The system includes a myriad of interconnected creeks, wetlands and floodplains that are ecologically important and reflect the natural character and attributes of the floodplain. While there are hundreds of wetlands across the lower Murray region, only 37 have ever received water for the environment.

Regulation and diversion of the Murray River flow have substantially reduced the frequency and duration of the high river flow that would naturally water the lower Murray wetlands. This change to the water regime has been exacerbated by climate change and has reduced the variety and condition of environmental values associated with billabongs and other floodplain habitats.

Water for the environment can be delivered to some wetlands in the region by directly pumping from the Murray River and/or using irrigation supply infrastructure. Most wetlands that receive environmental flows can be managed independently of each other.

Figure 5.2.6 The lower Murray wetlands system



Environmental values

The lower Murray wetlands are comprised of many wetlands, creeks and billabongs. The wetlands may be permanent or temporary, and freshwater or saline, depending on their location in the landscape, interactions with groundwater and management history.

Differences in water regime and water quality across the wetlands provide a range of habitats for plants and animals. For example, permanent, saline wetlands (such as Koorlong Lake) provide vital habitat for the endangered Murray hardyhead. Ephemeral wetlands support different ecological processes in their wet and dry phases. During the wet phase, they provide short-term boom periods when river red gums and wetland plants grow, spread and provide habitat for aquatic animals (such as waterbugs, birds, frogs and, in some cases, fish). During their dry phases, sediments are exposed to the air (which is important for carbon and nutrient cycles), and terrestrial plants grow and complete their life cycles.

Environmental objectives in the lower Murray wetlands

	A1 – Maintain the native frog population, including the endangered growling grass frog
	**B1** – Provide feeding and breeding habitat for a range of waterbird species, including threatened and migratory species and colonial nesting species (such as egrets)
	**CN1** – Promote carbon and nutrient cycling to enable wetland processes for food webs
	F1 – Increase the Murray hardyhead populations in permanent wetlands where they are known to persist **F2** – Maintain populations of other native fish in permanent wetlands
	**V1** – Increase the diversity, extent and abundance of wetland plants **V2** – Improve the condition of river red gums, black box and lignum communities

Traditional Owner cultural values and uses

Watering of the Murray Wetlands supports cultural values (such as traditional food sources, medicines and important species) and provides teaching, learning and storytelling opportunities.

In October 2023, site visits were conducted with the First People of the Millewa-Mallee Aboriginal Corporation (FPMMAC) at Musk Duck Lagoon (Tiffany's) and Wallpolla Horseshoe Lagoon. Discussions with Traditional Owners covered areas for environmental water within the FPMMAC Registered Aboriginal Party area for 2024-25. Areas visited included outlying creeks, wetlands, floodplains, lakes, lagoons, billabongs and river bends.

During site visits with Traditional Owner groups, the Mallee CMA discussed the proposed 2024-25 watering of the Murray Wetlands. Site visits were conducted with Tati Tati Land & Water, Wadi Wadi Land & Water, Dadi Dadi Weki Weki, Culpra Millie, Munatunga Elders and Wadi Wadi Nation at Lake Powell, Heywood Lake and various places within Nyah and Vinifera in November 2023. These discussions focused on where Traditional Owners want to see environmental water delivered for 2024-2025 and activities at each site. The discussions raised a lot of interest in cultural practices and interests to help prioritise areas for environmental water delivery.

Discussions covered a range of options for delivering environmental flows in 2024-2025 and the traditional ecological needs in the current climate. Feedback was positive, with groups in discussions agreeing to the needs for and reasoning behind environmental watering. Drawdown and drying were discussed in depth, and much knowledge was shared before reaching agreement.

Understanding the environmental responses to the recent flooding and identifying and protecting cultural heritage were key topics for discussion. A common foundation of all groups was the importance of water in wetlands for their culture, spirituality and connection to Country.

Other discussions with and comments by Traditional Owner groups covered wanting more native plants and animals in the areas, increasing opportunities for Indigenous landcare, providing training opportunities (such as Indigenous ranger programs), protecting and preserving Aboriginal cultural heritage on the landscape, sharing information and knowledge with the broader community and increasing use by birdwatching groups.

Site visits were also conducted at Spences Bend and Bullock Swamp with Nyeri Nyeri in November 2023 with good discussion on proposed watering in 2024-2025 and local plants and animals, and recommendations from the group on possible project ideas for the area.

In March 2024, the Mallee CMA and Traditional Owner groups met to discuss 2024-25 seasonal watering proposals for Hattah Lakes and the Murray wetlands. Traditional Owners collectively agreed to the cultural values across the sites:

Cultural activities; native birds, reptiles, frogs, kangaroos, possums, turtles and fish; fishing; bush foods; endangered plants and animals; changing carp control to carp eradication; scar trees; clay balls; plants of cultural significance; and aquatic vegetation.

For Neds Corner floodplain, Neds Corner Lagoon and the Old Tip wetland, FPMMAC will coordinate with the Mallee CMA about the delivery of environmental water to achieve cultural objectives, where possible.

Planned environmental flows may be modified to align with cultural benefits so long as environmental outcomes are not compromised.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 5.2.14** with an icon (as explained in **Figure 1.2.3**). 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

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.2.14**, the Mallee CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, fishing and kayaking)
- riverside recreation and amenity (such as bike riding, birdwatching, bushwalking, camping, geocaching, photography and running)
- community events and tourism (such as day trips and sightseeing; education programs for school, TAFE and university students; and citizen science projects about birds, frogs and plants)
- socioeconomic benefits (such as economic benefits for businesses in the accommodation, beekeeping, food and beverage, ecotourism, hospitality and retail sectors; creating a focal point for socialising; and providing natural, green spaces for the local community).

Water for the environment in the lower Murray wetlands is essential to protect their unique ecosystems, plants and animals. It also provides for natural green and blue spaces, which are focal points for community and visitors alike in an otherwise dry environment. It is vital to preserve these landscapes and continue understanding how locals and visitors use them to identify their social, recreational and economic values and uses, including kayaking, walking, birdwatching and social and sporting events.

Face-to-face and online communication and community surveys indicate a lot of social and recreational use of wetlands and creeks, with a greater connection to them when they have water. Activities and values locals associate with watering include walking, water, camping, fishing, birdwatching, kayaking and bike riding. The community's favourite places include Kings Billabong, Bottle Bend, Lake Hawthorn, Catfish Billabong, Cardross Lakes and Bullock Swamp. All these sites have some connection with environmental watering. And the list isn't limited to the sites receiving environmental water yearly. The community strongly supports watering less-frequently-watered sites, with the benefits evident long after the watering occurs.

Local tourism also benefits from the environmental watering of the lower Murray wetlands and floodplains. Visitors to the Mildura Information Centre often ask about the best birdwatching places, which include Lake Hawthorn, Koorlong Lake, Brickworks Billabong,

Cowanna Billabong and Butlers Creek. All these sites are managed with environmental water.

Increased ecotourism and visitation to the area also provide economic benefits for local businesses, primarily the accommodation and food and beverage sectors but also ecotourism providers, tour operators and local retailers, including farmers markets.

Where environmental water management and delivery are managed to align with a community benefit, so long as environmental outcomes are not compromised, this is acknowledged in **Table 5.2.14** with the following icons (as explained in **Figure 1.2.3**).

Watering planned to support water sports activities (e.g. water skiing)

Watering planned to support waterbird-related recreational activities

Environmental water is regularly delivered to sites to meet waterbird and bird objectives, which support birdwatching, and water-based recreation.

Scope of environmental watering

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

Table 5.2.14 describes the potential environmental watering actions in 2024-25, 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 5.2.14 Lower Murray wetlands system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Bidgee Lagoons (top up in spring)	• Inundate adjacent river red gum and black box communities to stimulate growth and flowering to improve their condition and extent • Provide conditions and water levels (to target 52.4 m AHD) to support the growth of aquatic and emergent vegetation and promote the diversity of emergent vegetation communities • Provide feeding and breeding opportunities for frogs and habitat for fish species • Mobilise leaf litter to promote carbon and nutrient cycling	A1  CN1 F2  V1, V2
Bottle Bend Wetlands (fill in spring)	• Provide soil moisture to maintain and improve the health of the adjacent black box (to a target water level of 36.5 m AHD) • Provide conditions to support the growth of aquatic and emergent vegetation • Provide feeding and breeding opportunities for frogs • Maintain feeding and nesting opportunities for non-colonial waterbirds	A1  B1  V1, V2

Potential environmental watering action	Expected watering effects	Environmental objectives
Brickworks Billabong (fill in spring/summer, then as required)	• Recreate wetland habitat to support Murray hardyhead populations (to a target water level of 31.6 m AHD) • Re-establish and improve the extent and coverage of ruppia to provide nursery habitat for Murray hardyhead and provide high levels of aquatic productivity • Manage salinity within an acceptable range for Murray hardyhead and ruppia • Provide shallow-water habitat and exposed mudflats to support foraging and resting waterbirds, including migratory waterbirds	 B1 F1  V1
Bridge Creek (includes Bridge Creek Wetland) (fill in spring)	• Provide soil moisture to maintain and improve the condition of streamside and floodplain vegetation (to a target water level of 56.5 m AHD), specifically river red gum, black box and lignum • Increase dissolved organic matter, particulate matter and macroinvertebrate productivity • Provide shallow-water habitat to provide feeding habitat for wetland-dependent species, including frogs and birds • Stimulate the growth of aquatic vegetation • Provide conditions for semi-aquatic lake-bed herbland to establish during draw down	A1  B1  CN1  V1, V2
Brown Swamp (Pound Bend) (fill in autumn)	• Inundate and wet outer fringing lignum and vegetation communities (to a target water level of 47.0 m AHD) to improve their condition • Inundate adjacent river red gum communities to stimulate their growth and flowering, to improve their condition and extent	 V2
Bullock Swamp North (partial fill in spring) 	• Provide soil moisture to maintain and improve the condition of streamside and floodplain vegetation (to a target water level of 38.5 m AHD), specifically black box and lignum • Provide feeding opportunities for waterbirds • Provide a lateral spread of freshwater (to a target level of 38.5 m AHD) to refresh local groundwater, which will support the condition of surrounding black box trees not directly inundated and improve the condition of the swamp	 B1  V2
Burra Creek North (fill in autumn) **Burra Creek South (fill in autumn)** **Burra Creek South Proper (fill in autumn)**	• Provide soil moisture to maintain and improve the condition of streamside and floodplain vegetation, specifically river red gum, black box and lignum • Provide habitat through improved vegetation communities and water resources for birds and frogs • Mobilise leaf litter to promote carbon and nutrient cycling	A1  B1  CN1  V2

Potential environmental watering action	Expected watering effects	Environmental objectives
Koorlong Lake (top-ups in spring, then as required)	• Increase and maintain the water level (to a target level between 36.7 m AHD and 38.0 m AHD) to support the growth of saline aquatic vegetation, including ruppia, to provide nursery habitat for Murray hardyhead and provide high levels of aquatic productivity • Maintain the water level within a 1.3 m range to provide feeding resources for waterbirds and maintain the Murray hardyhead population	 B1 F1  V1
Lake Carpul (fill in winter/ spring 2024)[1] **Part B: July-November 2024** 	• Provide a range of open-water, shallow-water and emergent vegetation habitats for water-dependent species, including frogs and birds, to support breeding and feeding opportunities • Stimulate the growth of aquatic vegetation during inundation • Inundate and wet outer fringing river red gum, black box, lignum and vegetation communities (to a target water level of 55.05 m AHD at Lake Powell and 52.23 m AHD at Lake Carpul) to maintain and improve their condition • Provide conditions for semi-aquatic lake-bed herbland to establish during drawdown • Mobilise carbon and aid nutrient cycling within the wetland to support wetland processes	A1  B1  CN1  V1, V2
Lake Powell (fill in winter/ spring 2024)[1] **Part B: July-November 2024** 		
Lake Hawthorn (top-ups in spring, then as required)	• Maintain the water level between 33 m AHD and 33.3 m AHD to encourage the germination and growth of saline aquatic vegetation, including ruppia, and provide mudflat and shallow-water feeding habitat for shorebirds	 B1  V1
Neds Corner Floodplain[2] **(fill in autumn)** 	• Provide a range of open-water, shallow-water and emergent vegetation habitats for wetland-dependant species, including frogs and birds, and support breeding and feeding opportunities • Stimulate the growth of aquatic vegetation during inundation • Provide soil moisture to maintain and improve the condition of streamside and floodplain vegetation, specifically black box • Provide conditions for semi-aquatic lake-bed herbland to establish during draw down	A1  B1  V1, V2
Neds Corner Lagoon[2] **(fill in autumn)** 		
Old Tip Wetland[2] **(fill in autumn)** 		

Potential environmental watering action	Expected watering effects	Environmental objectives
Nyah Floodplain (fill in autumn)	• Inundate the base and littoral zone of Parnee Malloo Creek (to a target water level of 63.2 m AHD) to support aquatic and semi-aquatic plant communities • Improve the condition of vegetation communities to provide a range of habitats and resources for birds and frogs • Inundate floodplain adjacent to Parnee Malloo Creek to promote the growth of herb and shrub layers • Inundate river red gums to maintain and improve their condition • Mobilise carbon and nutrients to promote chemical and biological processes	
Outlet Creek (Karadoc Swamp) (fill in spring)	• Provide soil moisture to maintain and improve the condition of streamside and floodplain vegetation, specifically river red gum, black box and lignum • Provide suitable habitat for native frog species • Provide open-water habitat as feeding and breeding habitat for waterbirds	
Vinifera Floodplain (fill in autumn)	• Inundate the soils (to a target water level of 63.2 m AHD) to support aquatic and semi-aquatic plant communities • Improve the condition of vegetation communities to provide a range of habitats and resources for birds and frogs • Inundate the floodplain to promote the growth of herb and shrub layers • Inundate river red gums to maintain and improve their condition • Mobilise carbon and nutrients to promote chemical and biological processes	

1 This potential watering action is Part B of a watering action commenced in 2023-24.

2 In past seasonal watering plans, this wetland has been watered as part of Neds Corner Central. It is one of three wetlands at this site: Old Tip Wetland, Neds Corner Floodplain and Neds Corner Lagoon.

Scenario planning

Table 5.2.15 outlines potential environmental watering and expected water use in various planning scenarios.

Three permanent wetlands in the lower Murray wetlands system rely on environmental watering or natural inundation every year to maintain their environmental values and are high priorities for watering in all planning scenarios in 2024-25. Brickworks Billabong and Koorlong Lake are important sites for endangered Murray hardyhead. Lake Koorlong currently supports a healthy population of Murray hardyhead and requires top-ups each year to maintain salinity levels within the target range for ruppia and successful fish breeding. Brickworks Billabong used to support Murray hardyhead, but the 2022 floods flushed the fish from the wetland and allowed pest species to become established. The billabong was drawn down in 2023-24 to eliminate pest fish species and will be filled again in 2024-25 to restore suitable habitat to allow the successful reintroduction of Murray hardyhead. Lake Hawthorn has similar characteristics to Brickworks Billabong and Koorlong Lake, but attempts to establish a Murray hardyhead population in the lake have not succeeded.

The lake's semi-saline conditions continue to support ruppia and provide foraging habitat for shorebirds. It draws down in summer and autumn and requires a spring top-up in all planning scenarios.

All other lower Murray wetlands that can receive environmental water require top-ups less than once a year, either because they are large and, when full, can retain water for several years or are ephemeral and rely on periods of inundation followed by periods of complete drying to support their environmental values. Each wetland has different watering requirements, usually determined by the vegetation communities they support. Other than in flood years, it is generally desirable for wetlands across the region to be in different stages of their wetting and drying cycles to create a mosaic of habitats for waterbirds and other native animals while also meeting the watering needs of vegetation communities at each site. Widespread floods in 2022 and subsequent inundation of low-lying areas of the floodplain in 2023-24 mean that most of the lower Murray wetlands are now in a similar phase. They either still hold a significant volume of water, are starting to draw down or have recently dried. Environmental watering in 2024-25 aims to re-establish a variety of wetland habitats across the lower Murray floodplain by refilling some sites where vegetation communities will benefit from another inundation and allowing other sites that require more frequent drying to draw down.

Natural inundation in recent years has greatly improved environmental conditions at Outlet Creek (Karadoc Swamp), Bullock Swamp North, Bottle Bend wetlands, Old Tip Wetland, Neds Corner Lagoon and Floodplain. A follow-up watering is included in the dry-to-wet planning scenarios to consolidate these gains and build resilience for potential drier periods ahead. Lake Powell and Lake Carpul will also benefit from a follow-up watering in these planning scenarios, and the planned watering in winter/spring is the second half of a watering action that commenced in autumn 2024. Bridge Creek (including Bridge Creek Wetland) is one of the few lower Murray wetlands that didn't respond well to recent floods. The Mallee CMA suggests the wetland may need a longer period of inundation to improve the condition of the black box at the site and proposes to fill the wetland and use temporary levees to retain water for an optimal duration in 2024-25.

Nyah and Vinifera floodplains, Bidgee Lagoons, Pound Bend and the Burra Creek sites have all been inundated multiple times since 2021. Their environmental condition is currently high, and they don't need more watering in the drought and dry planning scenarios but are prioritised in the average and wet planning scenarios to enhance their ecological condition. Brown Swamp at Pound Bend was naturally inundated in spring 2022 and has retained deep pools, which have watered the root zone and improved the condition of fringing vegetation and streamside species. Additional watering in 2024-25 is expected to improve the condition and increase the abundance and diversity of understorey vegetation adjacent to the swamp.

Vegetation communities at Bidgee Lagoons and the Burra Creek sites also improved as a result of recent floods, and additional top-ups are planned to encourage the further growth of herbland communities within the wetlands and macrophytes along associated creeklines to support waterbirds, frogs and other animals. Nyah and Vinifera floodplains are also prioritised in the average and wet planning scenarios to maintain their high natural watering frequency, preserve the rare vegetation communities of the floodplains (which are dominated by forest) and support the diverse plants and animals, including some species of conservation significance.

All other wetlands on the lower floodplain in the lower Murray wetlands system will be allowed to draw down to support dry-phase ecosystem processes, as recommended in their management plans.

A carryover target of 1,900 ML for 2025-26 has been set to ensure a sufficient water supply for annual watering at Brickworks Billabong, Koorlong Lake and Lake Hawthorn.

Table 5.2.15 Lower Murray wetlands system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Natural flow in the Murray River is too low to connect to the wetlands • Very low rainfall year-round and extremely hot and dry conditions in summer/ autumn cause substantial wetland drying • Wetlands rely on environmental water	• Short periods of high flow in the Murray River are possible, but overbank flow to the wetlands is unlikely • There may be low rainfall and a very warm summer/autumn • Wetlands rely on environmental water	• Sustained periods of high flow in the Murray River in late winter and early spring may wet some low-lying wetlands, but most will rely on environmental water • Local rainfall may be high and provide run-off to some wetlands	• Lengthy periods of high flow and floods with major spills from storages are likely, resulting in widespread wetting of the floodplain and most wetlands • There may be some reliance on environmental water to achieve target water levels • Local rainfall may be high and will provide run-off to most wetlands
Potential environmental watering – tier 1 (high priorities)	• Brickworks Billabong (fill in spring/ summer, then as required) • Koorlong Lake (top-ups in spring, then as required) • Lake Hawthorn (top-ups in spring, then as required)	• Bottle Bend Wetlands (fill in spring) • Brickworks Billabong (fill in spring/ summer, then as required) • Bridge Creek (includes Bridge Creek Wetland) (fill in spring) • Bullock Swamp North (partial fill in spring)	• Bidgee Lagoons (top-up in spring) • Bottle Bend Wetlands (fill in spring) • Brickworks Billabong (fill in spring/ summer, then as required) • Bridge Creek (includes Bridge Creek Wetland) (fill in spring)	• Bidgee Lagoons (top-up in spring) • Bottle Bend Wetlands (fill in spring) • Brickworks Billabong (fill in spring/ summer, then as required) • Bridge Creek (includes Bridge Creek Wetland) (fill in spring)

Planning scenario	Drought	Dry	Average	Wet
(continued) **Potential environmental watering – tier 1 (high priorities)**		• Koorlong Lake (top-ups in spring, then as required) • Lake Carpul (fill in winter/spring 2024) • Lake Hawthorn (top-ups in spring, then as required) • Lake Powell (fill in winter/spring 2024) • Neds Corner Floodplain (fill in autumn) • Neds Corner Lagoon (fill in autumn) • Old Tip Wetland (fill in autumn) • Outlet Creek (Karadoc Swamp) (fill in spring)	• Brown Swamp (Pound Bend) (fill in autumn) • Bullock Swamp North (partial fill in spring) • Burra Creek North (fill in autumn) • Burra Creek South (fill in autumn) • Burra Creek South Proper (fill in autumn) • Koorlong Lake (top-ups in spring, then as required) • Lake Carpul (fill in winter/spring 2024) • Lake Hawthorn (top-ups in spring, then as required) • Lake Powell (fill in winter/spring 2024) • Neds Corner Floodplain (fill in autumn) • Neds Corner Lagoon (fill in autumn) • Nyah Floodplain (fill in autumn) • Old Tip Wetland (fill in autumn) • Outlet Creek (Karadoc Swamp) (fill in spring) • Vinifera Floodplain (fill in autumn)	• Brown Swamp (Pound Bend) (fill in autumn) • Bullock Swamp North (partial fill in spring) • Burra Creek North (fill in autumn) • Burra Creek South (fill in autumn) • Burra Creek South Proper (fill in autumn) • Koorlong Lake (top-ups in spring, then as required) • Lake Carpul (fill in winter/spring 2024) • Lake Hawthorn (top-ups in spring, then as required) • Lake Powell (fill in winter/spring 2024) • Neds Corner Floodplain (fill in autumn) • Neds Corner Lagoon (fill in autumn) • Nyah Floodplain (fill in autumn) • Old Tip Wetland (fill in autumn) • Outlet Creek (Karadoc Swamp) (fill in spring) • Vinifera Floodplain (fill in autumn)

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 2,050 ML (tier 1) • N/A (tier 2)	• 8,580 ML (tier 1) • N/A (tier 2)	• 14,275 ML (tier 1) • N/A (tier 2)	• 8,230 ML (tier 1) • N/A (tier 2)
Priority carryover requirements for 2025-26	• 1,900 ML			

5.2.7 Lindsay, Mulcra and Wallpolla islands

System overview

Lindsay, Mulcra and Wallpolla islands cover over 26,100 ha of Victorian floodplain in the Murray-Sunset National Park (see Figure 5.2.7). They form part of the Chowilla Floodplain and Lindsay-Wallpolla islands icon site that straddles the Victoria–South Australia-New South Wales border in the mid-Murray River system.

A network of permanent waterways, small creeks and wetlands characterises the Lindsay, Mulcra and Wallpolla islands floodplain. Lindsay River, Potterwalkagee Creek and Wallpolla Creek form the southern boundaries of the site and create large floodplain islands with the Murray River to the north.

In their natural state, these waterways and wetlands would regularly flow and fill in response to high water levels in the Murray River. Large floods still occur, but major storages in the upper reaches of the Murray River system and extraction for consumptive use have reduced the frequency of small to moderate-sized floods.

Flows in the mid-Murray River system are regulated through a series of weir pools. The weir pools are named after the locks that form part of the infrastructure at the weirs that allow vessels to navigate from one weir pool to the next. The weir pools are primarily managed as small water storages to ensure adequate water levels for off-stream diversion via pumps and regulated channels.

Water is diverted from the Lock 9 weir pool in the Murray River to Lake Victoria, where it is stored for later use to meet South Australia's water demands. The diversion causes water to bypass Murray River locks 7 and 8 weir pools, and at times it can greatly affect the flow in those reaches.

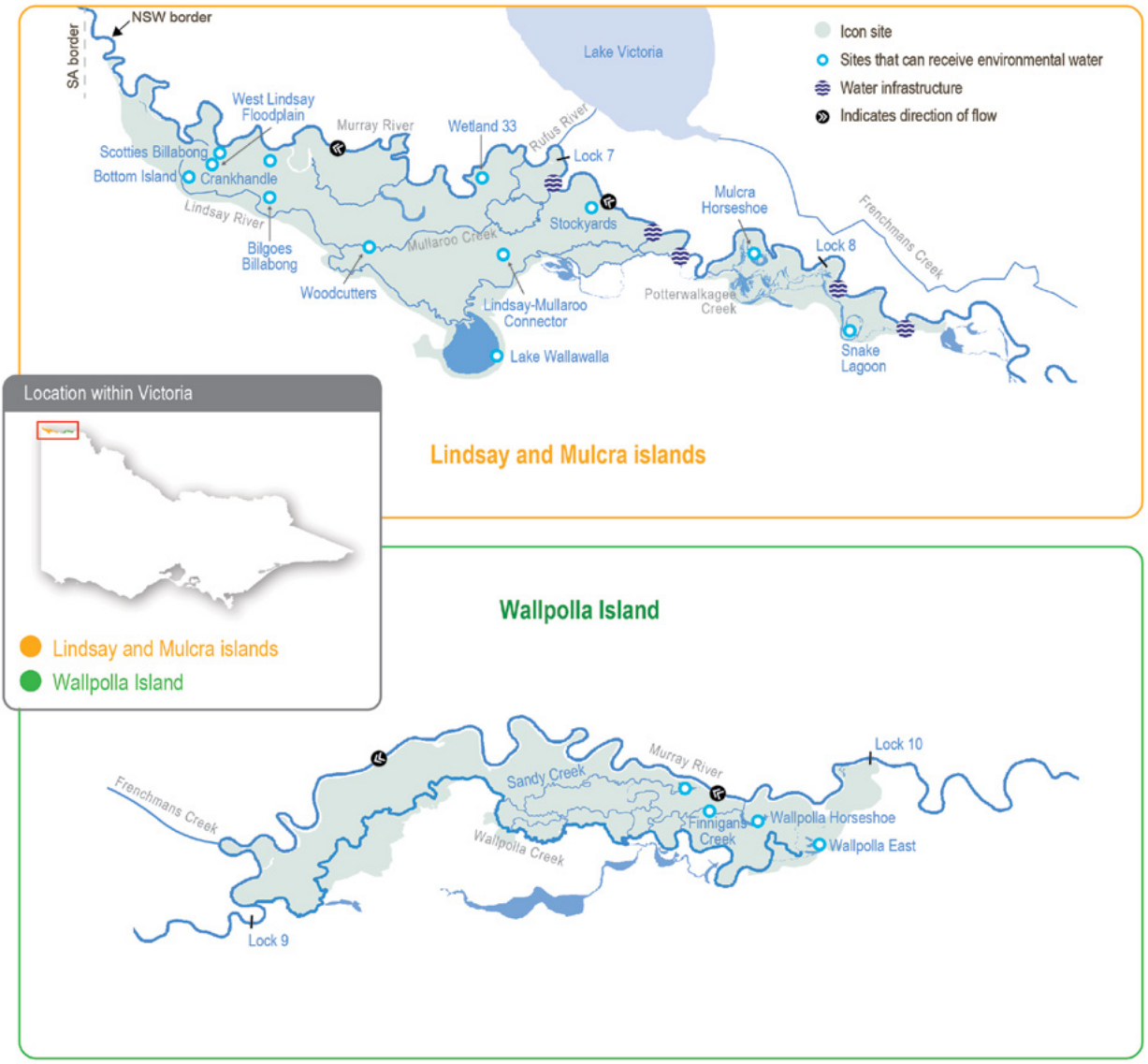
In recent years, water levels in locks 7 and 8 weir pools have been managed to achieve environmental benefits in the Murray River channel. For example, weir pool levels have been raised during winter and spring and lowered during summer and autumn to mimic the seasonal river flow. The raising and lowering provide greater environmental benefits than a stable weir pool because it wets and dries off-channel habitats and creates more variable flow patterns in the Murray River and connected floodplain streams. Changes in water levels during appropriate seasons help establish fringing vegetation in shallow margins of the river channel and promote the cycling of nutrients and carbon as conditions fluctuate between wet and dry.

Static weir pool levels and reduced Murray River flow significantly affect the Lindsay River and Potterwalkagee Creek flows. When the natural flow increases and/or water levels in locks 7 and 8 weir pools are raised above the full supply level, the upper Lindsay River starts flowing (Lock 7) and the flow to Potterwalkagee Creek increases (Lock 8). When weir pools are lowered, flow to the upper Lindsay River and Potterwalkagee

Creek ceases. Mullaroo Creek on Lindsay Island is less affected by weir pool levels, and flow is controlled independently through the Mullaroo Creek regulator, which connects the creek and the Murray River. Moderate lowering of the Lock 7 weir pool level has little effect on Mullaroo Creek, but lowering more than 0.5 m below full supply level makes it difficult to deliver the recommended minimum flow of 600 ML per day that is required to maintain fast-flowing habitat for native fish, especially Murray cod.

Fluctuation of weir pool levels is a major consideration for jurisdictions managing the flow in the Murray River and the anabranch waterways of Lindsay, Mulcra and Wallpolla islands. Environmental objectives and associated water regimes for the Murray River sometimes conflict with those for the Lindsay, Mulcra and Wallpolla anabranch systems. Responsible agencies in Victoria and NSW and the Murray-Darling Basin Authority collaboratively plan how to manage weir pools and flows to floodplain habitats effectively.

Figure 5.2.7 The Lindsay, Mulcra and Wallpolla islands



Environmental values

The Lindsay, Mulcra and Wallpolla islands represent three separate anabranch systems that contain various streams, billabongs, large wetlands and swamps. When flooded, waterways and wetlands within these systems provide habitat for native fish, frogs, turtles, waterbirds and water-dependent plants. Terrestrial animals (such as woodland birds) also benefit from improved productivity and food resources when anabranch systems are inundated. Large floodplain wetlands (such as Lake Wallawalla) can retain water for several years after receiving inflows; they provide important refuges for wetland-dependent species and support terrestrial animals (such as small mammals and reptiles).

Mullaroo Creek supports one of the most significant populations of Murray cod in the mid-Murray River system. Mullaroo Creek provides a fast-flowing habitat that Murray cod favour, contrasting with the artificially slow-flowing and still habitats in the nearby Murray River weir pools. Fish in Mullaroo Creek breed and produce juveniles that contribute to populations in adjacent parts of the Murray system (such as in the Darling River in NSW and the lower Murray River in South Australia). Waterways and wetlands throughout the icon site support several other fish species, including freshwater catfish, golden perch, silver perch, Murray-Darling rainbowfish and unspecked hardyhead.

The reduced frequency and duration of floods in the Murray River have degraded the water-dependent vegetation communities throughout the Lindsay, Mulcra and Wallpolla island system, reducing the diversity and abundance of animals that rely on healthy vegetation for habitat.

Environmental objectives in Lindsay, Mulcra and Wallpolla islands

	F1 – By 2030, increase the abundance of small-bodied native fish and the spread of age classes for long-lived native fish, compared to 2006 baseline levels
	A1 – Maintain the frog population
	**CN1** – By 2030, improve the function of water-dependent ecosystems by improving productivity linkages between river and floodplain habitats
	**V1** – Improve threatened flow-dependent plant populations **V2** – By 2030, maintain the extent and improve the condition of river red gum, black box and lignum compared to 2006 baseline levels **V3** – By 2030, improve the species richness and abundance of native wetland and floodplain aquatic vegetation functional groups
	**B1** – Maintain communities and species diversity of colonial nesting waterbirds, waterfowl, and waders that feed on fish **B2** – By 2030, increase the colonial nesting waterbird population at Lake Wallawalla and the non-colonial waterbird population at Mulcra Horseshoe and Wallpolla Horseshoe

Traditional Owner cultural values and uses

Aboriginal ancestral occupation across the Lindsay-Mulcra-Wallpolla floodplain dates back tens of thousands of years, sustained by the rich productivity of the floodplain woodland and wetland systems. Historically, the islands would have been an abundant source of food and water for these communities. The floodplain is a vital part of community health and wellbeing for Aboriginal communities.

The First People of the Millewa-Mallee Aboriginal Corporation (FPMMAC) is the Recognised Aboriginal Party (RAP) in north-west Victoria for Country that runs south of the Murray River to the Mallee Highway and west from the Calder Highway to the South Australian border, including the Murray-Sunset National Park.

There are many sites of cultural significance across the Lindsay-Mulcra-Wallpolla floodplain, including ceremonial grounds, earth oven remains, scar trees, birthing trees, shell middens, song lines, ancestral resting places and story places.

The people represented by the FPMMAC have maintained a connection with the Murray River for thousands of generations; the river and its surrounds are one of the richest sources of Aboriginal archaeological and heritage material in the nation. The floodplain provides vital resources, including food, water, shelter, medicine and tools. The Traditional Owners retain a strong connection to this Country.

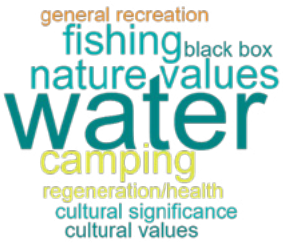
The Mallee CMA has a strong working relationship with the FPMMAC, supported by regular two-way communication, planning, knowledge-sharing and collaboration. Water in the landscape is essential to the spirituality of the people FPMMAC represents, strengthening their connection to Country. The Mallee CMA and FPMMAC have frequent discussions about water, including objectives, planning and delivery of environmental water.

This year, the Mallee CMA engaged with Traditional Owners much earlier in the seasonal watering planning process than in previous years in response to feedback.

In October 2023, Mallee CMA presented to FPMMAC about environmental watering practices, how the Murray River is regulated and how environmental water benefits Mallee floodplains, including Lindsay, Mulcra and Wallpolla icon sites, due to the extensive floodplain area in the region. Mallee CMA also presented the 2022-23 flood impacts, including the environmental benefits of the unregulated watering event.

In October, a Talk Water event was held on Country at Lake Wallawalla with Traditional Owners, discussing proposed environmental watering for 2024-45. Key feedback was Traditional Owners would like to see water remain in Lake Wallawalla at all times to support the health of trees, plants, birds and animals. In addition to sites, values were discussed for the Lindsay, Mulcra and Wallpolla islands.

Values of the Lindsay, Mulcra and Wallpolla islands provided by Traditional Owners



Throughout 2023-24, FPMMAC, Mallee CMA and Parks Victoria met to discuss Lake Wallawalla. FPMMAC has shared aspirations to develop Lake Wallawalla in a way that encourages people to visit the site with restrictions to protect cultural heritage values. Additionally, they aspire to build a site for cultural ceremonies and for further works to repair and protect particular cultural heritage sites.

Planned environmental flows may be modified to align with cultural benefits so long as environmental outcomes are not compromised.

Feedback about cultural input into the environmental water program and seasonal watering proposals occurs formally and informally. There are many meetings and discussions throughout the year with staff and leaders from FPMMAC, where these matters are raised and explored in detail.

FPMMAC is partnering with the Mallee CMA in all watering actions, management and monitoring on Country in 2024-25.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 water for a particular site, their contribution is acknowledged in **Table 5.2.16** with an icon (as explained in **Figure 1.2.3**). 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

Social, recreational and economic values and uses

The Lindsay-Mulcra-Wallpolla floodplain is a vast, isolated landscape. Its remote nature is a major drawcard for people hoping to 'get away from it all' during trips to the area. Tourism is one of the largest industries in the Mildura/Mallee area. The Murray-Sunset National Park is one of the area's major attractions, and with the Lindsay, Mulcra and Wallpolla islands attracts visitors from around the country.

The permanent water sources of the Murray River and its anabranches are focal points for visitors. They provide many recreational opportunities, including for camping, canoeing, watching birds and wildlife, photography, fishing and four-wheel driving. When environmental water is delivered, the region's attractiveness increases, with short-term responses to watering offering more opportunities (such as yabbying and birdwatching). Many families and groups have longstanding connections with the Lindsay-Mulcra-Wallpolla area and make regular trips to enjoy this diverse landscape.

Feedback from the community highlights the importance of these landscapes to people and the additional benefits of delivering environmental water.

The Lindsay, Mulcra and Wallpolla islands are important for apiarists who use the area for their beehives and honey collection. The bees benefit from a natural environment, which allows them to rest away from commercial crops (such as nuts and fruit) and the insecticides used in their production. Delivery of environmental water improves local vegetation's health, resulting in flower production and subsequently more honey produced.

The direct local economic benefits of environmental watering across the Lindsay-Mulcra-Wallpolla floodplain include work for the contractors who provide the pumps needed at many sites to deliver the water. Mallee CMA contracts suitable local businesses, which employ local staff and use local goods and services.

Research helps us learn about the natural environment and the responses of plants and animals and the hydrological and geomorphological outcomes of delivering environmental water to wetlands, creeks, channels, floodplains and rivers. Research can help identify ways to improve recreational outcomes (such as improved breeding response to a recreational angling species) and cultural outcomes (such as more medicinal plants on the floodplain) by improving the timing, volume and duration of watering. Researchers may be local or use local hospitality and accommodation providers.

In planning the potential environmental watering actions in **Table 5.2.16**, the Mallee CMA has considered how environmental flows could support social, recreational and economic values and uses, including:

- water-based recreation (such as canoeing, kayaking, fishing and yabbying)
- riverside recreation and amenity (such as bushwalking, camping, bird and wildlife watching, four-wheel driving and photography)
- community events and tourism (such as increased and longstanding repeat visitation, ecotourism and educational programs for school, TAFE and university students)
- socioeconomic benefits (such as for commercial beekeepers who rest bees around the floodplain away from crops and pesticides ready for the next season, local businesses providing accommodation and hospitality to tourists, researchers and local water delivery contractors).

Scope of environmental watering

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

Table 5.2.16 describes the potential environmental watering actions in 2024-25, 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 5.2.16 Lindsay, Mulcra and Wallpolla islands potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Lindsay Island – Mullaroo Creek		
Year-round low flow (minimum of 600 ML/day)	• Maintain fast-flowing habitat for large-bodied native fish (such as Murray cod, silver perch and golden perch) • Maintain habitat for aquatic vegetation and soil moisture to maintain the condition of streamside vegetation	F1, V2, V3
Elevated spring flow (1,200 ML/day for three months during September to November)	• Increase the extent and velocity of fast-flowing habitat to cue the movement and spawning and improve recruitment opportunities for large-bodied native fish • Increase fish passage between Mullaroo Creek and the Murray River via the Mullaroo Creek regulator fishway • Reduce the vigour of typha by inundating reed beds during the growing season to prevent the growth of vegetation	F1, V3
Lindsay Island – Lindsay River		
Spring low flow via the northern regulator (45 ML/day for three months during September to November)	• Provide temporary flowing water to connect pools and support the dispersal and recruitment of small- and large-bodied native fish and the spawning of small-bodied native fish • Stimulate the release of carbon and nutrients from the sediment to increase the productivity of the floodplain food web • Maintain bank soil moisture to support the growth of streamside vegetation • Reduce the vigour of typha by inundating reed beds during the growing season to prevent the growth of vegetation	F1, CN1, V2, V3
Lindsay Island wetlands		
Woodcutters (fill in spring)	• Provide shallow- and open-water habitat to create foraging and breeding opportunities for waterbirds and frogs • Increase soil moisture to maintain and improve the condition of river red gums	B1, A1, V2

Potential environmental watering action	Expected watering effects	Environmental objectives
Mulcra Island – Potterwalkagee Creek		
Spring low flow via the Stoney Crossing regulator (35-115 ML/day for three months during September to November) 	• Provide temporary flowing water to connect pools and support the dispersal and recruitment of small- and large-bodied native fish, and the spawning of small-bodied native fish • Stimulate the release of carbon and nutrients from the sediment to increase the productivity of the floodplain food web • Maintain soil moisture to maintain the condition of streamside vegetation • Reduce the vigour of typha by inundating reed beds during the growing season to prevent the growth of vegetation	**F1**  **CN1**  **V2, V3**
Spring low flow via the upper Potterwalkagee Creek regulator (15 ML/day for three months during September to November) 		
Mulcra Island wetlands		
Mulcra Horseshoe (fill in spring) 	• Provide shallow and open-water habitat to create foraging and breeding opportunities for waterbirds • Provide shallow-water habitat to provide refuge (if conditions are dry in the next 2-3 years) and feeding habitat for frogs • Stimulate the growth of emergent, aquatic and other plants growing on the water's edge • Provide conditions for lake-bed herbaceous plants to grow as the wetland draws down during summer and autumn, such as the threatened native couch, mallee cucumber and branching groundsel	 **B1, B2** **A1**  **V1, V2, V3**
Wallpolla Island		
• No watering activities are planned for Wallpolla Island in 2024-25		

Scenario planning

Table 5.2.17 outlines potential environmental watering and expected water use in a range of planning scenarios.

The two categories of opportunities to deliver water for the environment at Lindsay and Mulcra islands in 2024-25 are:

- deliveries of water for the environment to anabranch waterways (Mullaroo Creek, Lindsay River and Potterwalkagee Creek) in coordination with weir pool operation
- deliveries via temporary pumps to individual wetlands at Lindsay and Mulcra islands.

Anabranch watering

Permanent flowing water with a modest increase in spring is essential for Mullaroo Creek in all planning scenarios because there is good evidence this watering regime promotes fish movement and breeding, particularly for Murray cod. The flow in the Mullaroo Creek is controlled through the Mullaroo Creek regulator, and it can be managed independently of weir pool operations and moderate fluctuations in the flow in the Murray River. Delivering this water regime in all planning scenarios is practical and desirable.

Lindsay River and Potterwalkagee Creek require a low flow in eight or nine of every 10 years to maintain soil moisture for streamside vegetation and replenish and connect deep pools for the dispersal and recruitment of native fish. In most years, this is achieved by delivering a low magnitude flow in spring, but every second or third year it is delivered at a higher magnitude through winter, spring and early summer to enhance connectivity through the waterways and with the Murray River. The occasional delivery of higher-magnitude flows in Potterwalkagee Creek also enables the delivery of water to the floodplain on Mulcra Island. The flow is typically prevented from entering both anabranches from mid-to-late summer to the end of autumn. Once or twice every 10 years, the flow may not be delivered for a full year to support dry-phase environmental processes and increase the richness and abundance of the native wetland and floodplain aquatic vegetation. To achieve these outcomes, in 2024-25 the following water regimes are planned to be implemented in Lindsay River and Potterwalkagee Creek.

For the Lindsay River, the operation of the Lock 7 weir pool is expected:

- in the drought planning scenario, to ensure the weir pool does not exceed the full supply level and there is no flow in any section of the river
- in the dry and average planning scenarios, to raise the weir pool enough to deliver low flows via the northern regulator in spring, but no flow via the southern regulator, with no flow through the river in summer/winter
- in the wet planning scenario, for high flows in the Murray River to likely to deliver natural flows through all sections of the river for extended periods in winter, spring and early summer.

For Potterwalkagee Creek, the operation of the Lock 8 weir pool is expected:

- in the drought planning scenario, to hold the weir pool at full supply level or below year-round and to manage the Stoney Crossing to provide a minor flow into the creek in spring
- in the dry and average planning scenarios, to raise the weir pool enough to deliver spring low flows via the Stoney Crossing regulator and the upper Potterwalkagee regulator, with no flow through the creek from summer to winter
- in the wet planning scenario, for high flows in the Murray River to likely deliver natural flow through all sections of the creek and inundate parts of the adjacent floodplain for extended periods in winter, spring and early summer.

Deliveries via temporary pumps

Many wetlands and creeklines across the Lindsay, Mulcra and Wallpolla islands had substantial flooding or periods of sustained high flow from winter/spring 2022 to early autumn 2024. Natural flooding has improved the condition of all floodplain and wetland ecosystems, so little active watering via temporary pumping is needed in 2024-25.

Watering Woodcutters on Lindsay Island and Mulcra Horseshoe on Mulcra Island in spring are high priorities in all planning scenarios, noting that they are expected to fill from natural flooding in a wet planning scenario.

Woodcutters Creek requires a flow optimally in eight of every 10 years, but it has only filled twice in the last 10 years: in 2016 and 2022. Watering Woodcutters Creek in spring 2024 will enhance the recovery of plants growing on the water's edge (such as river red gums) that declined in condition due to prolonged drying between 2016 and 2022.

The vegetation community at Mulcra Horseshoe requires inundation in nine out of every 10 years for optimal condition. The wetland has filled seven times in the last 10 years but only three times in the last six years. Additional watering is proposed in 2024-25 to move it closer to its optimal watering regime and improve the condition of the surrounding river red gums and understory vegetation.

All other sites in the Lindsay, Mulcra and Wallpolla islands that are usually considered for environmental watering have been watered multiple times in the last three years and will be allowed to draw down in 2024-25 to support dry-phase environmental processes (such as providing foraging habitat for wading waterbirds and allowing the growth of lake-bed herbland communities). Offsetting wetting and drying phases in different wetlands across Lindsay, Mulcra and Wallpolla islands provides a variety of habitat types and resources for waterbirds, terrestrial birds and other animals.

Table 5.2.17 Lindsay, Mulcra and Wallpolla islands environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Year-round low flow in the Murray River and no natural floodplain wetting • Weir pools will be maintained at full supply level in spring and drawn down below full supply level during summer, autumn and winter • Substantial wetland drying will occur	• Rare high-flow events in the Murray River and no natural floodplain wetting • Weir pools will be raised in spring and drawn down below full supply level in summer, autumn and winter • Substantial wetland drying will occur	• Short periods of high flow, most likely in spring/summer, will provide minor wetting of the floodplain • Weir pool levels will be maintained at full supply level or raised in winter/spring and summer and drawn down in summer, autumn and winter	• Long periods of high flow, and major spills from storages will result in widespread wetting of the floodplain and wetting of most wetlands • Weirs would be removed to allow the passage of a natural flow
Lindsay Island				
Potential environmental watering – tier 1 (high priorities)	• Year-round low flow (Mullaroo Creek) • Elevated spring flow (Mullaroo Creek) • Woodcutters (fill in spring)	• Year-round low flow (Mullaroo Creek) • Elevated spring flow (Mullaroo Creek) • Spring low flow (Lindsay River via the northern regulator) • Woodcutters (fill in spring)	• Year-round low flow (Mullaroo Creek) • Elevated spring flow (Mullaroo Creek) • Spring low flow (Lindsay River via the northern regulator) • Woodcutters (fill in spring)	• Year-round low flow (Mullaroo Creek) • Elevated spring flow (Mullaroo Creek) • Spring low flow (Lindsay River via the northern regulator) • Woodcutters (fill in spring)

Planning scenario	Drought	Dry	Average	Wet
Mulcra Island				
Potential environmental watering – tier 1 (high priorities)	• Spring low flow (Potterwalkagee Creek via the Stony Crossing regulator) • Mulcra Horseshoe (fill in spring)	• Spring low flow (Potterwalkagee Creek via Stony Crossing and upper Potterwalkagee regulators) • Mulcra Horseshoe (fill in spring)	• Spring low flow (Potterwalkagee Creek via Stony Crossing and upper Potterwalkagee regulators) • Mulcra Horseshoe (fill in spring)	• Spring low flow (Potterwalkagee Creek via Stony Crossing and upper Potterwalkagee regulators) • Mulcra Horseshoe (fill in spring)
Possible volume of water for the environment required to achieve objectives[1]	• 1,070 ML	• 1,070 ML	• 1,070 ML	• 0-1,070 ML

1 These estimates include delivering water for the environment via temporary pumps to Woodcutters and Mulcra Horseshoe. Water for the environment used at Mullaroo Creek, Lindsay River and Potterwalkagee Creek is calculated alongside the use attributable to raising and lowering locks 7, 8 and 9 and 15 weir pools and is accounted for in Victoria or New South Wales. Water delivered by the VEWH in these arrangements is expected to be between zero and 4,000 ML.

5.3 Ovens system

Waterway manager – North East Catchment Management Authority

Storage manager – Goulburn-Murray Water

Environmental water holder – Commonwealth Environmental Water Holder

System overview

The Ovens River rises in the steep, forested mountains of the Great Dividing Range near Mount Hotham and flows about 150 km to join the Murray River in the backwaters of Lake Mulwala (Figure 5.3.1). The system has two small water storages: Lake Buffalo on the Buffalo River and Lake William Hovell on the King River. The regulated reaches of the Ovens system include the Buffalo and King rivers below these storages and the Ovens River from its confluence with the Buffalo River to the Murray River.

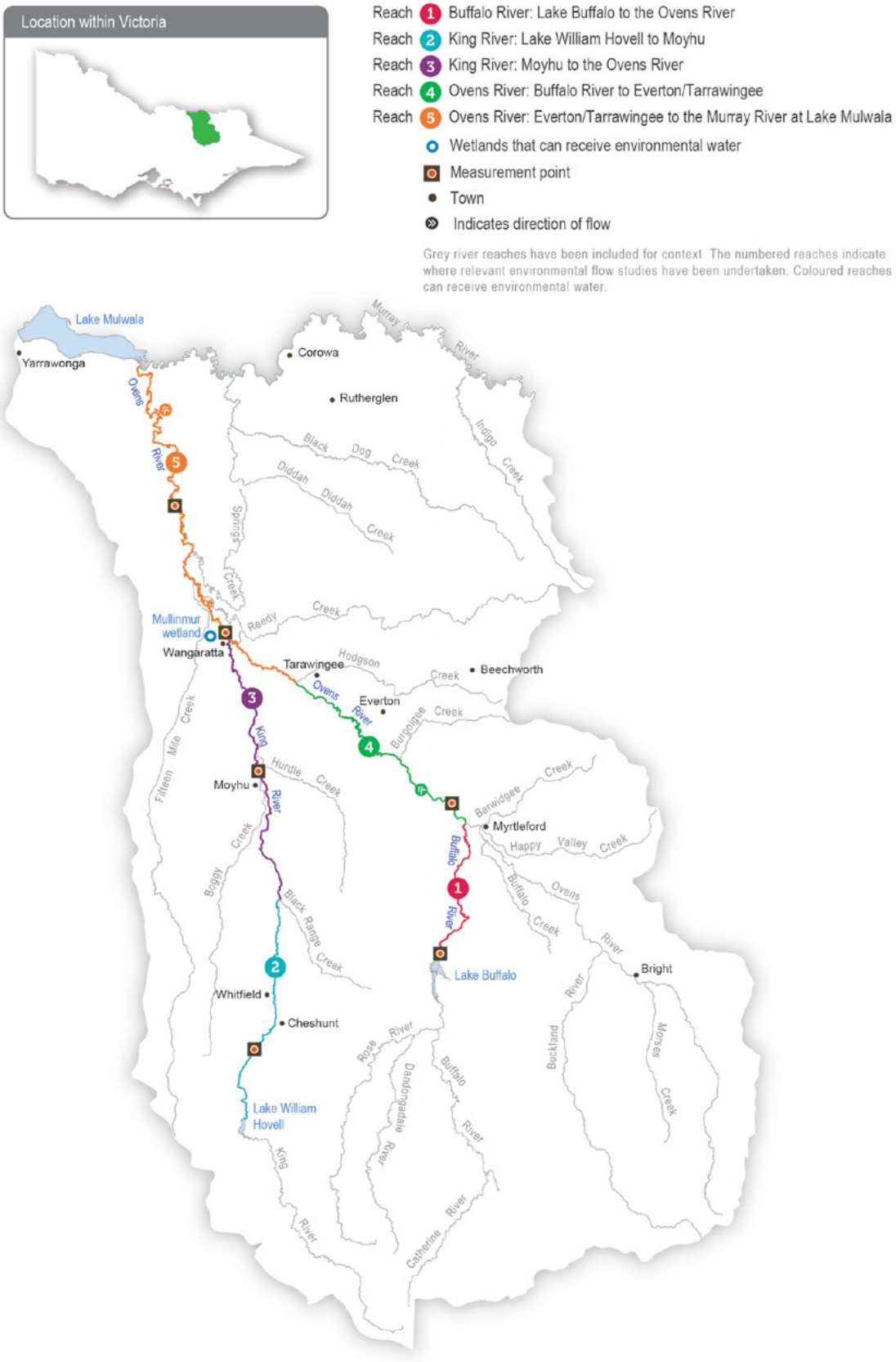
As its storages are small and spill regularly, the Ovens system maintains a large proportion of its natural flow regime, particularly in winter/spring. However, the storages and licensed water extractions throughout the system can restrict the flow in drier years, and parts of the system can become flow-stressed during summer and autumn.

The Ovens River flows into Lake Mulwala on the Murray River; the lake is the largest weir pool on the Murray regulated system. The Ovens River's flow contributes to the reliability and variability of the flow in the Murray River and supports many downstream uses, including irrigation, urban supply and watering of iconic floodplain sites (such as Barmah Forest).

Water for the environment is held in Lake Buffalo and Lake William Hovell and can be released when the storages are not spilling. Five reaches in the Ovens system can benefit from releases of water for the environment. While all are important, a relatively small volume (123 ML) of water is available, and it is insufficient to meet most environmental flow objectives. In recent years, private landowners have donated some of their annual water allocations to the VEWH to use in the King River. The Taungurung Land and Waters Council has also transferred their annual allocation to the VEWH to be delivered to the King River to heal Country.

The water transfers are used selectively to deliver the greatest possible environmental benefit. Water for the environment is most commonly used in the Ovens system to deliver critical flow events in reaches immediately below the two main storages, or it is used in conjunction with operational water releases to influence the flows of the Buffalo River and the lower Ovens River. It may also be used to top up Mullinmur Wetland in Wangaratta.

Figure 5.3.1 The Ovens system



Environmental values

The diverse aquatic habitat and abundant food resources associated with the Ovens system support many native fish species, including Murray cod, trout cod, golden perch and unspecked hardyhead. The Buffalo River provides valuable habitat for large-bodied fish species during part of their breeding cycle, while trout cod have an extensive range within the system and are found as far up the King River as Whitfield. A project to recover trout cod populations in the Ovens system has been successful, and efforts to reintroduce the endangered Macquarie perch are continuing with promising results. Macquarie perch recruitment has been observed through recent surveys by the Arthur Rylah Institute (ARI) on the Ovens River, with fish captured up the Buffalo and King rivers and downstream as far as Peechelba in 2023. In January 2024, the Victorian Fisheries Authority banned the take of Macquarie perch across Victoria to protect their population.

The lower Ovens wetland complex contains over 1,800 wetlands. It is listed as nationally significant and is home to various waterbirds, including egrets, herons, cormorants and bitterns. The streamside zones of river channels throughout the Ovens system support some of Victoria's healthiest river red gum forests and woodlands, while the wetlands support various aquatic and semi-aquatic vegetation communities.

Water for the environment was delivered to Mullinmur Wetland at Wangaratta for the first time in 2019-20. This site has been the focus of several environmental improvement projects recently, including carp removal, a revegetation program and the reintroduction of native fish.

Environmental objectives in the Ovens system

F1 – Maintain the size and distribution of native fish populations

MI1 – Maintain an adequate abundance and diversity of waterbugs to support river food webs and associated ecosystem processes

V1 – Maintain the condition and extent of wetland vegetation communities

WQ1 – Maintain water quality for all river life

Traditional Owner cultural values and uses

The Ovens system is within the recognised Registered Aboriginal Party and Recognition and Settlement Agreement boundary of the Taungurung Land and Waters Council (TLaWC) and the Yorta Yorta Nation Aboriginal Corporation (YYNAC). The Ovens system is also an area of significance to the Bangarang, Dhuduroa and Waywurru people.

The North East CMA consulted TLaWC in planning for potential 2024-25 environmental flows in the Ovens system.

The Taungurung Land and Waters Council water knowledge group Baan Ganalina (Guardians of Water) supports increasing Taungurung influence in water management, building internal capacity and advancing Taungurung water rights.

The ***Taungurung Country Plan***'s water chapter ***Baan Dhumba-Dji-Ngan Mundak Gunga*** (We must speak to protect water) lists several objectives. These include increasing and strengthening Taungurung voices, increasing water literacy and capacity and returning water to disconnected wetlands. The future delivery of water for the environment by the Taungurung Land and Waters Council on Taungurung Country would help achieve some of these objectives.

The Yorta Yorta Nation Aboriginal Corporation ***Yorta Yorta Whole-Of-Country Plan 2021-2030*** outlines objectives for Yorta Yorta Country, including for the Ovens River, and it identifies the lower Ovens River as a high priority for management actions. The Country Plan's objectives aim to support more culturally informed planning for water in the lower Ovens River in the future. In discussions in 2024, Yorta Yorta have indicated that they do not wish to be involved in developing the Ovens seasonal watering proposal or the seasonal watering plan process in its current form, and continued engagement is needed to find a pathway forward for future years. The North East CMA is continuing to work with members of Yorta Yorta to meet on Country in 2024.

TLaWC and YYNAC are collaborating with the North East CMA on a 2022-24 project to update environmental flow recommendations for the Ovens system. The project aims to progress Taungurung and Yorta Yorta cultural objectives.

Planned environmental flows may be modified to align with cultural benefits so long as environmental outcomes are not compromised. The TLaWC may use its 39 ML entitlement in the King River system to support environmental flows in 2024-25 in line with Taungurung cultural obligations to heal and care for Country. The Council's allocation has been released from Lake William Hovell five times as an environmental flow (from 2020 to 2024) in partnership with the North East CMA, Goulburn-Murray Water and the VEWH to provide additional water to the King River and help heal Country.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 5.3.1** with an icon (as explained in **Figure 1.2.3**). 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

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.3.1**, the North East CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as kayaking, boating and fishing)
- riverside recreation and amenity (such as camping, visitation for mental/physical health and wellbeing)
- community events and tourism (such as providing a setting for community gatherings, outdoor school learning, sporting events and citizen science projects)
- socioeconomic benefits (such as businesses used by anglers and stock and domestic uses that rely on water quality, supported by deliveries of water for the environment when the natural flow is at its lowest from November to March).

Environmental flows may be delivered to Mullinmur Wetland in summer to re-establish submerged aquatic vegetation and support native fish at the site. The water is expected to sustain other benefits to the local community (such as recreation and amenity). The Mullinmur Wetland site is managed by the Catholic Education Department, supported by Wangaratta Landcare and Sustainability Incorporated. An education hub provides a space for environmental education for students from Galen Catholic College, young people attending the Borinya Wangaratta Community Partnership School and other people from the local community, including a team of Waterwatch citizen scientists. These volunteers have been involved in monitoring changes in conditions for plant and fish species to inform deliveries of water for the environment.

Scope of environmental watering

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

Table 5.3.1 describes the potential environmental watering actions in 2024-25, 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 5.3.1 Ovens system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Buffalo River (targeting reach 1)		
Summer/autumn low-flow variability (greater than 70 ML/day for two days during February to April)	• Increase connectivity between pools for fish movement • Maintain waterbug habitat • Maintain adequate oxygen levels in pools	F1, MI1, WQ1
Autumn low flow fresh (430 ML/day for three days during March to April)	• Provide flow cues to stimulate the movement of native fish • Increase connectivity between pools for fish movement • Mix pools to improve the water quality • Provide small variations in river levels to connect new food sources and habitat for waterbugs • Provide an increase in the water velocity to scour biofilm from the river bed to generate new food sources for waterbugs	F1, MI1, WQ1
King River (targeting reaches 2 and 3)		
Summer/autumn low-flow variability (greater than 60 ML/day for two to four days during February to April)	• Increase connectivity between pools for fish movement • Maintain waterbug habitat • Maintain adequate oxygen levels in pools	F1, MI1, WQ1
Mullinmur Wetland		
Mullinmur Wetland (top-up during November to April)	• Maintain the water level within the wetland to support the growth and recruitment of aquatic vegetation • Maintain habitat and water quality for native fish	F1, V1

Scenario planning

Table 5.3.2 outlines potential environmental watering and expected water use in various planning scenarios.

The weather and inflows into storages greatly affect how water for the environment will likely be used in the Ovens system. In the drought and dry planning scenarios, the highest priority will be to use available water for the environment to introduce some variability to the summer/autumn low flow to limit the duration of extremely low-flow or cease-to-flow events that can stress native fish and waterbugs. In the average and wet planning scenarios, the objective is to provide a greater flow to support fish movement and breeding and increase the abundance and diversity of waterbugs. There is not enough water for the environment to deliver the recommended autumn fresh in full, so releases would need to coincide with and add to operational water releases. All the potential environmental watering actions for the Ovens River system are expected to be met naturally in the wet planning scenario.

Due to the small volume of water for the environment available, there is limited opportunity to vary the potential environmental watering actions each year for each planning scenario. However, water allocation donations (such as those by the Taungurung Land and Waters Council and a private donor in the King River) help to increase the effectiveness of some potential watering actions.

Mullinmur Wetland has flooded naturally in each of the last four years and last received environmental water in 2019-20. Prolonged inundation has caused the loss of submerged and emergent aquatic vegetation, and the Mullinmur Wetland Management Committee has instigated a project to replant vegetation in the wetland to improve habitat for native fish and other aquatic animals. The committee is trying to partially draw down the wetland to facilitate these plantings. The proposed action to top up Mullinmur Wetland is a low priority in 2024-25 but may be considered if it is needed to prevent the wetland from completely drying.

All available water for the environment is expected to be used in 2024-25. No carryover targets have been set for 2025-26.

Table 5.3.2 Ovens system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Possible winter/early-spring natural fresh • Very low flow through summer and autumn • No bulk water release	• Possible winter/early-spring natural fresh • Very low flow through summer and autumn • Bulk water release is unlikely	• High winter/spring natural freshes • Moderate flow in summer and autumn with occasional natural freshes • Bulk water release is likely	• High natural freshes and low flow throughout most of the year • Bulk water release is likely • All flow objectives are achieved naturally
Expected availability of water for the environment	• 123 ML (73 ML held in Lake Buffalo and 50 ML held in Lake William Hovell)			
Buffalo River (targeting reach 1)				
Potential environmental watering – tier 1 (high priorities)	• Summer/autumn low-flow variability	• Summer/autumn low-flow variability	• Summer/autumn low-flow variability • Autumn low-flow fresh	• Summer/autumn low-flow variability • Autumn low-flow fresh

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)	• N/A			
King River (targeting reaches 2 and 3)				
Potential environmental watering – tier 1 (high priorities)	• Summer/ autumn low-flow variability	• Summer/ autumn low-flow variability	• Summer/ autumn low-flow variability	• Summer/ autumn low-flow variability
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Mullinmur Wetland				
Potential environmental watering – tier 1 (high priorities)	• N/A			
Potential environmental watering – tier 2 (additional priorities)	• Mullinmur Wetland top-up			
Possible volume of water for the environment required to achieve objectives	• 123 ML (tier 1) • 20 ML (tier 2)			• 0-123 ML (tier 1) • 0-20 ML (tier 2)

5.4 Goulburn system

Waterway manager – Goulburn Broken Catchment Management Authority/Melbourne Water

Storage manager – Goulburn-Murray Water

Environmental water holders – Victorian Environmental Water Holder (including the Living Murray program) and the Commonwealth Environmental Water Holder

The Goulburn system includes the Goulburn River and Goulburn wetlands

5.4.1 Goulburn River

System overview

The Goulburn is Victoria's largest river basin, covering over 1.6 million ha or 7.1 per cent of the state (Figure 5.4.1). The Goulburn River flows for 570 km from the Great Dividing Range upstream of Woods Point to the Murray River east of Echuca. It is an ancient, iconic river rich with environmental, cultural and recreational values.

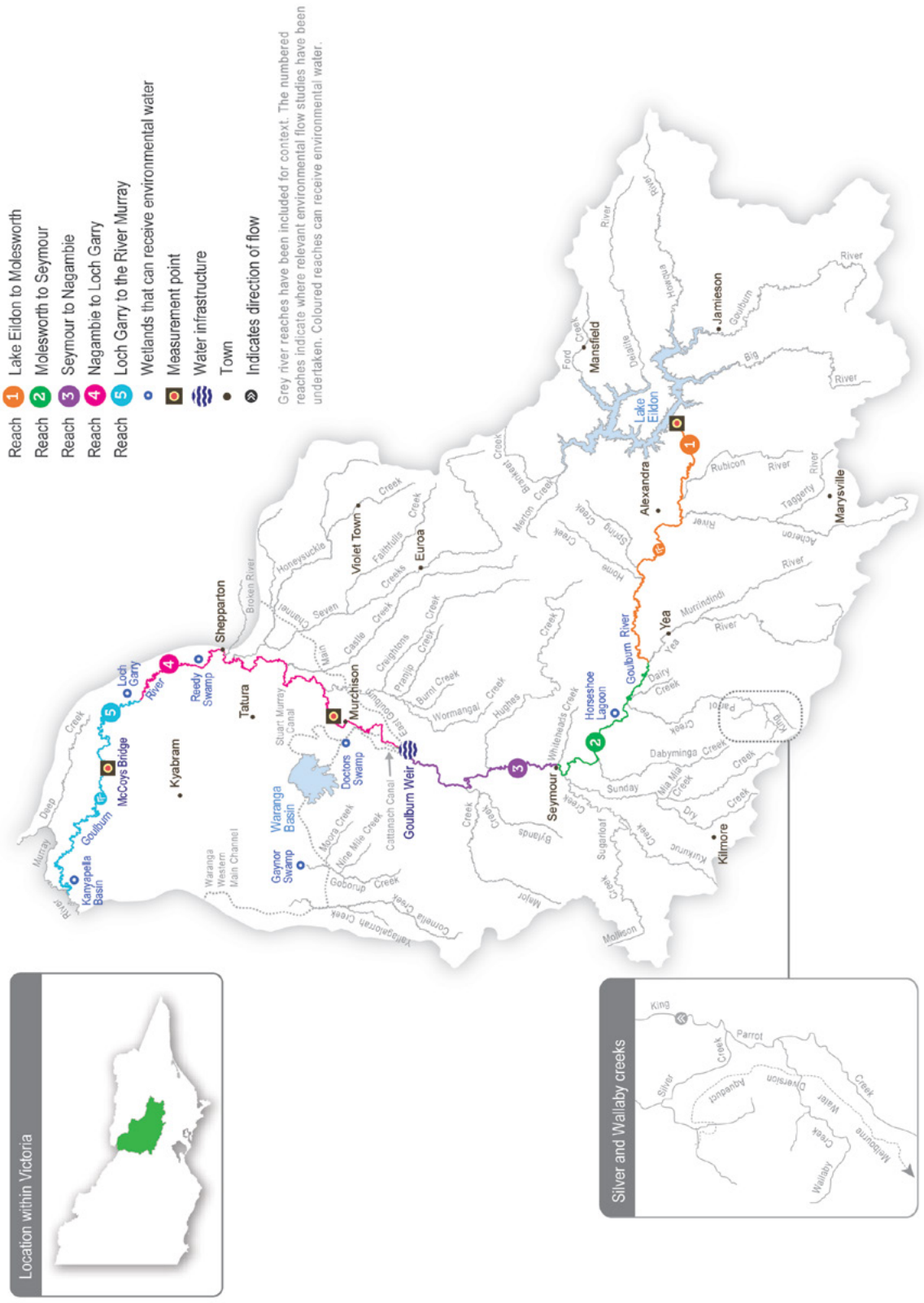
There are several environmental water holders in the Goulburn system. The Commonwealth Environmental Water Holder (CEWH) holds the largest volume, and the use of Commonwealth Water Holdings is critical to achieving outcomes in the Goulburn River, as well as priority environmental sites further downstream. Water for the environment held on behalf of the Living Murray program may assist in meeting objectives in the Goulburn system en route to icon sites in the Murray system. Water held by the VEWH in the Goulburn system is primarily used to meet environmental objectives in the Goulburn River and the Goulburn wetlands, but it can also be used to support environmental objectives at downstream sites along the Murray River and in South Australia.

The construction and operation of Lake Eildon and Goulburn Weir have significantly altered the natural flow regime of the Goulburn River. Water harvesting during wet periods and releases to meet irrigation and other consumptive demands during dry periods means the flow below these structures is typically low in winter/spring and high in summer/autumn. This is the reverse of the natural seasonal flow pattern. Land use changes and the construction of small dams and drainage schemes have further modified the Goulburn River's flow regime. Levees and other structures prevent water from inundating the floodplain and filling many of the natural wetlands and billabongs. Several tributaries, including the Acheron, Yea and Broken rivers, join the Goulburn River downstream of Lake Eildon and can add some flow variation to the river's regulated flows. Large floods that cause the Goulburn River's storages to fill and spill are also important for the overall flow regime and its associated environmental values.

The priority environmental flow reaches in the Goulburn River are downstream of Goulburn Weir (reaches 4 and 5), collectively called the lower Goulburn River. The mid-Goulburn River extends from Lake Eildon to Goulburn Weir (reaches 1 to 3). From early spring to late autumn, large volumes of water are delivered from Lake Eildon to Goulburn Weir to supply the irrigation system. During that period, the flow in the mid-Goulburn River is usually well above the recommended environmental flow targets. Deliveries of water for the environment have the most benefit in the mid-Goulburn River (especially in reach 1 immediately downstream of Lake Eildon) outside the irrigation season when releases from Lake Eildon are often much lower than natural.

Environmental flow targets in the lower Goulburn River can sometimes be met by the coordinated delivery of operational water being transferred from Lake Eildon to the Murray River. These inter-valley transfers (IVTs) occur during the irrigation season between spring and autumn and may meet environmental flow objectives without the need to release water for the environment. IVTs in the Goulburn River can significantly exceed the environmental flow recommendations for summer and early autumn, damaging bank vegetation and eroding riverbanks. A new Goulburn to Murray trade rule and operating plan was introduced in 2022-23 to prevent further damage to the lower Goulburn River from a prolonged high flow over summer and autumn. Wet conditions between 2021-22 and 2023-24 have meant only small volumes of IVTs have been delivered from the Goulburn system in recent years, so the impact of the new trade rules and operating plan on environmental assets is yet to be fully assessed.

Figure 5.4.1 The Goulburn system



Environmental values

The Goulburn River and its tributaries support a range of native fish (including golden perch, silver perch, Murray cod, trout cod, Macquarie perch and freshwater catfish), turtles, platypus and rakali (water rats). Aquatic vegetation, scour holes and woody debris within the channel provide high-quality habitat for adult and juvenile fish. River red gums are a dominant feature of the streamside zone along the length of the Goulburn River. These trees shade the river and provide habitat for many species, including the squirrel glider. Leaves that fall from the river red gums provide carbon that supports riverine food webs, and dead trees that fall into the river provide a surface for biofilms and waterbugs and habitat for fish. Birds (such as egrets, herons and cormorants) use trees along the river to roost and feed, while frogs benefit from shallow vegetated habitats at the edge of the river channel and in adjacent wetlands.

The Goulburn River system is an important conservation area for threatened species. Several wetlands in the Goulburn catchment are formally recognised for their conservation significance. Tributaries of the mid-Goulburn River between Lake Eildon and Goulburn Weir host some of the last remaining Macquarie perch populations in the Murray-Darling Basin, while freshwater catfish occur in lagoons connected to reach 3 of the Goulburn River. Citizen science monitoring programs indicate the mid-Goulburn River supports a strong population of platypus, which are now classified as vulnerable under Victoria's *Fauna and Flora Guarantee Act 1988*. Monitoring in recent years shows that environmental flows in the lower Goulburn River trigger golden perch and silver perch to spawn. However, the extent to which these spawning events contribute to populations locally and in the wider southern basin is unknown. Self-sustaining populations of Murray cod have been confirmed, and trout cod are extending their range in the lower Goulburn River.

Environmental objectives in the Goulburn River

	**CN1** – Provide sufficient rates of carbon and nutrient production and processing to support native fish and waterbug communities
	F1 – Increase the abundance, spatial distribution and size class diversity of key native fish species
	**G1** – Maintain substrate surfaces to support ecological processes **G2** – Maintain the diversity of the channel form (e.g. shallow and deep water habitats)
	**MI1** – Maintain abundant and diverse waterbug communities to support riverine food webs
	**PR1** – Increase the self-sustaining platypus population
	**T1** – Maintain the self-sustaining turtle population
	**V1** – Increase the abundance of aquatic and flood-tolerant plants in the river channel and on the lower banks to provide shelter and food for animals and stabilise the riverbank **V2** – Increase the abundance of aquatic and flood-tolerant plants in low-lying and connected wetlands
	WQ1 – Minimise the risk of hypoxic blackwater

Traditional Owner cultural values and uses

The Goulburn River system flows through Taungurung Country and Yorta Yorta Country.

Each year, the Goulburn Broken CMA consults with the Taungurung Land and Waters Council (TLaWC) and the Yorta Yorta Nation Aboriginal Corporation (YYNAC) about plans for environmental watering in the Goulburn River. Consultation takes the form of formal and informal discussions.

TLaWC and YYNAC are members of the Goulburn Environmental Water Advisory Group and the Goulburn and Broken Operational Advisory Group. Both groups meet frequently throughout the year and share technical, operational and other information (such as recreational and cultural values) to support environmental water management and decision-making in the Goulburn River.

In 2023, the Goulburn Broken CMA met with the Taungurung water knowledge group Baan Ganalina (Guardians of Water) to discuss environmental flow recommendations for *Waring* (reaches 1 to 3 of the Goulburn River).

Baan Ganalina supports flows that would help to reinstate a more natural water regime that better reflects the size, timing and variability of natural inflows to this part of the river, including off-channel areas.

> "These flow recommendations will help support *Waring* (Goulburn River), which is such an important part of Taungurung identity. It's good to see how the Goulburn Broken CMA has used peer-reviewed articles to show the effects on important animals like platypus and shared this knowledge. The river is a work in progress, but together with the Goulburn Broken CMA, we will continue to seek ways to heal Country despite the harm it has suffered. Baan Ganalina hopes to see the proposed *higher* winter flows, and looks forward to taking an ongoing role in monitoring their effects."
>
> *– Baan Ganalina, 2023*

TLaWC communicated outcomes for *Waring* that align with Taungurung objectives and responsibilities to heal and care for Country, include connecting wetlands that support valued species at appropriate times. This helps to protect intangible and tangible cultural heritage and values, including traditional food and medicine plants. Planned flows will also support ongoing efforts by Taungurung and program partners to care for the river and its floodplain, including investigations into rehabilitating degraded significant sites.

In 2023, the Goulburn Broken CMA met with Yorta Yorta Nation Aboriginal Corporation. YYNAC indicated there is alignment between planned watering actions for *Kaiela* (reaches 4 and 5 of the Goulburn River) and the cultural and ecological values of the Yorta Yorta people. The planned flows will encourage native fish to spawn, alleviate the slumping of culturally important sites (such as middens and scar trees) and will revive streamside vegetation, which is important for food, fibre and medicine.

A Yorta Yorta Nation Aboriginal Corporation representative contributed to the 2020 Kaiela Environmental Flows Study, which has influenced environmental flows in the lower Goulburn River since 2021-22.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 5.4.1** with an icon (as explained in **Figure 1.2.3**). 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

In 2022, Taungurung Land and Waters Council joined the Goulburn and Broken Operational Advisory Group, which shares technical and operational information to support environmental water management and decision-making in the Goulburn River and lower Broken Creek.

Social, recreational and economic values and uses

In planning the potential watering actions in **Table 5.4.1**, the Goulburn Broken CMA considered how environmental flows could support values and uses such as:

- water-based recreation (such as boating, canoeing, fishing, gaming, hunting and kayaking)
- riverside recreation and amenity (for landholders and visitors)
- community events and tourism (such as paddling and boating businesses)
- socioeconomic benefits (such as improving water quality for stock and domestic uses, irrigation diverters and water supply for settlements on the Goulburn River).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in **Table 5.4.1** with the following icon.

Watering planned to support angling activities

The Goulburn River provides numerous recreational and economic benefits. Environmental flows support native fish populations by providing fish passage and habitat and encouraging fish migration and spawning, which in turn benefits recreational anglers. Following community feedback, the timing of targeted environmental flow events in September (mid-Goulburn) and November/December (lower Goulburn) is planned to reduce impacts on river access around the opening of different fishing seasons, benefitting anglers and local businesses.

Scope of environmental watering

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

Table 5.4.1 describes the potential environmental watering actions in 2024-25, 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 5.4.1 Goulburn River potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Goulburn River reach 1		
Year-round low flow (400-2,000 ML/day) 	• Maintain habitat for small-bodied native fish • Maintain adequate foraging habitat for platypus and reduce the risk of predation • Provide habitat and food for turtles • Wet and maintain riffles to provide habitat for biofilms and waterbugs Additional benefits when flows delivered are above 800 ML/day: • scour fine sediment from the gravel bed and riffle substrate • maintain existing beds of in-channel vegetation • provide connection to low-lying, off-stream wetland habitats, which increase food resources (waterbugs) available for fish and native animals	F1  G1  MI1  PR1  T1  V1

Potential environmental watering action	Expected watering effects	Environmental objectives
Winter fresh (one fresh of more than 8,000 ML/day for five to 10 days during July to August)	• 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 • Scour bed sediments to maintain pools and change in-channel complexity for improved habitat • Inundate aquatic vegetation in connected wetlands to avoid exposure to frost • Connect larger off-stream wetlands to the river channel to provide habitat for small-bodied native fish • Increase foraging conditions for platypus and turtles • Increase the availability of habitat to support macroinvertebrate lifecycles	F1, G1, G2, MI1, PR1, T1, V1, V2
Winter/spring fresh(es) (one to three freshes of more than 5,000 ML/day for five to 10 days during May to November)	• Scour fine sediment from the gravel bed and riffle substrates • Maintain existing beds of in-channel vegetation • Maximise the time off-stream wetland habitats are available for small-bodied native fish and platypus • Increase foraging conditions for platypus and turtles • Increase the availability of habitat to support macroinvertebrate lifecycles	F1, G1, MI1, PR1, T1, V1, V2
Spring fresh (one fresh of more than 8,000 ML/day for five to 10 days during September to November)	• Maintain mid-Goulburn off-stream habitat for small-bodied native fish and platypus • Scour bed sediments to maintain pools and change in-channel complexity for improved habitat • Maintain existing beds of aquatic vegetation both in-channel and in connected wetlands • Connect larger off-stream wetlands to the river channel to provide habitat for small-bodied native fish • Increase foraging conditions for platypus and turtles • Increase the availability of habitat to support macroinvertebrate lifecycles • Increase soil moisture in banks and connected wetlands to improve the condition of existing native vegetation	F1, G1, G2, MI1, PR1, T1, V1, V2

Potential environmental watering action	Expected watering effects	Environmental objectives
Goulburn River reach 4 and 5		
Year-round low flow (600-1,000 ML/day)	• Provide slow, shallow habitat required for the recruitment of larvae/juvenile fish and habitat for adult small-bodied fish • Provide deep water habitat for large-bodied fish • Submerge snags and littoral vegetation to provide habitat for fish and waterbugs and a substrate for biofilms to grow • Provide habitat and food for turtles • Maintain habitat for aquatic vegetation and water the root zone of low-bank vegetation • Vary flow within a specified range to encourage plankton production for food, disrupt biofilms and maintain water quality • Provide a low, variable flow to enable vegetation to establish to protect against notching and bank erosion	CN1, F1, MI1, PR1, T1, V1, WQ1
Winter/autumn fresh (one fresh of up to 10,000 ML/day with more than four days above 7,300 ML/day during July to August and May to June)	• Wash organic matter and carbon (e.g. leaf litter) into the channel • Provide connectivity to off-channel habitats and through the river for fish dispersal and greater food resources • Scour bed sediments to maintain pools and change in-channel complexity for improved habitat • Provide cues for platypus to nest higher up the bank • Provide sediment and plant propagules from tributary inflows after large rain events to encourage the establishment of new plants • Drown terrestrial vegetation on low banks and trigger the recruitment of native, flood-tolerant streamside vegetation • Improve waterbug habitat and food availability by scouring fine sediments	CN1, F1, G1, G2, MI1, PR1

Potential environmental watering action	Expected watering effects	Environmental objectives
Early-spring fresh (one fresh of up to 10,000 ML/day with more than seven days above 7,300 ML/day during September to October)	• Wash organic matter and carbon (e.g. leaf litter) into the channel • Provide connectivity to off-channel habitats and through the river for fish dispersal and greater food resources • Scour bed sediments to maintain pools and change in-channel complexity for improved habitat • Increase soil moisture in banks to improve the condition of existing native vegetation • Provide sediment and plant propagules from tributary inflows after large rain events to encourage the establishment of new plants • Drown terrestrial vegetation on low banks and trigger the recruitment of native flood-tolerant streamside vegetation • Improve waterbug habitat and food availability by scouring fine sediments and biofilms from hard substrates	 CN1 F1  G1, G2  MI1  V1, V2
Late-spring fresh (one fresh of more than 6,600 ML/day for two days during October to December) 	• Stimulate spawning of golden and silver perch • Scour bed sediments to maintain pools and change in-channel complexity for improved habitat • Improve waterbug habitat and food availability by scouring fine sediments and biofilms from hard substrates	F1  G1, G2  MI1
Autumn fresh (one fresh of more than 5,700 ML/day for two to five days during March to May)	• Cue fish to move into and through the system to increase their abundance and dispersal • Scour bed sediments to maintain pools and change in-channel complexity for improved habitat • Increase soil moisture in banks to maintain existing vegetation • Scour old biofilm from hard substrates to allow new biofilm growth to improve food and habitat for macroinvertebrates	F1  G1, G2  MI1
Environmental risk mitigation flow; slow recession of unregulated flow or releases from Goulburn Weir (6,000 ML/day)	• Minimise the risk of bank erosion associated with a rapid reduction in the water level • Transport and deposit seed, plant propagules and sediment on the riverbank • Minimise the risk of hypoxic blackwater after natural events	 G1  V1 WQ1

Scenario planning

Table 5.4.2 outlines potential environmental watering and expected water use in various planning scenarios.

The environmental flows study for the Goulburn River recommends a range of watering actions needed most years to achieve the target environmental outcomes. High water availability in the Goulburn system at the end of 2023-24 and a strong resource outlook for 2024-25 mean all recommended watering actions can potentially be met, even in a return to dry conditions. Therefore, the proposed actions are the same for all planning scenarios in 2024-25.

The highest-priority environmental watering actions in the lower Goulburn River in 2024-25 aim to increase the extent and improve the composition and condition of riparian vegetation within the channel. Unnaturally high IVT flows have severely damaged native vegetation on the banks of the lower Goulburn River during the irrigation seasons from 2017 to 2021. The lower parts of the bank have very limited vegetation, and a few species that can tolerate prolonged inundation dominate the middle and upper parts of the bank. The loss of vegetation on the lower banks has reduced the quantity and quality of littoral habitat for fish and waterbugs and increased the risk of bank slumping, increasing sediment deposition within the channel. Large spring and summer floods in 2022-23 and 2023-24 restricted the recovery of bank vegetation but also deposited sediments and seeds that helped new plant growth in autumn 2024. Ongoing flow management is required to consolidate this new growth and help the vegetation fully recover.

The most important flows for bank vegetation in the Goulburn River are year-round low flows and freshes during winter and spring. The target range for low flows aims to inundate enough of the channel to support in-stream vegetation and expose the lower parts of the bank for sustained periods during the warmer growing season to avoid drowning riparian vegetation. Winter and spring freshes are needed to periodically wet higher parts of the bank to enhance the growth and recruitment of native plants growing on the water's edge and deter the growth of terrestrial species. Where possible, these freshes will be delivered by passing tributary inflows from the mid-Goulburn River to the lower Goulburn reaches so that seeds, sediments and nutrients that are carried from natural tributary flows are transported and deposited along the banks of rivers throughout the whole system.

Year-round low flows and freshes may be fully or partially achieved with natural flows under wetter climate scenarios, and operational releases (such as IVTs) may help meet environmental flow targets in the drier climate scenarios. Goulburn-Murray Water generally diverts a proportion of the natural high flow from Goulburn Weir into the Waranga Basin. These operational transfers can cause the flow rate in the lower Goulburn River to drop rapidly after a natural high-flow event, and water for the environment may be used as required to slow the recession of natural spills at Goulburn Weir to reduce the risk of bank slumping.

The next-highest priority for environmental watering in 2024-25 will be to support native fish objectives. Recent monitoring has recorded significant declines in small-bodied native fish populations in the Goulburn River and other connected systems since the 2022 and 2023 floods. These declines are likely due to a range of factors, including hypoxic blackwater, temporary loss of slow-flowing littoral habitat within the channel and an increase in the proliferation of carp in the Murray River and its tributaries. Recent fish monitoring also suggests there has been little recruitment of larger native species (such as golden and silver perch) in recent years. While these species do not need to spawn every year, actions to increase their populations will be taken where possible. Late-spring freshes are known to trigger golden and silver perch spawning in the lower Goulburn River, and water for the environment may be used to deliver freshes in spring 2024 as long as their timing does not compromise outcomes for re-establishing bank vegetation.

The final focus for environmental watering in the Goulburn River in 2024-25 will be to maintain minimum flows in reach 1 (immediately downstream of Lake Eildon) during winter when there are no irrigation releases and deliver multiple freshes in winter and spring to reinstate some natural flow variation and connect floodplain wetlands between reach 1 and reach 3. Collectively, these flows will maintain in-channel habitat through the mid-Goulburn system and provide opportunities for fish and platypus to access off-channel habitats for feeding and breeding. Citizen science monitoring of platypus suggests that multiple years of high overbank flooding may have damaged their breeding cycles. Therefore, delivering a winter fresh in reach 1 to optimise platypus breeding success is a high priority in 2024-25.

Carrying over water to meet minimum low-flow objectives from July 2025 to September 2026 is an important consideration in the drought and dry climate scenarios, but it is less important in the average and wet planning scenarios due to likely high early-season allocations.

Table 5.4.2 Goulburn River environmental watering planning scenarios

Planning scenario	Drought	Dry	Below average	Average	Wet
Expected conditions	• Very few or no large natural-flow events • Blackwater could be an issue if there is a large rain event in the warmer months	• One to two short-duration, large natural flow events are likely to provide small winter/spring freshes • Blackwater could be an issue if there is a large rain event in the warmer months	• One to three average duration, large natural flow events are likely to provide winter/spring freshes • Blackwater could be an issue if there is a large rain event in the warmer months	• Large natural-flow events will provide low flow for most of the year and will likely provide winter/spring freshes • Blackwater could be an issue if there is a large rain event in the warmer months	• Large natural-flow events will provide low flow and multiple freshes and/or overbank flow events in winter/spring • Blackwater could be an issue if there is a large rain event in the warmer months
Expected availability of water for the environment	• 604 GL	• 754 GL	• 754 GL	• 754 GL	• 754 GL
Goulburn River (targeting reach 1)					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)** • Year-round low flow • Winter fresh • Winter/spring freshes • Spring fresh				
Goulburn River (targeting reach 4 and 5)					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)** • Year-round low flow • Winter/autumn fresh • Early-spring fresh • Autumn fresh • Ecological risk mitigation flow • Late-spring fresh				
Possible volume of water for the environment required to achieve objectives	• 576 GL (tier 1a)	• 562 GL (tier 1a)	• 520 GL (tier 1a)	• 520 GL (tier 1a)	• 555 GL (tier 1a)
Priority carryover requirements for 2025-26	• 50,000 ML		• N/A		

5.4.2 Goulburn wetlands

System overview

Within the Goulburn Broken catchment, there are about 2,000 natural wetlands identified, but only six — Doctors Swamp, Gaynor Swamp, Horseshoe Lagoon, Kanyapella Basin, Loch Garry and Reedy Swamp — have received water for the environment through the VEWH's or CEWH's entitlements. Several other small wetlands in the Goulburn catchment have been watered under a separate arrangement through the Murray-Darling Wetlands Working Group.

Doctors Swamp, Gaynor Swamp, Kanyapella Basin, Loch Garry and Reedy Swamp can receive water for the environment through irrigation supply infrastructure. The volume of water that can be delivered to each wetland depends on the physical capacity of the infrastructure and the seasonal allocation. Water for the environment can be delivered from the Goulburn River to Horseshoe Lagoon via a temporary pump.

Environmental values

Many natural wetlands across the Goulburn catchment, including Doctors Swamp, Gaynor Swamp, Kanyapella Basin, Loch Garry and Reedy Swamp, are formally recognised for their conservation significance. The Goulburn wetlands support various plant communities ranging from river red gum swamps to cane grass wetlands.

Doctors Swamp is one of Victoria's most intact red gum swamps, supporting over 80 wetland plant species.

Gaynor Swamp is a cane grass wetland situated on paleosaline soils: soils formed from historic oceans. When wet, the wetland supports thousands of waterbirds, including brolga and intermediate egrets. Gaynor Swamp is more saline than other wetlands in the region when water levels are low, and it attracts a different group of feeding waterbirds as it draws down. The red-necked avocet is one of the most significant species that feed on exposed mudflats at Gaynor Swamp.

Horseshoe Lagoon is a paleochannel of the Goulburn River with tall marsh, floodway pond herbland and floodplain streamside woodland vegetation communities. The lagoon supports numerous waterbird species and is home to three turtle species, including the broad-shelled turtle.

Kanyapella Basin is a shallow freshwater marsh that provides habitat for numerous plant and animal species, including the threatened intermediate egret. Historically, it has been a popular breeding site for ibis, herons and cormorants.

Loch Garry is a paleochannel of the Goulburn River that provides deep open-water habitat. Shallow, vegetated wetland depressions, red gum forest and sand ridges surround the channel. It is an important site for waterbird feeding and roosting, and it is a drought refuge for eastern great egrets, musk ducks, nankeen night herons and royal spoonbills.

Reedy Swamp contains a mosaic of vegetation types, including tall marsh, floodway pond herbland and rushy riverine swamp. It is a vital drought refuge, nesting site for colonial waterbirds and stopover feeding site for migratory birds (such as sharp-tailed sandpiper and marsh sandpiper).

Environmental objectives in the Goulburn wetlands

	A1 – Maintain the frog population
	**B1** – Provide breeding habitat for waterbirds **B2** – Provide feeding and roosting habitat for waterbirds
	**CN1** – Restore carbon and nutrient cycling within the wetlands to increase ecosystem productivity
	**T1** – Maintain the freshwater turtle population
	**V1** – Increase the diversity and cover of native wetland plant species consistent with ecological vegetation class benchmarks **V2** – Reduce the cover and diversity of exotic plants

Traditional Owner cultural values and uses

The Goulburn wetlands span the lands of two Traditional Owner groups, represented by the Taungurung Land and Waters Council (TLaWC) and the Yorta Yorta Nation Aboriginal Corporation (YYNAC). Gaynor Swamp and Horseshoe Lagoon are on Taungurung Country. TLaWC has been involved in environmental water planning for both wetlands for several years and in delivering water for the environment at Horseshoe Lagoon since 2021. TLaWC has been working with Parks Victoria to reintroduce aquatic plant species that are either missing or in low numbers at Horseshoe Lagoon to boost their diversity and abundance.

Doctors Swamp, Kanyapella Basin, Loch Garry and Reedy Swamp are on Yorta Yorta Country. The YYNAC has been involved in planning for environmental flows at these wetlands for several years, including participating in developing environmental water management plans.

In late 2023, the Goulburn Broken CMA discussed proposed 2024-25 priorities for water for the environment in the Goulburn wetlands through the Goulburn Broken Wetlands Technical Reference Group. As this could not be done online or in person, the proposals were emailed for review and feedback. Priorities were also discussed with the Goulburn Broken Environmental Water and Wetlands Advisory Group which met online on 29 February 2024.

The TLaWC has identified that water for the environment supports cultural values by protecting intangible cultural heritage and valued species, traditional food and medicine plants. Participation in environmental water planning by TLaWC and the Taungurung water knowledge group Baan Ganalina (Guardians of Water) makes an essential contribution in enabling Taungurung Traditional Owners to fulfil their obligations to care for Country. This includes working to restore a more natural watering regime to degraded significant sites and rehabilitating habitat for native species. This work contributes to reconnecting the Taungurung community to Country by supporting and securing access for Taungurung contemporary cultural practices and uses, teaching places, camping sites and other places of cultural importance.

The Taungurung people have a special interest in rehabilitating floodplain wetlands associated with *Waring* (Goulburn River reaches 1 to 3), which are now largely disconnected from the main river channel due to the impacts of river flow regulation. The Council monitors biocultural values and habitat conditions at six disconnected wetlands as part of the ongoing Reading Country program. The monitoring findings will inform future seasonal watering proposals and planning for water for the environment. The Council is working with partners to improve habitat conditions for native species in the area, and healthy Country assessments will provide important information about cultural objectives and indicators.

Horseshoe Lagoon has high cultural significance for the Taungurung people, particularly Taungurung women, as it is central to their creation story. Environmental water provides the opportunity for Traditional Owner women to visit the site for their cultural beliefs, traditional foods and medicines.

In 2017, TLaWC undertook an Aboriginal Waterways Assessment at Horseshoe Lagoon. In 2019, the Council helped develop the environmental water management plan before the first delivery of water for the environment to Horseshoe Lagoon in winter 2019. In 2021 and 2022, council staff and Baan Ganalina coordinated the delivery of environmental water to Horseshoe Lagoon by managing the pumping and delivery. This is planned again for autumn 2025, provided the drying period is met.

For Yorta Yorta people, water for the environment supports many cultural values. At Doctors Swamp, it supports *nardoo* (a food source), native grasses, old man weed (which has medicinal uses), sedges and rushes (for basket weaving), as well as a wide range of bird and animal species. At Loch Garry, water for the environment supports culturally important food, fibre and medicinal plants. A flow delivered to Loch Garry in April 2020 initiated a resurgence of these plants and giant rush, which provided nesting opportunities for important bird species. Loch Garry is rich in cultural values: stone scatters, scar trees and significant sand hills in the higher elevations.

Kanyapella Basin is important for the Yorta Yorta People's cultural and spiritual connections. It supports the health of cultural values in the landscape (such as the Creation Story and traditional food and medicine plants). Before the delivery of environmental flows in winter 2020, Yorta Yorta People conducted a cultural burn at the site, helping to enable direct delivery of the water and help the growth of old man weed.

Planned environmental flows may be modified to align with cultural benefits so long as environmental outcomes are not compromised.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, 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 5.4.3** with an icon (as explained in **Figure 1.2.3**). 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

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.5.4**, the Goulburn Broken CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing)
- riverside recreation and amenity (such as birdwatching, camping, cycling, hiking, photography and walking)
- community events and tourism (such as birdwatching events, the Nature Scripts Initiative and outdoor classroom learning).

Environmental watering of wetlands increases the number of visitors and opportunities for them, including for birdwatching, photography, walking, camping, and hunting (state game reserves have been reclassified as wildlife reserves).

Wetlands provide resources for Traditional Owners for cultural values and uses, including hunting, food, medicinal and traditional activities.

A summary of potential shared benefits of the 2024-2025 proposed environmental water deliveries in the Goulburn catchment are listed below.

Shared benefits of watering wetlands in the Goulburn Catchment in 2024-25

Wetland	Beneficiary	Connection to wetland	Value	How have these benefits been considered?
Horseshoe Lagoon	Taungurung women Bird watchers Photographers Walkers Campers Local landholders	Connection to Country for Taungurung women	Environmental water provides a connection to Country for Traditional Owners, especially women from Taungurung Land and Waters Council.	Autumn watering of the site promotes growth of wetland plants that are beneficial for roosting and foraging for waterbirds. The water provides the opportunity for Traditional Owner women to visit the site for their cultural beliefs, traditional foods, and medicines.

Scope of environmental watering

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

Table 5.4.3 describes the potential environmental watering actions in 2024-25, 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 5.4.3 Goulburn wetlands system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Horseshoe Lagoon (fill in autumn 2025 if it is dry for six months)	• Inundate the deeper section and wetland margin to maintain naturally occurring wetland vegetation communities and help recently planted aquatic vegetation continue to establish • Suppress the growth of weeds • Provide food and breeding habitat for turtle populations • Provide food and roosting habitat for birds	T1, V1, V2 B2

Scenario planning

Table 5.4.4 outlines potential environmental watering and expected water use in various planning scenarios.

The Goulburn wetlands have filled multiple times in recent years due to natural floods. The latest floods were in October 2023 and January 2024, and all six Goulburn wetlands were relatively full at the end of autumn 2024. Reedy Swamp and Loch Garry have held water continuously since 2021, and the priority at all Goulburn wetlands in 2024-25 will be to allow them to draw down naturally to support dry-phase ecosystem processes, including nutrient cycling. Drying the wetlands will also help control pest species, including European carp at Horseshoe Lagoon and Reedy Swamp and cumbungi at Doctors Swamp and Gaynor Swamp. It is recommended that Gaynor Swamp remain dry for four years to combat cumbungi expansion.

The only active environmental watering action planned for the Goulburn wetlands in 2024-25 is to fill Horseshoe Lagoon in autumn 2025 if it has been dry for at least six months. The environmental water management plan for Horseshoe Lagoon recommends annual filling, whereas other wetlands require less frequent wetting. Active watering at Horseshoe Lagoon is more likely in the drought-to-average climate scenarios because it will likely fill naturally in the wet planning scenario.

No end-of-year carryover target has been set for the Goulburn wetlands because seasonal allocations are expected to meet environmental watering requirements in 2025-26.

Table 5.4.4 Goulburn wetlands system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Catchment run-off and natural flow into the wetlands are highly unlikely	• Catchment run-off and natural flow into the wetlands are highly unlikely	• Some catchment run-off and natural flow into some of the wetlands are likely, particularly in winter/spring	• Catchment run-off and natural flow into the wetlands are likely to fill or partially fill the wetlands, particularly in winter/spring
Potential environmental watering – tier 1 (high priorities)	• Horseshoe Lagoon			• N/A
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 120 ML	• 120 ML	• 80 ML	• N/A
Priority carryover requirements for 2025-26	• N/A			

5.5 Broken system

Waterway manager – Goulburn Broken Catchment Management Authority

Storage manager – Goulburn-Murray Water

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

The Broken system includes the Broken River, upper Broken Creek, lower Broken Creek and the Broken wetlands.

5.5.1 Broken River and upper Broken Creek

System overview

The Broken River is a tributary of the Goulburn River, rising in the Wellington-Tolmie highlands and flowing northwest to Benalla and then west for a total distance of 190 km before it joins the Goulburn River near Shepparton (Figure 5.5.1). Lake Nillahcootie is the main storage on the Broken River. It is about 36 km upstream of Benalla and harvests water from the river to support stock and domestic supply and irrigated agriculture. The main tributaries of the Broken River are Hollands Creek, Ryans Creek and Lima East Creek.

Lake Nillahcootie has a storage capacity of about half the mean annual flow of its upstream catchment, so it fills in most years. The operation of Lake Nillahcootie has modified the river's natural flow pattern: winter/spring flow downstream of the reservoir is less than natural because a large proportion of inflow is harvested, while the summer/autumn flow is greater than natural because water is released to meet downstream irrigation demands. These impacts are most pronounced in the reach between Lake Nillahcootie and Hollands Creek. Below Hollands Creek, the river retains a more natural flow pattern due to flows from unregulated tributaries, although the total annual flow is considerably less than natural. The catchment has been extensively cleared for agriculture, including dryland farming (such as livestock grazing and cereal cropping) and irrigated agriculture (such as dairy, fruit and livestock).

Water is released from Lake Nillahcootie to meet downstream demand and minimum-flow requirements specified under the bulk entitlement for the Broken River system. Releases from storage may be less than 30 ML per day as tributary inflows immediately below the storage (such as from Back Creek) can supply much of the minimum-flow requirements specified in the bulk entitlement.

Upper Broken Creek is defined as the 89-km stretch of creek from the Broken River (at Caseys Weir) to the confluence with Boosey Creek near Katamatite. Upper Broken Creek flows across a flat riverine plain and has naturally low run-off from its local catchment. It receives flood flows from the Broken River, although river regulation, earthworks and road construction have reduced the frequency of these floods.

Upper Broken Creek has been regulated for more than a century. Before 2007, water was diverted into upper Broken Creek at Caseys Weir to meet local demand, but recent water savings projects have reduced the demand on the creek. There is now a low flow between Caseys Weir and Waggarandall Weir throughout the year. The flow below Waggarandall Weir is more variable and experiences regular cease-to-flow periods. These changes have reduced the amount of permanent aquatic habitat.

Delivery of water for the environment to the Broken River is primarily constrained by the small volume of Water Holdings in the Broken system. Environmental water holders can trade water into the Broken system from other trading zones subject to relevant limits and conditions to meet environmental needs.

The bulk entitlement for the Broken system held by Goulburn-Murray Water stipulates that a minimum environmental flow — also known as passing flow — is to be maintained in the Broken River when there are natural flows into the system. The bulk entitlement also allows Goulburn-Murray Water and the Goulburn Broken CMA to agree to reduce the minimum passing flow and accumulate unused volumes for later releases that will provide a greater environmental benefit. Accumulated passing flow is the first volume lost when the storage spills. Environmental flows in upper Broken Creek are restricted by the volume of available supply, channel capacity and the need to avoid flooding low-lying, adjacent land.

Figure 5.5.1 The Broken system

Environmental values

The Broken River retains one of the best examples of healthy in-stream vegetation in a lowland river in the region. A range of native submerged and emergent plant species, including eelgrass, common reed and water ribbons, populate the bed and margins of the river. These plants provide habitat for various animals, including small- and large-bodied native fish. Murray cod, Macquarie perch, golden perch, silver perch, river blackfish, mountain galaxias, southern pygmy perch and Murray-Darling rainbowfish all occur in the Broken River. The river also supports a platypus population.

Upper Broken Creek is dominated by unique box streamside vegetation and remnant plains grassy woodland. The creek and its streamside zone support numerous threatened species, including brolga, Australasian bittern, buloke and ridged water-milfoil. Much of the high-quality native vegetation in the region is set aside as a natural features reserve managed by Parks Victoria. Upper Broken Creek supports a variety of native fish species, including carp gudgeon, Murray cod, river blackfish and Murray-Darling rainbowfish, as well as platypus and common long-necked turtle.

The Broken River and upper Broken Creek are listed in the Directory of Important Wetlands in Australia.

Environmental objectives in the Broken River and upper Broken Creek

	F1 – Maintain the native fish population
	**G1** – Turn over bed sediments and scour around large wood to maintain in-channel habitat diversity
	**MI1** – Maintain the diversity and abundance of waterbugs
	**PR1** – Maintain the platypus population
	**V1** – Maintain in-stream vegetation
	WQ1 – Maintain water quality

Traditional Owner cultural values and uses

The Broken River system flows through the Country of the Taungurung and the Yorta Yorta peoples. The Broken Creek is on Yorta Yorta Country. Water for the environment in the Broken system supports the health of cultural values and landscapes, including intangible cultural heritage, valued species and traditional food and medicine plants.

The Taungurung Land and Waters Council (TLaWC) and the Yorta Yorta Nation Aboriginal Corporation (YYNAC) are Broken Environmental Water Advisory Group members. Each year, the Goulburn Broken CMA discuss plans for environmental watering in the Broken River and upper Broken Creek with TlaWC and YYNAC. Both groups support the proposed watering actions.

TLaWC plans to assess cultural values and objectives for the Broken River through healthy Country assessments like Aboriginal Waterway Assessments. These will help the Council develop more specific cultural objectives for the Broken River system and culturally informed recommendations for water for the environment.

In 2021, YYNAC provided the following statement about the cultural values of the Broken River system, including Broken Creek.

> "The Broken River (and Broken Creek) holds many cultural values. Common reed contained within the slack water provides important material for tools while also providing refuge for culturally important fish species (large- and small-bodied). The river also has significant stands of old-growth river red gum containing important habitat and exhibiting scars made from carving out canoes and coolamons."

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

Social, recreational and economic values and uses

In planning the potential environmental watering actions, the Goulburn Broken CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, fishing, kayaking and swimming)
- riverside recreation (such as birdwatching, bushwalking, camping, duck hunting and picnicking)
- green and blue spaces, important for community mental and physical health and wellbeing in an otherwise dry environment
- community events and tourism (such as markets around Benalla Lake)
- socioeconomic benefits (such as maintaining the volume of water in the lower sections to optimise the efficiency of deliveries of consumptive water, maintaining the quality of water for irrigation, stock and domestic use and supporting terrestrial birds that help control agricultural pests).

Scope of environmental watering

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

Table 5.5.1 describes the potential environmental watering actions in 2024-25, 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 5.5.1 Broken River and upper Broken Creek potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Upper Broken Creek[1] – reach 1 (compliance points: Waggarandall Weir and Caseys Weir)		
Year-round low flow (5-10 ML/day)	• Maintain aquatic habitat and connections between weir pools for native fish and platypus • Inundate benthic surfaces and large wood located at the bottom of the channel, which are waterbug habitat • Maintain water quality (specifically dissolved oxygen levels) for native fish, platypus and waterbugs	 F 1  PR1  MI1  WQ1
Year-round fresh (trigger-based, of 20-50 ML/day for 10 days)[2] *Triggers:* • *low dissolved oxygen* • *low or cease-to-flow river conditions* • *high water temperatures*	• Increase the flow and flush pools to improve water quality and dissolved oxygen levels	 WQ1
Winter/spring fresh (50 ML/day for 10 days from July to November)[2]	• Increase food resources for native fish, platypus and waterbugs • Increase the flow and flush pools to improve water quality and dissolved oxygen levels • Increase longitudinal connection that provides opportunities for the downstream dispersal of juvenile platypus in early winter • Provide migration cues and longitudinal passage for native fish	 F 1  PR1  MI1  WQ1

Potential environmental watering action	Expected watering effects	Environmental objectives
Broken River[3] – reaches 1, 2 and 3 (compliance points: Back Creek Junction, Caseys Weir, Gowangardie Weir)		
Year-round low flow (15-100 ML/day)	At 15 ML/day: • Provide minimum longitudinal connection along the length of the river and habitat for native fish, aquatic plants, platypus and waterbugs • Maintain water quality and oxygen levels for native fish, platypus and waterbugs • Maintain riffles, pools and slackwater habitats for native fish, aquatic plants, platypus and waterbugs At 30-100 ML/day: • Increase habitat for in-stream and fringing vegetation and prevent terrestrial vegetation from colonising the stream bed • Enhance riffles, pools and slackwater to increase the diversity of habitat for native fish, aquatic plants, platypus and waterbugs • Improve water quality and oxygen levels	 V1 F1  PR1  MI1 WQ1
Summer/autumn fresh (one fresh of 400-500 ML/day for two to five days during December to May)	• Scour sediments around large wood, turn over bed sediments, replenish biofilms and maintain macrophyte habitat • Provide flow cues to stimulate native fish to breed and migrate • Increase food resources for native fish, platypus and waterbugs	F 1  G1  PR1  MI1

1 Potential watering actions in upper Broken Creek will be delivered at a lower magnitude if insufficient water is available to achieve the target magnitude, i.e. 1-9 ML per day.

2 The compliance point is Caseys Weir, as potential watering action targets a maximum volume that can be diverted from Caseys Weir to Broken Creek (50 ML per day) rather than a volume at Waggarandall Weir.

3 30-100 ML per day is the recommended flow required to achieve optimal habitat and water quality in the Broken River. When water availability is low, a flow may need to be delivered at 15 ML per day to provide the minimum habitat and water quality requirements to sustain populations of fish, platypus and vegetation while conserving enough water to deliver throughout the year.

Scenario planning

Table 5.5.2 outlines potential environmental watering and expected water use in various planning scenarios.

The small environmental water entitlement restricts the scope of watering actions that can be delivered in the Broken River system. The proposed actions for 2024-25 are similar to those that have been delivered in previous years.

There are two sets of watering actions: one for upper Broken Creek and another for the Broken River. Delivering a flow to upper Broken Creek is a higher priority because upper Broken Creek has no inflows from tributaries and relies more on operational water deliveries and water for the environment. The potential watering actions for upper Broken Creek require less water than those for the Broken River. Any environmental flows delivered to upper Broken Creek will pass through reaches 1 and 2 of the Broken River, where they will provide some environmental benefit.

All potential watering actions in the Broken River and upper Broken Creek are required across all planning scenarios, but there is unlikely to be enough supply to meet all demands. The expected supply is only sufficient to partially deliver summer low flows through upper Broken Creek in the drought and dry planning scenarios and fully deliver the summer low flow in upper Broken Creek in the average and wet planning scenarios. Year-round low-flow requirements for the Broken River are typically met by passing and operational flows in the average and wet planning scenarios. Delivery of the remaining potential watering actions relies on natural events and the VEWH and CEWH trading water into the system where possible. The VEWH and CEWH have traded water into the Broken system to deliver critical watering actions in 2022-23 and 2023-24, and it is expected that trade will allow some tier 1b watering actions to be delivered in average and wet planning scenarios in 2024-25.

The main environmental watering objective in upper Broken Creek is to maintain a low flow throughout the year to maintain connectivity, water quality and habitat for native fish, platypus and waterbugs. Maintaining an adequate flow is particularly important during spring and summer when native fish, platypus and waterbugs are most active and plants grow the most. Longitudinal flow connectivity may be lost in drier conditions, but baseline ecological values may be protected in weir pools. The year-round, trigger-based fresh will help prevent low dissolved oxygen events, which can result in fish deaths. The Goulburn Broken CMA will monitor water quality conditions in upper Broken Creek and seasonal forecasts and may limit water use for lows flows during low-risk periods to conserve water for additional trigger-based freshes if necessary. Upper Broken Creek no longer receives the natural high flows that provide longitudinal connectivity for fish and platypus migration, and water traded into the system may be used to deliver winter/spring freshes to restore these ecological functions in average or wet planning scenarios.

A year-round low flow (in all planning scenarios) and a summer/autumn fresh (in the average and wet planning scenarios) are needed to support the Broken River's environmental objectives. However, there is little capacity to influence these with environmental water, especially in the drought and dry planning scenarios. Any environmental water allocations in the drought or dry planning scenarios will be prioritised to deliver a flow to upper Broken Creek, and water will need to be traded into the system if a decision is made to supplement low operational deliveries and natural tributary inflows in the Broken River in these planning scenarios. In the average and wet planning scenarios, increased operational deliveries and tributary inflows will help meet the recommended year-round low flow in the Broken River, but the recommended minimum low flows may not be met in the dry or drought planning scenarios.

Carryover requirements have not been identified for the upper Broken Creek and Broken River. The preferred course is to use available water in 2024-25 and seek extra supply through trade in 2025-26, if needed, to meet essential environmental demands.

Table 5.5.2 Broken River and upper Broken Creek environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Limited or no unregulated flow in Broken River or upper Broken Creek • Low releases of operational water in Broken River • Likely low and cease-to-flow events throughout the year in all reaches	• Low, unregulated flow in Broken River • Low or no unregulated flow in upper Broken Creek • Low releases of operational water in Broken River and upper Broken Creek • Possible low and cease-to-flow events throughout the year in all reaches	• High winter/spring flow in Broken River • Increased releases of operational water in Broken River • Periods of unregulated flow in upper Broken Creek	• High winter/spring flow in Broken River • Increased releases of operational water in Broken River • Periods of unregulated flow in upper Broken Creek with some winter/spring freshes
Expected availability of water for the environment	• 187 ML	• 306 ML	• 647 ML	• 647 ML
Upper Broken Creek – reach 1				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Year-round low flows (partially delivered)			
	Tier 1b (supply deficit)			
	• Year-round low flow (remaining volume) • Year-round fresh (as required)		• Year-round low flow (remaining volume) • Year-round fresh (as required) • Winter/spring fresh	
Potential environmental watering – tier 2 (additional priorities)	• N/A			

Planning scenario	Drought	Dry	Average	Wet
Broken River – all reaches				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• N/A		• Year-round low flow	
	Tier 1b (supply deficit)			
	• Year-round low flow		• Summer/autumn fresh	
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 187 ML (tier 1a) • 3,888-5,988 ML (tier 1b)	• 306 ML (tier 1a) • 3,769-5,869 ML (tier 1b)	• 647 ML (tier 1a) • 3,900-7,254 ML (tier 1b)	• 647 ML (tier 1a) • 3,900-7,254 ML (tier 1b)
Priority carryover requirements for 2025-26	• N/A			

5.5.2 Lower Broken Creek

System overview

The lower Broken Creek system is within Yorta Yorta Country, and their cultural connection is evident throughout the landscape. The lower Broken Creek system includes the section of Broken Creek that flows from the confluence of Boosey Creek near Katamatite to the Murray River and Nine Mile Creek, which is an anabranch of lower Broken Creek that flows from the East Goulburn Main Channel to below Numurkah.

Lower Broken and Nine Mile creeks have been regulated for over a century. Before regulation, the creeks would have had most of their flow in winter/spring, then contracted to isolated pools or dried out during summer/autumn. The adjacent floodplain would have also flooded regularly. The creeks now have numerous weirs that maintain a relatively constant water level from mid-August until mid-May to support irrigated agriculture and little flow during the non-irrigation season. These modifications have changed how native species use the creek and favour invasive species (such as arrowhead). Previously, native fish would have moved into the creek when it flowed and returned to the Murray River as it dried. Both creeks now provide year-round habitat for native fish, and fish passage structures allow fish to move between weir pools. Water for the environment supports these permanent fish habitats by providing flows to trigger fish movement and support fish passage, encourage the growth of native plants, promote in-stream productivity, control water quality and flush the water fern azolla as necessary.

The irrigation channel network delivers regulated water from the Goulburn and Murray systems to lower Broken Creek. Lower Broken Creek is operated separately from upper Broken Creek and Broken River, and both are supplied from Lake Nillahcootie on the upper Broken River.

Environmental water can be provided to lower Broken Creek from the Goulburn system through the East Goulburn Main Channel and the Murray system through the Yarrawonga Main Channel. Water is released into lower Broken Creek from several irrigation regulators along its length. The main priority for environmental flows in the lower Broken Creek system is a minimum flow

throughout the year to maintain suitable habitat for native fish. Particular attention is paid to reaches 1 and 2 during the non-irrigation season when the flow can stop. The next priority is to deliver freshes in winter/spring to trigger fish movement and spawning, maintain water quality and manage azolla accumulations in reaches 3 and 4. Rices Weir is the measurement point for environmental flows in lower Broken Creek.

Operational water releases — inter-valley transfers (IVTs) from the Goulburn to the Murray or Barmah Choke bypass flows delivered to meet downstream demands — partly or wholly meet some environmental flow targets for lower Broken Creek. These operational deliveries mainly occur during peak irrigation demand between spring and autumn. Water for the environment may be used to supplement these operational releases and deliver recommended flow components not met by operational releases.

Environmental values

Lower Broken Creek and Nine Mile Creek support a diverse and abundant native fish community, including the threatened Murray cod, golden perch, silver perch, unspecked hardyhead and Murray-Darling rainbowfish.

Sections of lower Broken and Nine Mile creeks have been reserved as state parks and natural feature reserves. The associated floodplain and wetland habitats support box-dominated grassy woodland communities and numerous species of state and national conservation significance, including river swamp wallaby grass and the Australasian bittern.

Environmental objectives in the Lower Broken Creek

	F1 – Protect and increase the native fish population, including threatened Murray cod, golden perch, silver perch and small-bodied species
	**MI1** – Increase the diversity and abundance of the waterbug population
	**PR1** – Protect the platypus and rakali (water rat) populations, particularly outside the irrigation season
	**T1** – Protect the turtle population, particularly outside the irrigation season
	**V1** – Avoid the excessive build-up of azolla **V2** – Increase the cover and condition of native in-stream and littoral vegetation communities
	WQ1 – Maintain oxygen levels suitable for aquatic animals

Traditional Owner values and uses

The lower Broken Creek system is within Yorta Yorta Country, and their cultural connection is evident throughout the landscape.

Each year, the Goulburn Broken CMA meets with the Yorta Yorta Nation Aboriginal Corporation (YYNAC) representatives to discuss water for the environment in lower Broken Creek. In March 2024, a meeting was held to discuss 2024-25 environmental watering priorities.

YYNAC supports the planned environmental flows for 2024-25 in the lower Broken Creek. Flows will support in-stream vegetation and native fish, along with other aquatic plants and animals. The Goulburn Broken CMA will continue to work with the Yorta Yorta people to identify how the management of water for the environment can better support cultural values.

In 2021, the Yorta Yorta Nation Aboriginal Corporation provided the following statement about the cultural values of the Broken River system, including lower Broken Creek.

> "The Broken River (and Broken Creek) holds many cultural values. Common reed contained within the slack water provides important material for tools while also providing refuge for culturally important fish species (large and small-bodied). The creek also has significant stands of old-growth river red gum containing important habitat and exhibiting scars made from carving out canoes and coolamons."

YYNAC has raised concerns about the regulation of flows in all their waterways, which affects their Country and cultural knowledge.

YYNAC continues to pursue the Yorta Yorta people's inherent rights to water for Country. Rights to water will improve their spiritual, cultural, environmental, social and economic needs, in line with the ***Yorta Yorta Whole-Of-Country Plan 2021-2030***.

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

Social, recreational and economic values and uses

In planning the potential watering actions in **Table 5.5.3**, the Goulburn Broken CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, fishing, game hunting and kayaking)
- riverside recreation and amenity (such as aesthetic and amenity values that are particularly important for the community's mental health and wellbeing during dry periods and for passive recreation)
- community events and tourism
- socioeconomic benefits (such as consumptive water users, Goulburn-Murray Water irrigators and diverters and Goulburn Valley Water customers).

The creeks making up the lower Broken Creek system have a narrow streamside zone with residential and farming properties adjoining or overlooking them. The creek system runs through the Katamatite, Wunghnu, Numurkah and Nathalia townships. Consequently, these communities have a direct connection with their creek, which provides high aesthetic and amenity values that are particularly important to the community. The creeks are also important recreational areas, including for fishing, canoeing, kayaking and passive recreation.

> "The Broken and Nine Mile creeks are important in regards to being one of the most accessible waterways in Victoria for fishing, family picnics and camping"
>
> – Nathalia community member, 22 February 2023

The expected benefits from the delivery of water for the environment in lower Broken Creek and Nine Mile Creek in 2024-25 include benefits from winter flows which support amenity and maintain adequate depth for canoeing and fishing.

The lower Broken Creek system is the source of consumptive water for irrigation, stock and domestic uses for more than 70 diverters and urban water for Nathalia. The creek can be prone to poor water quality due to high turbidity, elevated colour and/or low dissolved oxygen events. Delivery of baseflows and freshes during the warmer months can help improve water quality for consumptive users.

Scope of environmental watering

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

Table 5.5.3 describes the potential environmental watering actions in 2024-25, 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 5.5.3 Lower Broken Creek potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Winter low flow (20-40 ML/day during May to August)	• Provide native fish with passage through fish ladders • Provide suitable foraging habitat for platypus and rakali (water rats) and support the conditioning of females in preparation for the breeding season • Provide habitat for turtles, including protection from exposure during their winter dormancy • Provide flowing-water habitat and avoid winter drying of weir pools for fish, vegetation, waterbugs, platypus and turtles • Maintain water over submerged aquatic plants so they are protected from drying and frost • Reduce the stagnation of weir pools	F1, PR1, T1, V2, MI1, WQ1
Spring/summer/ autumn low flow (70-250 ML/day in reaches 1 and 2 and 200-450 ML/day in reaches 3 and 4 during August to May)	• Provide habitat for native fish, platypus, rakali (water rats), turtles and waterbugs • Support the movement and recruitment of fish • Maintain oxygen levels in summer • Additional benefits when delivered from December to February (at 250-450 ML/day): • Mobilise azolla and increase oxygen levels during high-risk periods	F1, PR1, T1, V1, MI1, WQ1
Winter/spring fresh(es) (one to three freshes of 300-450 ML/day for one to two weeks during July to November)	• Flush and mobilise azolla if it has accumulated to maintain water quality • Trigger the movement and spawning of fish • Encourage the germination and growth of littoral and in-stream vegetation • Reduce the stagnation of weir pools to maintain water quality	F1, V1/2, WQ1

Scenario planning

Table 5.5.4 outlines potential environmental watering and expected water use in various planning scenarios.

The high degree of regulation in the lower Broken Creek system means flow patterns in the lower Broken and Nine Mile creeks are the same in all planning scenarios. Water for the environment will primarily be used in the lower Broken Creek system to guard against a reduced flow during the non-irrigation season.

Potential watering actions in all planning scenarios include maintaining a flow above 40 ML per day outside the irrigation season, ameliorating sudden fluctuations in irrigation demand during the irrigation season and delivering spring freshes to trigger fish movement or flush excessive accumulations of azolla. Delivering spring freshes in 2024-25 in all planning scenarios will be of particular importance to trigger the movement and spawning of native fish in the system and help the fish community recover from extensive flooding and associated hypoxic blackwater events that caused widespread fish deaths in

the lower Broken Creek and many parts of the southern connected basin. Low flows and freshes throughout the year will also support native fish, which are being restocked as part of a recovery project.

The Goulburn Broken CMA will monitor water quality throughout the year, and it may ask to increase the flow to the upper end of the recommended range in **Table 5.5.3** if dissolved oxygen levels drop below 4.0 mg/L. The total volume of water for the environment that will be needed to achieve planned watering actions in 2024-25 will vary depending on operational deliveries (including IVTs) and the size and duration of any unregulated flow events. A carryover target of 5,000 ML applies in all climate scenarios to ensure a minimum low flow and a small fresh can be delivered early in 2025-26.

Table 5.5.4 Lower Broken Creek environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• No unregulated flow	• Some unregulated flow in winter • No unregulated flow throughout the irrigation season (mid-August to May) • No diversion of unregulated Murray River flow is available	• Unregulated flow in winter/spring • Unregulated flow is unlikely from October to May • Diversion of unregulated Murray River flow is available from mid-August to October	• Unregulated flow is likely in winter/spring • Unregulated flow is possible from November to May • Diversion of unregulated Murray River flow available from mid-August to November
Lower Broken Creek (targeting reach 4)				
Potential environmental watering – tier 1 (high priorities)[1]	• Winter low flow • Spring/summer/autumn low flow • Winter/spring freshes			
Possible volume of water for the environment required to achieve objectives	• 80,000 ML			
Priority carryover requirements for 2025-26	• 5,000 ML			

1 Tier 1 potential environmental watering for lower Broken Creek is not classified as tier 1a or 1b because the water available for use is shared across various systems, and it is not possible to reliably determine the supply specifically available for lower Broken Creek.

5.5.3 Broken wetlands

System overview

Of some 3,600 natural wetlands in the Goulburn Broken region, only three in the Broken catchment have infrastructure that allows them to receive environmental water: Black Swamp, Kinnairds Wetland and Moodie Swamp.

All three wetlands are on the Country of the Yorta Yorta People. Their knowledge and practice are evident throughout the landscape; for example, Black and Moodie Swamps have evidence of old cooking mounds around their perimeter. Kinnairds Wetland and Black Swamp are red gum swamps near Numurkah. Moodie Swamp is a cane grass wetland adjacent to upper Broken Creek at Waggarandall that provides excellent breeding habitat for brolga.

The water regimes of these wetlands are influenced by their position in the landscape. The development and operation of the Shepparton and Murray Valley irrigation districts have changed the natural flow paths and the timing, frequency, volume and duration of natural flooding to these and other wetlands in the region. The existing irrigation system infrastructure enables water for the environment to be delivered to the three wetlands, but under existing agreements, irrigation deliveries have priority within the channel system. This limits the volume of water that can be delivered to the wetlands. The VEWH, waterway managers and storage managers adjust the timing and rate of environmental deliveries where possible to optimise environmental outcomes within the current system constraints.

Environmental values

Moodie Swamp, Kinnairds Wetland and Black Swamp support diverse vegetation communities ranging from river red gum to cane grass. The wetlands contain state and nationally threatened vegetation communities and species, including ridgid water-milfoil and river swamp wallaby grass. The wetlands also provide food resources and breeding habitat for bird species of high conservation significance, including eastern great egret, Latham's snipe, white-bellied sea eagle, Australasian bittern, brolga, royal spoonbill, yellow-billed spoonbill, Australasian shoveler and glossy ibis. Many of these species are listed in international agreements and conventions. Moodie Swamp also supports Sloane's froglet, listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Environmental objectives in the Broken wetlands

	A1 – Provide breeding habitat for frogs
	**CN1** – Restore carbon and nutrient cycling within the wetlands to increase ecosystem productivity
	**V1** – Improve the cover, diversity, recruitment/regeneration and growth of native wetland plant species, consistent with ecological vegetation class benchmarks **V2** – Reduce the cover and diversity of exotic plant species **V3** – Maintain populations of ridged water-milfoil **V4** – Maintain populations of river swamp wallaby grass
	**B1** – Provide breeding habitat for waterbirds **B2** – Provide feeding and roosting habitat for waterbirds

Traditional Owner cultural values and uses

Moodie Swamp, Kinnairds Wetland and Black Swamp support various native plants and animals that provide many cultural values and uses for the Yorta Yorta People. Black Swamp and Kinnairds Wetland support multiple varieties of nardoo (a food source), native grasses (such as old man weed, which has medicinal uses) and sedges and rushes (used for basket weaving). Basket weaving sedges also grow at Moodie Swamp.

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

Social, recreational and economic values and uses

When planning potential environmental watering actions, the Goulburn Broken CMA considers how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing)
- riverside recreation and amenity (such as birdwatching, camping, picnicking, photography, walking and hunting)
- community events and tourism (such as community gatherings at Kinnairds Wetland and the Walk and Squawk event)
- socioeconomic benefits (such as tourism, which greatly contributes to the local economy).

Scope of environmental watering

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

Table 5.5.5 describes the potential environmental watering actions in 2024-25, 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. No active deliveries of water for the environment are planned for the Broken wetlands in 2024-25 because they need to draw down to support dry-phase ecological processes required to achieve long-term environmental objectives at each site.

Table 5.5.5 Broken wetlands system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
• No deliveries of water for the environment are planned in 2024-25		

Scenario planning

Table 5.5.6 outlines potential environmental watering and expected water use in various planning scenarios.

Black Swamp, Kinnairds Wetland and Moodie Swamp rely on a mix of wetting and drying cycles to support their environmental values. The Broken River catchment has flooded three times since spring 2020, and as a result, Black Swamp, Kinnairds Wetland and Moodie Swamp have all exceeded their optimal wet-phase duration. Moodie Swamp has held water continuously since August 2021, and as a result, some of the cane grass and aquatic herbs are being replaced by a thick carpet of upright water-milfoil. This change in vegetation community composition is a natural response to the prolonged inundation. No environmental watering is planned at any of the Broken wetlands during 2024-25 to allow them to draw down and support dry-phase ecological processes. The planned drying aims to restore the intended mix of vegetation communities at Moodie Swamp and prevent changes in the Black Swamp and Kinnairds Wetland vegetation communities. The wetlands are expected to provide foraging habitat for various waterbirds as they draw down, and the drying sediments will facilitate carbon and nutrient cycling processes.

The wetlands are expected to draw down effectively in the drought-to-average planning scenarios, but natural floods in the wet planning scenario may top them up again. If the wetlands draw down during 2024-25, it is recommended that Kinnairds Wetland and Black Swamp remain dry until spring 2025 and Moodie Swamp remains dry for six to nine months before it is refilled.

Table 5.5.6 Broken wetlands system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Catchment run-off and natural flow into the wetlands are highly unlikely	• Catchment run-off and natural flow into the wetlands are unlikely	• Some catchment run-off and natural flow into some of the wetlands are likely, particularly in winter/spring	• Catchment run-off and natural flow into the wetlands may significantly contribute to water levels in the wetlands, particularly in winter/spring
Potential environmental watering – tier 1 (high priorities)	• N/A: No deliveries of water for the environment are planned in 2024-25			
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• N/A			
Priority carryover requirements for 2025-26	• N/A			

5.6 Campaspe system

Waterway manager – North Central Catchment Management Authority

Storage manager – Goulburn-Murray Water

Environmental water holders – Victorian Environmental Water Holder (including the Living Murray program) and the Commonwealth Environmental Water Holder

The Campaspe system includes the Campaspe and Coliban rivers.

5.6.1 Campaspe River

System overview

Natural inflows in the upper Campaspe River catchment are harvested into Lake Eppalock, located near the townships of Axedale and Heathcote. The main tributaries of the Campaspe River are the Coliban River, McIvor and Wild Duck creeks above Lake Eppalock and Mount Pleasant, Forest and Axe creeks below Lake Eppalock (Figure 5.6.1).

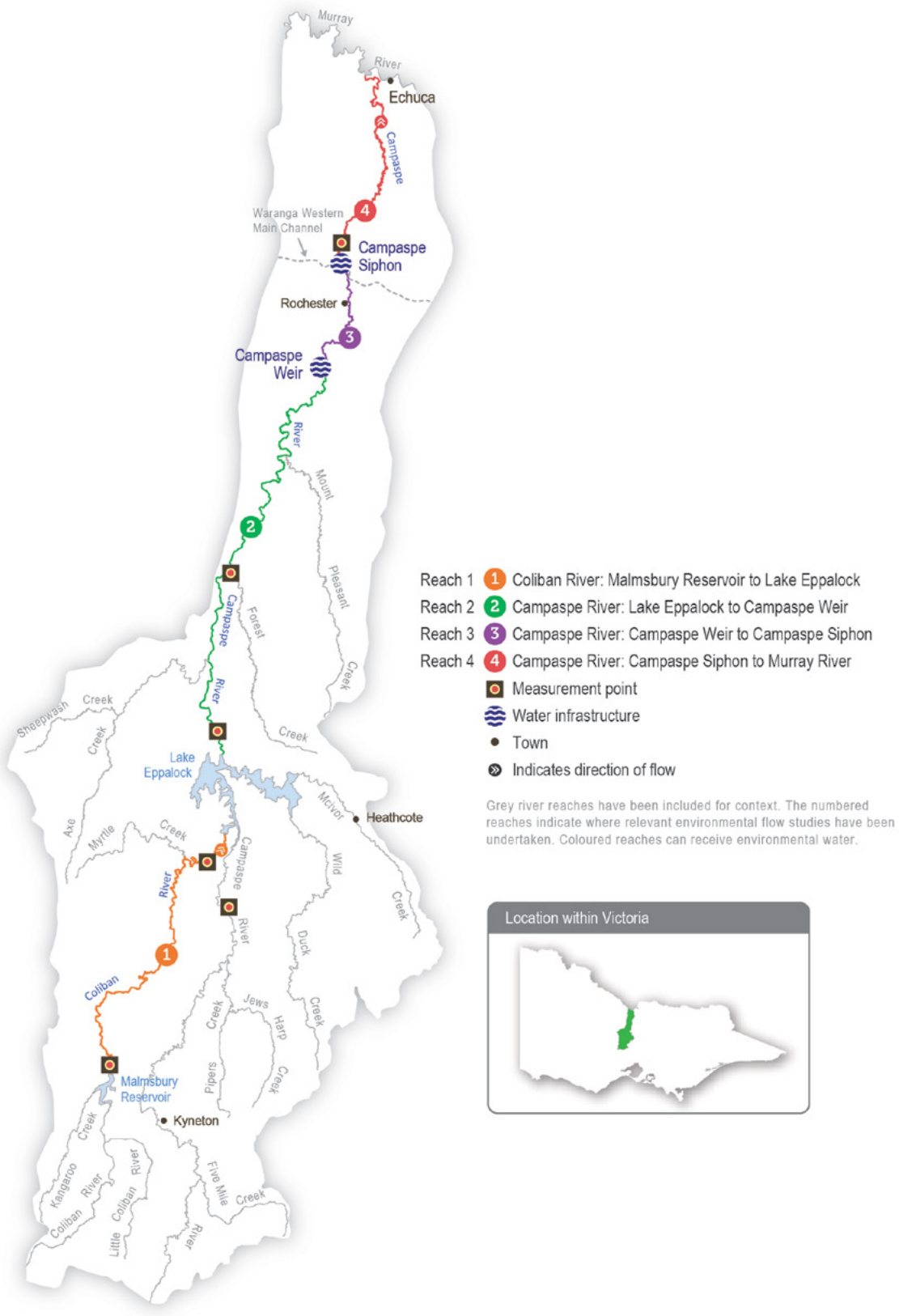
Below Lake Eppalock, the major in-stream structure is the Campaspe Weir, built to divert water to the Campaspe Irrigation District. It is no longer used for water diversion but is a barrier to fish migration. Gates on the weir provide some degree of control over the flow, but large flows spill over the weir. The Campaspe Siphon, just below Rochester, is part of the Waranga Western Channel, which carries water from the Goulburn system to western Victoria. Water can be released from the Waranga Western Channel into the lower reaches of the Campaspe River, or water can be pumped from the river into the Waranga Western Channel. The siphon is another barrier to fish migration when there is low-to-moderate flow.

The flow below Lake Eppalock is influenced mainly by releases from storage and the operation of the Campaspe Weir and the Campaspe Siphon. The Campaspe's major tributary (the Coliban River) flows through the three Coliban Water storages (the Upper Coliban, Lauriston and Malmsbury reservoirs) before reaching Lake Eppalock. Water for the environment is held and released from Lake Eppalock, with some limited ability to regulate the flow further downstream at the Campaspe Weir.

Water for the environment is released from Lake Eppalock to support aquatic plants and animals in and along the Campaspe River. It can be supplemented by water for the environment delivered via the Waranga Western Channel at the Campaspe Siphon, which provides flexibility to meet environmental demands in reach 4. Water for the environment is primarily used in the Campaspe River to improve the magnitude and variability of flow during winter and spring, but it is also used to deliver a critical flow in summer and autumn that is not met or exceeded by operational deliveries. Primary flow measurement points are at Barnadown (reach 2) and below the Campaspe Siphon (reach 4).

Goulburn-Murray Water transfers operational water from Lake Eppalock or through the Waranga Western Channel to Murray River customers and downstream storages (such as Lake Victoria). These inter-valley transfers (IVTs) usually occur in summer and autumn and, depending on the rate of delivery, can either support or compromise environmental flow objectives. High IVT flows delivered when the Campaspe River would naturally have a low flow may reduce suitable habitat for juvenile fish, which rely on protected, shallow areas of water near the edge of the river channel. Sustained high IVT flows in summer can also drown recruiting streamside vegetation. Storage managers and the North Central CMA have been working cooperatively to enhance the positive effects and limit the harmful effects of IVTs on native plants and animals in the Campaspe River. For example, IVTs are sometimes delivered in a pattern that meets summer low-flow and fresh requirements, reducing demand on the environmental entitlement. IVTs have also been released in a pattern to support native fish migration from the Murray River into reach 4 of the Campaspe River without affecting delivery to downstream users.

Figure 5.6.1 The Campaspe system



Environmental values

The Campaspe River below Lake Eppalock provides essential habitat for native fish species, including Murray cod, silver perch, golden perch, Murray-Darling rainbowfish and flat-headed gudgeon. Murray-Darling rainbowfish were presumed lost from the system during the Millennium Drought, but since 2011 they have been recorded at many sites on the Campaspe River. Environmental flows help native fish migrate and disperse throughout the Campaspe system.

Platypus, rakali (water rats), turtles and frogs are also present along the length of the Campaspe River. The narrow streamside vegetation zone is dominated by large, mature river red gum trees supporting wildlife (such as the swift parrot and squirrel glider).

Environmental objectives in the Campaspe system

	F1 – Protect and increase the native fish population **F2** – Facilitate recolonisation by native fish species (including trout, cod and blackfish) that have been presumed lost
	**MI1** – Increase the diversity and biomass of waterbugs
	**PR1** – Protect the platypus population
	**V1** – Maintain adult river red gums and increase the recruitment of immature trees **V2** – Maintain the extent and increase the diversity of streamside vegetation **V3** – Increase the extent of in-stream aquatic plants
	WQ1 – Maintain water quality in deep pools and prevent stratification in summer **WQ2** – Reduce the risk of low-oxygen blackwater events in summer

Traditional Owner cultural values and uses

Djaara, Taungurung and Yorta Yorta Nations are the First Peoples of the Campaspe River, and we acknowledge their rights to practice their culture and identity as Traditional Owners, to maintain their relationship with the river and natural resources on or depending on their land and to protect places and areas of importance on their land. The Traditional Owners have rights as the primary guardians, keepers and knowledge holders of Aboriginal cultural heritage and knowledge.

In planning for environmental flows in the Campaspe River in 2024-25, the North Central CMA met with the Dja Dja Wurrung Clans Aboriginal Corporation (DJAARA) and the Taungurung Land and Waters Council (TLaWC) to discuss how cultural objectives can be supported by water for the environment and the importance of Traditional Owner involvement in the management of water on Country.

To enhance Traditional Owner engagement, DJAARA hosted a North Central CMA environmental water officer to work from the DJAARA office one day a week while developing the seasonal watering proposal. The purpose was to work with DJAARA to gain input into the Campaspe River's and other systems' seasonal watering proposals for 2024-25 and allow for exchanging information between both organisations.

This exchange provided further insight for DJAARA as to how environmental water is delivered on Djandak (Dja Dja Wurrung Country) and highlighted the need for DJAARA to be enabled to employ environmental water officers to participate meaningfully in the delivery of environmental water on Djandak (Dja Dja Wurrung Country) and incorporate their traditional ecological knowledge.

The VEWH supports the realisation of DJAARA's objectives for water on Country as expressed in *Dhelkuyna Dja: Dja Dja Wurrung Country Plan 2014-2034* and *Dhelkunyangu Gatjin, the DJAARA Gatjin Strategy*, which means 'working together to heal water.'

TLaWC discussed the proposed watering actions with the Taungurung water knowledge group Baan Ganalina (Guardians of Water) in early 2023. This was informed by earlier discussions between the North Central CMA and Baan Ganalina in 2023 and ongoing biocultural monitoring and assessments at seven sites on the Campaspe River by TLaWC as part of its Reading Water Country program during the previous year.

The Djaara and Taungurung Nations' values and uses of the Campaspe River and how these have been considered in developing the 2024-25 Campaspe seasonal watering proposal are summarised below.

Djaara

Dhelkunya Dja: Dja Dja Wurrung Country Plan 2014-2034 describes the Djaara peoples' aspirations for the management of rivers and waterways and articulates the Djaara's support for reinstating environmental flows as an overall objective for the management of water on Country.

> "Traditional Aboriginal culture revolved around relationships to the land and water — relationships that hold deep physical, social, environmental, spiritual and cultural significance. Today, the land and its waterways remain central to our cultural identity and aspirations for community and economic development. Our rivers are the veins of Country, and provide food and medicine, and places to camp, hunt, fish, swim and hold ceremonies. They are places that are central to our creation stories, and many of our cultural heritage sites are associated with waterways — burial sites, birthing sites and middens. Our waterways are places that we connect with our ancestors and pass traditional knowledge on to our children and grandchildren."
>
> ***– Dhelkunya Dja: Dja Dja Wurrung Country Plan 2014-2034***

Initial capture and articulation of cultural values has been completed by DJAARA through conducting an Aboriginal Waterways Assessment (AWA) on the Campaspe River in 2019. While not able to meaningfully inform the Seasonal Watering Plan for 2024-25, the AWA sets the foundation for a future Cultural Water Management Plan (CWMP) that would set the objectives and watering actions to maintain cultural values and uses for DJAARA. The CWMP would be a holistic management plan for the waterway that considers environmental objectives among other socioeconomic and cultural values. DJAARA's right to participation and incorporation of traditional ecological knowledge into natural resource management would be in part enabled.

Collaboration between the North Central CMA, DJAARA and the Djaara people is guided by the 2016 Dja Dja Wurrung Clans Aboriginal Corporation and North Central Catchment Management Authority Engagement Framework, the Kapa Gatjin (We speak water) North Central CMA Seasonal Watering Proposal Engagement Framework and input from Kapa Gatjin (Dja Dja Wurrung water knowledge group).

Currently DJAARA does not have a role in environmental water planning and approvals that would enable DJAARA to have agency to influence environment water deliveries to Djandak to support and maintain their cultural values. DJAARA does not currently have sufficient funding allocations through the north central catchment environmental water flows program to collaborate on environmental water deliveries.

Cultural objectives for the Campaspe River developed in 2019-20 emphasise the importance of native fish, turtles, medicine plants and pest control. DJAARA expects to be respected and involved in environmental water management. Cultural and environmental objectives may align, but they are independent and must be defined, monitored and reported independently. The North Central CMA will work with Kapa Gatjin, and funding sources will need to be found, to enable DJAARA to complete a CWMP with comprehensive participation from the DJAARA membership and to enable Kapa Gatjin members to undertake monitoring to track progress in achieving their cultural values.

Table 5.6.1 Kapa Gatjin objectives and values, Campaspe River

Cultural objective	Cultural values and hydrological objectives	Concerns	Indicator	Measure	Watering/ management action	Potential watering action (where applicable)
Cultural heritage (intangible)	• Increase knowledge of site-specific water management advice	• Gaps between traditional knowledge and land/water management	• Stronger relationships and communication between Traditional Owners, landowners and North Central CMA		• On-site cultural tours	
Cultural heritage (tangible)	• Protection of culturally significant artefacts (e.g. scar trees)	• Many sites are unrecorded				• Ramp up and down rates to minimise the risk of erosion and bank slumping
Plants	• Promote the growth of traditional food, fibre and medicine plants (e.g. water ribbons, water pepper, old man weed, native thistles)	• Lack of native biodiversity and culturally significant vegetation	• Improved water quality • More abundant native species • Improved bank stability	• Plant surveys • Photo points	• Make water available during seed dispersal seasons	• Summer freshes and a winter high flow to wet margins of the riverbank to promote in-stream and fringing vegetation
	• Improve water quality and bank stability	• Bank erosion • Habitat destruction • Loss of cultural artefacts	• Decrease in bank erosion rate • More plants growing on the water's edge	• Water quality testing	• Implement flood management	• Flow variability

Cultural objective	Cultural values and hydrological objectives	Concerns	Indicator	Measure	Watering/ management action	Potential watering action (where applicable)
Wildlife	• Improve vegetation and pest management to prevent the encroachment of terrestrial weeds	• Lack of native biodiversity	• Absence of weeds • Increased abundance of (locally) native plants	• Plant surveys • Photo points	• Physical and/ or chemical removal of weeds, streamside burning • Environmental flow that helps re-establish native grasses (exclusion plots)	• Winter high flow to prevent terrestrial vegetation establishing on the lower bank
	• Improve native fish populations	• Water high and low flows deliveries may not be timed with other natural breeding cues	• Recruitment of native plants and animals	• Plant and animal surveys • Photo points • Fish tagging	• Ensuring the delivery of flows is timed with other natural breeding cues	• All flow variability

Author - Voytek Lapinski, Taungurung Land and Waters Council (TLaWC)

On 4-5 September 2019, the North Central CMA met with the Taungurung water knowledge group, Baan Ganalina for a two-day field tour of the Campaspe River and a workshop to identify biocultural values and express Taungurung objectives for healing and caring for the Campaspe River in line with cultural obligations and priorities.

In line with values and objectives identified by knowledge holders during this process and building on the ecological and cultural assessment undertaken on the Campaspe in 2019 in collaboration with Dja Dja Wurrung, commencing in 2022, Biik crew members have monitored seven sites on the river monthly to maintain connection to Country and help collect biocultural knowledge. This knowledge has been synthesised through ongoing discussions with Baan Ganalina to develop the cultural objectives in this section.

Baan Ganalina has highlighted the importance of native animals, including fish, frogs, platypus, waterbirds, mussels and crustaceans, and identified the importance of overstorey, mid-layer and aquatic vegetation in creating healthy habitat. The group has emphasised the principle of 'right way water' (right time, right place, right amount) to ensure the river's flow is at varying and seasonally appropriate levels and the importance of reconnecting backwaters, maintaining water quality and preventing flows that might erode or damage cultural sites. The group also emphasised the need for their ongoing involvement in water management decisions so cultural values and objectives are incorporated appropriately.

TLaWC has identified that this method of ongoing engagement is needed so objectives identified in the initial cultural waterway assessment process can be built upon in subsequent years through an iterative refinement process in response to cultural direction and priorities. This requires regular assessments of the river as well as necessary funding.

The following is not a complete picture of Taungurung knowledge, values and objectives regarding the Campaspe River. Funding is required to enable Baan Ganalina and Biik crew members to monitor the ongoing health of Country. The North Central CMA continues to work with TLaWC and Baan Ganalina to support the assessment and monitoring of biocultural values on the Campaspe River.

Baan Ganalina cultural objectives for the Campaspe River, 2023

The health of Country is central to all Taungurung objectives for the Campaspe River. Taungurung have an obligation to care for the river and know that the health of the Taungurung community and its Country are connected and interdependent. Objectives for environmental flow management, streamside works and other management activities on the river should not be considered in isolation. They must always recognise this interconnectedness and the central role of Traditional Owners in speaking for Country.

Baan Ganalina has prioritised the following aspects of the broader health of Country as objectives for 2024-25.

- Taungurung are better able to meet their cultural obligation to care for the river and actively manage land and water through increased activation of rights and building capacity.
- Taungurung's obligation to care for the Campaspe includes obligations to other Nations who share the river. The Campaspe is a meeting place with Djaara and connects the two Nations. Reading and healing Country activities need to recognise and support this important relationship.
- Healthy water and healthy flows. Water on Country is 'right way water': at the right times, at the right places and in the right amounts. This includes:
  - maintaining and improving water quality
  - the river flowing at varying seasonally appropriate levels: environmental water releases should mimic natural flow regimes and respond to/top up natural flow events
  - the flow regime supporting fish habits, maintaining water quality and supporting the abundance and diversity of native species and wildlife, as set out below.
- Native species diversity and abundance:
  - overstorey trees: support the health of existing red gums and encourage recruitment
  - establish a healthy mid-storey and understorey where they are absent
  - maintain and improve aquatic vegetation; water ribbons and juncus (rushes) are key food and fibre plants, respectively, and good indicators of the health of Country

- Wildlife diversity and abundance:
  - promote healthy breeding frog populations and provide cues for frog breeding
  - maintain or improve mussel and crustacean populations
  - maintain or improve platypus populations and provide cues for platypus breeding
  - maintain or improve waterbird populations
  - improve native fish populations, provide cues for fish breeding and ensure fish can move.
- The backwaters are an essential part of the Campaspe, and maintaining their health and connection to the river is vital for its health.
- Supporting food sources is essential. There are many food plants on the Campaspe (such as water ribbons), which should be supported.
- Improve community ties to the river through ongoing reading Country activities, support camping by the river and access to and availability of food species.
- Officially record culturally significant sites and artefacts. Maintain and protect cultural sites.

Kapa Gatjin and Baan Ganalina advisory groups' joint 2019 Campaspe River Aboriginal Waterway Assessment

The Kapa Gatjin advisory group and the Taungurung Baan Ganalina advisory group completed a joint Aboriginal Water Assessment along the Campaspe River in November 2019.

Table 5.6.2 summarises the cultural aspirations and values and uses the assessment identified. Djaara emphasises that it is impossible to include all their cultural water aspirations, uses, values and places of cultural importance in one document. Djaara's values are diverse and complex and can widely differ between family and clan groups. Djaara's interests and beliefs are multifaceted and cannot be defined through a single standpoint or response, and this summary of values and uses is not sufficient to inform environmental flow deliveries. A Cultural Water Management Plan is required as the next step.

Table 5.6.2 Traditional Owner values and uses, Campaspe River

Traditional Owner group	Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
Kapa Gatjin and Baan Ganalina	• Protect culturally significant sites (such as scar trees).	• Water for the environment deliveries will include ramp-up and ramp-down rates at the lower end of the environmental flow recommendations to minimise erosion risk and bank slumping. • More work is required to locate and document cultural assets that may be affected by river flows.
Baan Ganalina	• The flow regime reflects the principle of 'right way water'. Environmental water releases should mimic natural flow regimes and respond to/top up natural flow events. Backwaters are connected to maintain the health of the river.	• Environmental water deliveries, where feasible, should be delivered consistent with antecedent conditions and seasonality, respectful of natural cycles and the needs of Country. Winter and spring high and low flows should reflect the climatic conditions at the time of delivery: lower in dry years and greater in average to above-average rainfall years. Summer freshes and winter high-flow events should be delivered to coincide with forecast rainfall events if possible.
Kapa Gatjin	• Promote the growth of traditional food, fibre and medicine plants (such as water ribbons, water pepper and juncus).	• Environmental water deliveries will include summer/autumn freshes and winter/spring high flows to wet riverbank margins to promote in-stream and fringing vegetation.

Traditional Owner group	Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
Baan Ganalina	• Maintain or improve the diversity, abundance and health of native vegetation assessed using indicator species (such as water ribbon for food and juncus for fibre) to assess the overall health of Country.	• Environmental water deliveries will include summer/autumn freshes and winter/spring high flows to wet riverbank margins to promote bank, in-stream and fringing vegetation.
Kapa Gatjin	• Improve vegetation and prevent the encroachment of terrestrial weeds.	• Ensure winter/spring high flows to prevent terrestrial vegetation establishing on the lower bank.
Kapa Gatjin and Baan Ganalina	• Healthy water, improved water quality.	• Delivery of the recommended flow regime will lead to improved water quality. • Delivery of a winter/spring high flow will reduce the risk of a blackwater event in summer.
Kapa Gatjin and Baan Ganalina	• Improve native fish populations.	• Some environmental water deliveries will protect and improve native fish populations (such as summer/autumn freshes for large-bodied fish movement and steady spring flows to prevent Murray cod abandoning their nests).
Baan Ganalina and Yorta Yorta	• Maintain and improve platypus populations.	• Connect the low flow for movement, summer/autumn fresh in April reduces predation during juvenile dispersal. • A winter/spring low flow allows male platypus to move long distances during the breeding season, and the timing of a spring high flow prevents burrows from being inundated during the breeding season.

Yorta Yorta First Nations People

Yorta Yorta have raised concerns in the past about the impacts of gold mining and groundwater extraction on river flows in the Campaspe Valley. Yorta Yorta support flows that will mitigate the impacts of consumptive water delivery in summer and provide conditions to improve habitat for platypus breeding.

The Yorta Yorta Nation Aboriginal Corporation continues to pursue the Yorta Yorta People's inherent rights to water for Country. Rights to water will address their spiritual, cultural, environmental, social and economic needs, in line with the ***Yorta Yorta Whole-Of-Country Plan 2021-2030***. Yorta Yorta values encompass an inherent and living connection to land (*woka*), water (*wala*) and caring for Country. Examples of Yorta Yorta cultural values and uses that are supported through deliveries of water for the environment include:

- maintaining refuges that protect turtles, an important totemic species for the Yorta Yorta People
- watering to support vegetation, which includes food, fibre and medicinal plants
- improving the health of river red gums, which has benefits for important Yorta Yorta sites and significant markings (such as a scar tree) and furthers connections to Country
- restoring the environment to achieve healthy Country.

Increasing the involvement of Traditional Owners in managing environmental flows and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH

and its program partners. This is reinforced by legislation and policy commitments, including the *Water Act 1989*, the ***Victorian Aboriginal Affairs Framework***, the 2016 ***Water for Victoria***, the 2022 ***Water is Life: Traditional Owner Access to Water Roadmap***, and, in some cases, agreements under the *Traditional Owner Settlement Act 2010*.

Social, recreational and economic values and uses

Consistent with *Water for Victoria* and the Victorian *Water Act 1989*, CMAs consider shared benefits in environmental water planning and delivery. Shared benefits may be intrinsic or secondary opportunistic benefits, including economic, social, indigenous cultural, recreational and environmental benefits from storing, delivering or using water.

The Campaspe River provides diverse social, recreational and economic values, which **Table 5.6.3** shows. Recreation and tourism activities include camping, fishing, water sports, birdwatching and duck hunting. These activities directly benefit the local economy and economies in the wider region. One shared benefit identified by the 2016-2024 Victoria Environmental Flow Monitoring and Assessment program is the increased breeding and abundance of native fish in the Campaspe River. This ecological benefit also achieves social, recreational, economic and cultural objectives.

Although they are not measured, the river likely provides indirect economic benefits through ecosystem services (such as groundwater recharge and carbon storage). The delivery of environmental water aims to support shared economic, social and cultural benefits as long as they do not compromise the environmental objectives of watering or impose extra demands on the Environmental Water Reserve: that is, require additional environmental water.

In planning the potential environmental watering actions in **Table 5.6.4**, the North Central CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, kayaking, fishing and water sports)
- riverside recreation and amenity (such as birdwatching, bushwalking, camping, cycling, duck hunting and picnicking)
- community events and tourism (such as visitors travelling to canoe and kayak on the river)
- socioeconomic benefits (such as diversions for irrigation, domestic and stock uses; local and regional economic benefits from increased visitation; ecosystem services such as carbon storage, groundwater recharge and water quality regulation; lower salinity management costs, lower blackwater and blue-green algae risks for landholders, and contributions to community enjoyment, health and recuperation).

Planned environmental flows may be modified to align with a community benefit so long as environmental outcomes are not compromised. There are many places along the Campaspe River where visitors like to camp. Aysons Reserve is a popular camping site near Elmore, and it draws hundreds of campers during school holidays. Where possible, freshes are delivered outside peak visitation periods (such as the March and April long weekends) to ensure the flow is not too high for campers and water-related activities.

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

Table 5.6.3 Social, recreational and economic shared benefits, Campaspe River

Waterway	Beneficiary	Connection to river	Values, uses, objectives & opportunities	How have these benefits been considered?
Campaspe River	• VRFish • Recreational fishers	• Anglers have a close connection, and interest in maintaining the river's health	• Flows associated with the movement or dispersal of fish benefit recreational fishers by encouraging fish to move through the system to promote a healthy fish population providing anglers with recreational opportunities	• Summer/autumn low flows and freshes • Winter/spring low and high flows
	• Domestic, stock and agricultural diverters • Recreational users • Traditional Owners	• Diverters along the river rely on environmental water to ensure they have useable water for domestic and agricultural business uses and that the river can support recreational activities	• Many potential watering actions target water quality. Low flows and freshes improve water quality for diverters to benefit their households	• Summer/autumn low flows and freshes in reach 4 help provide water with lower salinity for diverters • Winter/spring high flows reduce the risk of toxic blackwater in summer, which unregulated and operational flows can trigger
Campaspe River reaches 3 and 4	• Powered and unpowered boat users	• Rochester Weir (reach 3) and the Campaspe Weir Pool (reach 2) are popular locations for water-based recreational uses, including fishing and boating. Environmental water helps maintain water quality and water levels within the weirs and promotes a healthy riverine environment	• Environmental water increases the river's flow and improves water quality for canoeing, a popular activity along the river	• Summer/autumn low flows and freshes, which help provide lower-salinity water for diverters. • Winter/spring low and high flows

Waterway	Beneficiary	Connection to river	Values, uses, objectives & opportunities	How have these benefits been considered?
Campaspe River reach 2	• Unpowered boat users	• Canoeists want the river's health, flow and aesthetic values maintained	• Canoeing and kayaking are popular along the river, particularly at Rocky Crossing. Kayakers are notified of high river flows and schedule kayaking trips on the high flows	• Winter/spring low flows and freshes
Campaspe River reaches 2-4	• Campers	• Campers want the river's health, flow and aesthetic values maintained	• Aysons's Reserve camping site near Elmore draws hundreds of campers during the summer school holiday period. Other sites include Doaks Reserve, Runnymede Nature Reserve, Bryant's Lane, and Spencer Road Reserve. Campers enjoy healthy, flowing waterways with good water quality from environmental water	• All potential watering actions
Campaspe River reaches 2-4	• Passive recreation	• Bushwalkers and cyclists want the river's health, flow and aesthetic values maintained	• Many local councils provide picnic facilities and walking and cycling tracks that provide opportunities for passive recreation. The river is a vital feature of these opportunities and contributes to the wellbeing of the community, visitors and local economy	• All potential watering actions

Scope of environmental watering

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

Table 5.6.4 describes the potential environmental watering actions in 2024-25, 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 5.6.4 Campaspe system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Campaspe River (targeting reach 4)		
Winter/spring low flow (40-200 ML/ day during June to November)	• Maintain longitudinal connectivity to allow native fish to disperse within reaches • Provide foraging opportunities across a wide range of habitats for female platypus to develop fat reserves before breeding • Maintain water quality by preventing pools from stratifying • Discourage terrestrial plants from colonising the lower sections of the riverbank and low benches in the channel • Maintain soil moisture in the riverbank to water established river red gums and woody shrubs • Help establish littoral vegetation[1] • Provide a variety and large abundance of habitats for high macroinvertebrate productivity supporting food webs • A greater-volume flow will facilitate: – long-distance movement by male platypus, especially in the August to October breeding season – greater movement of large-bodied native fish	 F1  MI1  PR1  V2  WQ1

Potential environmental watering action	Expected watering effects	Environmental objectives
Winter/spring fresh(es) (one to two freshes 1,000-1,600 ML/day for two to five days during July to November)	• Enable plants growing on the water's edge to become established low on the bank and limit colonisation by terrestrial plant species • Provide sufficient velocity to scour accumulated sediment from pools and scour biofilms • Promote the local movement of adult fish to access alternative habitats and trigger mitigation from the Murray River • Flush accumulated leaf litter from the banks and low benches to reduce the risk of blackwater events during high river flow in summer • Maintain soil moisture for established river red gum and woody shrubs (such as bottlebrush and tea tree) • Maintain connectivity to allow native fish to move and access new habitat • Encourage female platypus to select nesting burrows higher up the bank to reduce the risk of a high flow later in the year flooding burrows when juveniles are present	F1, F2 MI1 PR1 V1, V2 WQ2
Summer/autumn low flow (40-60 ML/day[2] at the Campaspe Siphon during December to May)	• Maintain slackwater habitats for zooplankton and nursery habitats for native fish • Maintain the water depth and prevent stratification in deep pools in summer to maintain habitat for native fish and platypus • Help establish in-stream and littoral vegetation • Inundate a variety of habitats to facilitate the growth of biofilms and support waterbug productivity • Allow platypus to move between pools safely while foraging, and ensure there is adequate food for lactating females • Reducing flow to 20 ML/day in reaches 2 and 3 in autumn will expose mudflats and encourage the recruitment of some fringing vegetation	F1 MI1 PR1 V2, V3 WQ1
Summer/autumn freshes (three freshes of 100-200 ML/day for two to four days during December to May)	• Promote the germination, growth and survival of fringing emergent macrophytes, including phragmites, reeds and sedges, by inundating the lower banks and low benches to wet the soil • Promote the local movement of adult fish to access alternative habitats and trigger migration from the Murray River • Increase longitudinal connectivity to allow native fish to access new habitats • Wet submerged wood and flush fine silt and old biofilms to promote new biofilm growth and increase waterbug productivity for native fish and platypus • Facilitate the downstream dispersal of juvenile platypus in April/May to colonise other habitat areas	F1 MI1 PR1 V2 WQ1

Potential environmental watering action	Expected watering effects	Environmental objectives
Year-round fresh (trigger-based, 50-300 ML/day as required) *Triggers:* • *oxygen level below 5 mg/L* • *low or cease-to-flow river conditions* • *high water temperatures*	• Destratify pools and improve water quality (increase oxygen levels) along the river in reach 4, ensuring there is adequate oxygen to support aquatic animals (such as native fish and platypus)	 **WQ1**

1 A greater-magnitude flow rate will wet a larger perimeter of the riverbank, supporting increased littoral vegetation.

2 The reach 4 flow will target 40-60 ML per day. However, reducing the flow to 20-30 ML per day at reaches 2 and 3 may be considered in autumn to expose the river's mudflats and promote native vegetation recruitment. To achieve these two flow rate targets, water for the environment from the Goulburn River flow will need to be delivered to reach 4 at the Campaspe Siphon.

Scenario planning

Table 5.6.5 outlines potential environmental watering and expected water use environmental watering planning scenarios.

Flood events in 2022 and 2024 affected the condition of the Campaspe River. The upper banks and tops of banks benefited from the higher flows by removing terrestrial and agricultural vegetation. However, the frequent flows and prolonged inundation reduced the diversity and abundance of many streamside and littoral vegetation species on the lower section of the bank and reduced in-stream vegetation biomass. Although the floods were a natural disturbance event for the river, the benefits of previous years of environmental watering should have built system resilience to help the river rebound quickly.

The environmental water supply outlook for 2024-25 is expected to be high in all planning scenarios, so all planned environmental watering actions are likely to be delivered at magnitudes to improve the composition and condition of native plants growing on the water's edge and help the river recover from the 2022 and 2024 flood damage.

Planned watering actions for the Campaspe River aim to meet low-flow targets throughout the year and to deliver a mix of small and medium-sized freshes in all planning scenarios. In the drought and dry planning scenarios, freshes and the winter/spring low flow will likely be delivered at the lower end of the target magnitude and duration ranges, in line with climate conditions. Some watering actions will likely be achieved naturally in the average and wet planning scenarios. This means that water for the environment can be used to deliver freshes and a winter/spring low flow at the higher end of their recommended magnitude to help increase populations of platypus, native fish and native plants and improve the condition of individuals. The North Central CMA will monitor water levels and quality throughout the year and deliver trigger-based freshes in any planning scenario, if needed to improve poor water quality.

In all planning scenarios, the flow may be lowered to about 20 ML per day in reaches 2 and 3 in autumn to encourage the recruitment of fringing plants on exposed mudflats. This would be a joint initiative between the North Central CMA and Arthur Rylah Institute vegetation ecologists, and it will be supported by dedicated monitoring if it proceeds. Lowering the flow in reach 4 may pose a risk to water quality, so the watering trial will only proceed if sufficient water can be delivered from the Western Waranga Channel to supplement the flow downstream of the Campaspe Siphon.

The carryover target of 6,000 ML in the drought and dry planning scenarios is based on the volume required to deliver a priority summer/autumn low flow during 2025-26 if there is a return to dry or drought conditions. No carryover targets are set for the average/wet planning scenario, as early-season allocations in 2025-26 will likely be sufficient to meet summer/autumn low-flow environmental flow demands.

Table 5.6.5 Campaspe system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average to wet
Expected conditions	• Little to no natural flow from tributaries and local run-off • Low passing flow • Operational water deliveries	• Some natural flow from tributaries and local run-off • Increased passing flow • Operational water deliveries	• Moderate-to-high natural flow from tributaries and local run-off • Increased passing flow • An expected spill of Eppalock Reservoir
Expected availability of water for the environment	• 34,500 ML	• 34,500 ML	• 27,500 ML
Campaspe River (targeting reach 4)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Winter/spring low flow (lower magnitude) • Winter/spring fresh (one of lower magnitude and duration) • Summer/autumn low flow[1] • Summer/autumn freshes (three of lower magnitude and duration) • Year-round fresh (if required)	• Winter/spring low flow (lower magnitude) • Winter/spring fresh (one of lower magnitude and duration) • Summer/autumn low flow[1] • Summer/autumn freshes (three of lower magnitude and duration) • Year-round fresh (if required)	• Winter/spring low flow • Winter/spring fresh(es) (one to two freshes[2]) • Summer/autumn low flow[1] • Summer/autumn freshes (three freshes) • Year-round fresh (if required)
	Tier 1b (supply deficit)		
	• N/A	• N/A	• N/A

Planning scenario	Drought	Dry	Average to wet
Potential environmental watering – tier 2 (additional priorities)	• N/A		
Possible volume of water for the environment required to achieve objectives	• 28,100 ML (tier 1a) • 1,200 ML[3] (tier 1a Goulburn)	• 27,600 ML (tier 1a) • 1,200 ML[3] (tier 1a Goulburn)	• 27,000 ML (tier 1a) • 1,200 ML[3] (tier 1a Goulburn)
Priority carryover requirements for 2025-26	• 6,000 ML	• 6,000 ML	• N/A

1 This potential watering action may have a period of a lower flow rate in reaches 2 and 3 (20 ML per day) while maintaining the 40-60 ML per day flow in reach 4. To achieve this outcome, water for the environment from the Goulburn will need to be delivered to reach 4 at the Campaspe Siphon.

2 A second winter/spring fresh may be delivered in the average and wet planning scenarios to further improve streamside vegetation by wetting riverbanks, support fish movement and clear accumulated leaf litter to reduce the risk of blackwater events during the summer high flow.

3 The possible volume of water required from the Goulburn could increase to 2,400 ML if it is more effective to source water from Waranga Western Channel to deliver a year-round fresh to reach 4 at the Campaspe Siphon.

5.6.2 Coliban River

System overview

The Coliban River is the major tributary of the Campaspe River and flows into Lake Eppalock. It is highly regulated, with three storages harvesting water primarily for urban use.

The operation of the Malmsbury, Lauriston and Upper Coliban reservoirs regulates the flow in the Coliban River below Malmsbury Reservoir. An important distinction between the Coliban River and other regulated Victorian systems is the lack of irrigation demand that may be met by managed releases downstream of system storages. The flow in the river is influenced by the passing flow entitlement, which depends on catchment inflows and major flood events in the catchment.

The VEWH does not have any environmental entitlements in the Coliban system, but the passing flow can be managed — for example, it can be accumulated and released when most needed — to help mitigate some risks associated with a critically low summer/autumn flow, including low oxygen levels in the river between Malmsbury Reservoir and Lake Eppalock. The Commonwealth Environmental Water Holder has a small entitlement in the Coliban system, but using that water attracts high delivery costs.

Environmental values

The Coliban River provides habitat for platypus, rakali (water rats) and small-bodied native fish (such as flat-headed gudgeon and mountain galaxias). The Coliban River also contains a diverse range of waterbugs supported by stands of emergent and submergent aquatic vegetation. It is bordered by remnant patches of streambank shrubland vegetation and woodland containing river red gum, *Callistemon*, woolly tea tree and inland wirilda, which provide habitat for terrestrial animals.

Environmental objectives in the Coliban River

	F1 – Maintain the abundance and diversity of small-bodied native fish
	**MI1** – Maintain an adequate diversity and biomass of waterbugs to break down dead organic matter and supply the river's food chain
	**PR1** – Maintain the platypus population
	**V1** – Maintain the cover and diversity of aquatic plants **V2** – Maintain the cover and diversity of fringing vegetation while limiting encroachment into the middle of the channel **V3** – Maintain streamside woody vegetation and facilitate recruitment
	WQ1 – Maintain water quality to support aquatic life and ecological processes

Traditional Owner cultural values and uses

The Coliban River system is on the Country of the Djaara People, represented by the Dja Dja Wurrung Clans Aboriginal Corporation (DJAARA).

In November 2023, DJAARA launched its water strategy, ***Dhelkunyangu Gatjin: Working together to heal water***, setting a *baring* (pathway) for Djaara to partner with authorities and the community to manage water for a healthy and sustainable future. The ***Djaara Nation Statement*** in ***Water is Life: Traditional Owner Access to Water Roadmap 2022*** and the ***Dhelkunya Dja (Healing Country) Country Plan 2014-2034*** also describe Djaara aspirations for the management of water on their Country.

DJAARA's Kapa Gatjin (Dja Dja Wurrung water knowledge group) and the North Central CMA have been working together to identify sites where water for the environment can support Djaara aspirations for the Coliban River. Opportunities are also identified for greater Djaara involvement in managing and administering environmental water, with the aim of Djaara ownership and management of environmental water, as stated in the Gatjin strategy.

In recent years, DJAARA has completed several Aboriginal Waterways Assessments in the upper and lower catchments of the Coliban River.

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

The Recognition and Settlement Agreement 2013 (RSA) between DJAARA and the State of Victoria provides DJAARA with the right to participation, employment and incorporation of traditional ecological knowledge into natural resource management. DJAARA considers that to activate DJAARA's right in natural resource management and provide DJAARA with agency to identify and manage their cultural values, an approval step for DJAARA to sign off on environmental water deliveries on Djandak (Dja Dja Wurrung Country) is needed along with the introduction of DJAARA environmental water officers with a collaborative role in environmental water planning.

Social, recreational and economic values and uses

In planning the potential environmental watering actions in **Table 5.6.7**, the North Central CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as swimming, canoeing, and fishing)
- riverside recreation and amenity (such as socialising, relaxing, birdwatching, bushwalking, camping, and cycling)
- socioeconomic benefits, including tourism to Malmsbury, diversions for domestic and stock uses, benefits to the local and regional economies from recreational activities, ecosystem services (such as carbon storage, groundwater recharge and water quality regulation), lower salinity costs and blackwater and blue-green algae risks for landholders and contributions to community enjoyment, health, and recuperation.

The Coliban River provides diverse social, recreational and economic values to the local region, which **Table 5.6.6** summarises.

Table 5.6.6 Social, recreational and economic shared benefits, Coliban River

Beneficiary	Connection to river	Values, uses, objectives & opportunities	How have these benefits been considered?
• **VRFish** • **Recreational fishers**	• Anglers have a close connection to the river, and interest in maintaining its health	• Flows associated with the movement or dispersal of fish benefit recreational fishers by encouraging fish to move through the system to promote a healthy fish population	• Summer low flows and freshes • Winter low flows and high flows
• **Stock and domestic diverters**	• Stock and domestic diverters rely on unregulated and passing flows for household uses as there is no stock and domestic entitlement	• Many potential watering actions target water quality. Low flows and freshes improve water quality for diverters and provide water when the river has no natural flow	• Summer low flows and freshes • Winter low flows and high flows
• **Unpowered boat users**	• Canoeists want the river's health, flow and aesthetic values maintained	• Water for the environment provides river flows and improves water quality for canoeing, a popular activity along the river	• Summer low flows and freshes • Winter low flows and high flows
• **Campers**	• Campers want the river's health, flow and aesthetic values maintained	• Visitors can camp in many places along the Coliban and enjoy a healthy river environment	• All potential watering actions
• **Bushwalkers and cyclists**	• Bushwalkers and cyclists want the river's health and aesthetic values maintained	• There are walking and cycling tracks on Malmsbury Common, a popular site for passive recreation • The river contributes much to the wellbeing of the community and visitors and the local economy	• All potential watering actions

Planned environmental flows may be modified to align with a community benefit so long as environmental outcomes are not compromised. Where possible, low flows and freshes are delivered in summer to support angling and paddling. This is acknowledged in **Table 5.6.7** with the following icon (as explained in **Figure 1.2.3**).

	Watering planned to support angling activities
	Watering planned to support water sports activities (e.g. canoeing)

Scope of environmental watering

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

Table 5.6.7 describes the potential environmental watering actions in 2024-25, 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 5.6.7 Coliban River potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Coliban River (targeting reach 1)		
Winter/spring low flow (2-10 ML/day during June to November)	• Increase wet areas for native aquatic and streamside plants while limiting terrestrial species encroaching on the river channel • Increase flow to mix water in pools to prevent stagnation and a decline in water quality • Increase the channel area for habitat for waterbugs At 7-10 ML/day: • Maintain a connected river that allows small-bodied native fish and platypus to disperse throughout the reach	 F1  MI1  PR1  V1, V2, V3  WQ1
Winter/spring fresh (one fresh of 25-160 ML/day for three to five days during July to September)	• Increase the water depth through riffle-run habitats to 8-20 cm for a 25-50 ML/day event to increase the wetted river perimeter to increase habitat for waterbugs • Increase the water depth through riffle-run habitats to 45-60 cm for a 160 ML/day event to: – disperse native fish throughout the river and colonise sites – encourage female platypus to select a nesting burrow higher up the bank to reduce the risk of a greater flow later in the year flooding the burrow when juveniles are present – increase the wetted river perimeter for fringing and edge vegetation – flush organic matter to reduce the risk of declining water quality in summer	 F1  MI1  PR1  V2, V3

Potential environmental watering action	Expected watering effects	Environmental objectives
Summer/autumn low flow (2-10 ML/day during December to May) 	• Wet the channel to maintain in-stream aquatic and fringing vegetation • Maintain aquatic habitat that supports waterbugs, native fish and platypus • Maintain water quality, including oxygen levels At 7-10 ML/day: • Maintain up to 6 cm water depth between pools for native fish movement and maintain river pool depth	F1  MI1  PR1  V1, V2, V3 WQ1
Summer/autumn fresh(es) (one to two freshes of 25-160 ML/day for three to five days during December to May) 	• Increase the water depth through riffle-run habitats to 8-20 cm for a 25-50 ML/day event to maintain water quality and habitat for waterbugs • Increase the water depth through riffle-run habitats to 45-60 cm for a 160 ML/day event to: – facilitate the movement of fish and platypus – clean sediment and biofilms from river substrates – wet the benches and low banks to promote the growth and recruitment of fringing vegetation	F1  MI1  PR1 WQ1
Pulsed summer/ autumn low flow (5-15 ML/day for up to 14 days during December to May, trigger-based) *Triggers:* • *oxygen level below 5 mg/L* • *low or cease-to-flow river conditions* • *high water temperatures*	• Improve water quality, including oxygen levels • Maintain refuge habitat for aquatic animals, including fish and platypus	F1  PR1 WQ1

Scenario planning

Table 5.6.8 outlines potential environmental watering and expected water use in various planning scenarios.

The potential environmental flows required for the Coliban River include a low flow and freshes in all planning scenarios, but the magnitude of particular flows and the number and duration of freshes that can be delivered varies between planning scenarios due to available supply and the expected contribution of the natural flow in the system. If supply is limited, a low flow will be delivered at the lower end of the recommended magnitude to maintain some connecting flow for a more extended period. Freshes will be delivered where possible to facilitate the dispersal of platypus and fish and clean biofilms from in-stream surfaces.

In all planning scenarios, the highest-potential watering action in the Coliban River is the summer/autumn low flow to maintain sufficient habitat for native fish, platypus and waterbugs. Natural baseflow and tributary inputs help to maintain some flow through the Coliban River during winter and spring each year, but long sections of the river contract to a series of pools or completely dry during late summer and autumn, especially in dry and drought years. Deliveries of water for the environment in summer and autumn help to maintain water quality, especially when oxygen levels are low. They also maintain the depth of pools in the upper reaches to help sustain populations of native fish and platypus.

In July 2023, Malmsbury Reservoir started spilling, resulting in the loss of water held in the Passing Flows Account, including water carried over from 2022-23. When the reservoir ceased spilling in October 2023, the passing flows recommenced at a rate of 4 ML per day to maintain a continuous low flow and allow the remaining water to accrue and be used to deliver a summer/autumn fresh in April 2024. Providing Malmsbury Reservoir does not spill again over winter/spring 2024, any remaining water carried over from 2023-24 will be used to help maintain a continuous low flow in all planning scenarios in 2024-25. If a continuous flow cannot be maintained, shorter, pulsed flows may be delivered to maintain pool habitats for native fish and platypus. These trigger-based pulses will most likely be needed in the dry planning scenario, but may also be needed in the wetter planning scenarios if there is insufficient supply to deliver a continuous low flow in late summer or early autumn. Where possible, summer and autumn freshes will be delivered to facilitate the movement of fish and platypus and support fringing vegetation. These freshes will aim to be delivered in March or April to support the dispersal of juvenile platypus.

An aspirational carryover target of 720 ML has been set for all planning scenarios to supply high-priority summer and autumn low flows in 2025-26. This target is unlikely to be achieved in most years due to the limited availability of water for the environment in the Coliban system and yearly variations in climatic conditions. The carryover target will be revised throughout the year based on climatic forecasts, the risk of spills and the extent to which priority actions for 2024-25 have been met. For example, if forecasts indicate a high likelihood of dry conditions in 2025-26, setting aside supply for carryover might become a higher priority than delivering a second summer/autumn fresh in 2024-25. Alternatively, if Malmsbury Reservoir is predicted to spill, delivering at least one summer/autumn fresh in 2024-25 will be a higher priority than achieving the full 720 ML carryover target.

Table 5.6.8 Coliban River environmental watering planning scenarios

Planning scenario	Drought	Dry	Average to wet
Expected conditions	• Little to no natural flow	• Some natural flow	• Extended periods of natural flow, including some high-flow events and reservoir spills
Expected availability of water for the environment[1]	• 1,550 ML	• 1,680 ML	• 2,480 ML
Coliban River (targeting reach 1)			
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**		
	• Winter/spring low flow (lower magnitude) • Summer/autumn low flow (lower magnitude) • Summer/autumn fresh (one fresh of lower magnitude) • Pulsed summer/autumn low flow (trigger-based)	• Winter/spring low flow (lower magnitude) • Summer/autumn low flow • Summer/autumn fresh (one fresh of lower magnitude)	• Winter/spring low flow • Summer/autumn low flow • Summer/autumn fresh(es) (one to two freshes of lower magnitude)
	Tier 1b (supply deficit)		
	• Summer/autumn low flow (greater magnitude) • Summer/autumn fresh (tier 1a partially delivered at increased magnitude)	• Winter/spring fresh (one fresh) • Summer/autumn freshes (tier 1a partially delivered at increased magnitude)	• Winter/spring fresh (one fresh) • Summer/autumn freshes (tier 1a freshes at full magnitude)
Potential environmental watering – tier 2 (additional priorities)	• N/A		
Possible volume of water for the environment required to achieve objectives	• 1,550 ML (tier 1a) • 1,640 ML (tier 1b)	• 1,680 ML (tier 1a) • 1,650 ML (tier 1b)	• 2,020 ML (tier 1a) • 850 ML (tier 1b)
Priority carryover requirements for 2025-26	• 0-720 ML		

1 The expected availability of water for the environment is the total volume of expected available passing flows – both what is passed and what is banked.

5.7 Loddon system

Waterway manager – North Central Catchment Management Authority

Storage manager – Goulburn-Murray Water

Environmental water holders – Victorian Environmental Water Holder and the Commonwealth Environmental Water Holder

The Loddon system includes the Loddon River system (including Serpentine and Pyramid Creeks), the Boort wetlands and Birchs Creek subsystems

5.7.1 Loddon River system (including Serpentine and Pyramid Creeks)

System overview

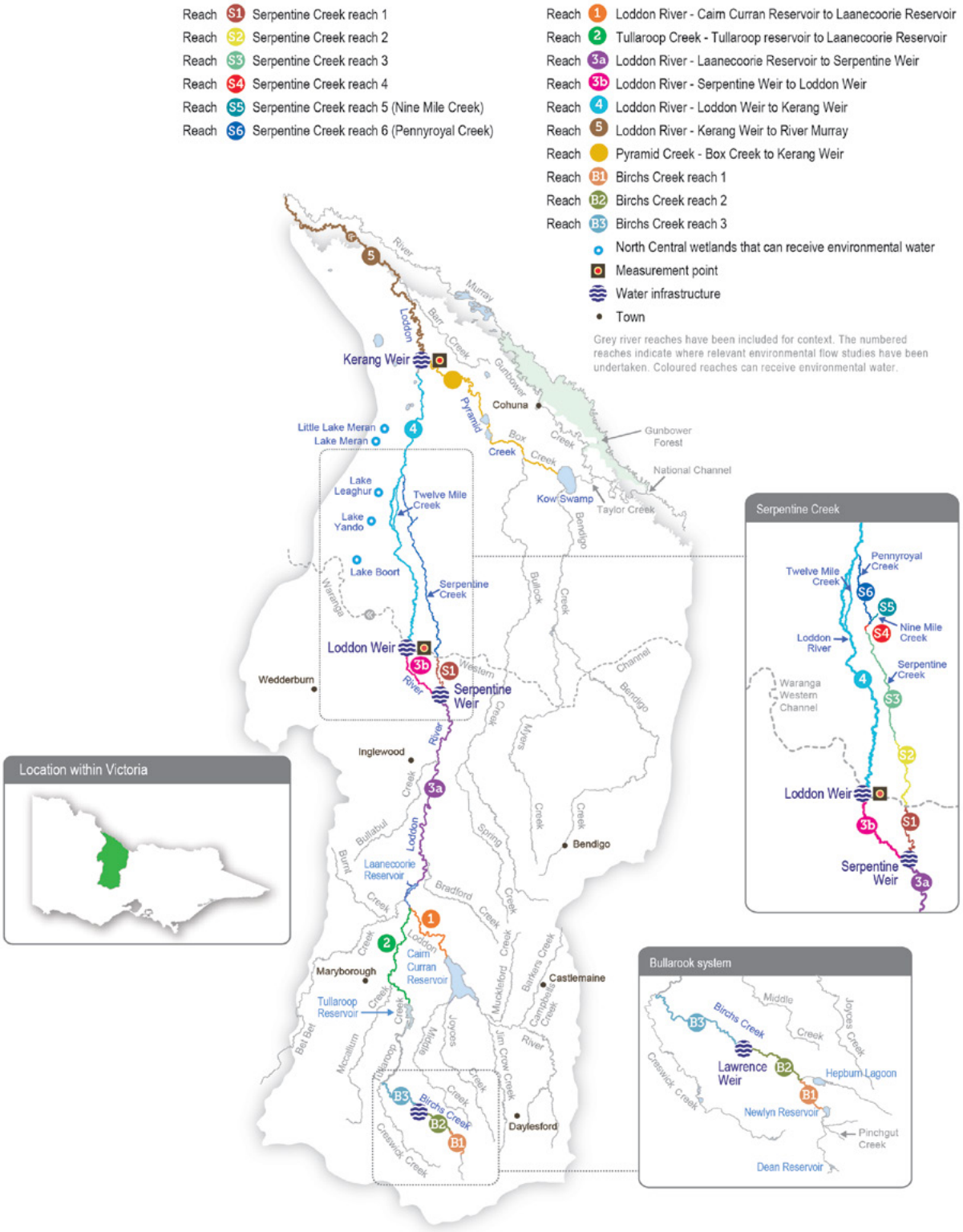
The Loddon River flows from the Great Dividing Range in the south to the Murray River in the north (Figure 5.7.1). The middle section of the Loddon River is characterised by many distributary streams and anabranches that carry water away from the river onto the floodplain. Pyramid Creek joins the lower Loddon River at Kerang, at which point the Loddon becomes part of the Murray River floodplain.

The two main storages on the Loddon River are Cairn Curran Reservoir and Tullaroop Reservoir. Laanecoorie Reservoir is a smaller storage used to regulate water released from the larger upstream storages. The operation of the Bridgewater, Serpentine, Loddon and Kerang weirs regulates the Loddon River's flow downstream of Laanecoorie Reservoir.

Water for the environment can be delivered to the Loddon River from Cairn Curran or Tullaroop reservoirs or from the Goulburn system via the Waranga Western Channel, which intersects with the Loddon River at Loddon Weir. Water is provided to Pyramid Creek through releases from Kow (Ghow) Swamp, which receives water diverted from the Murray River at Torrumbarry Weir. Water is diverted from the Loddon River to the Loddon Valley Irrigation Area to supply agriculture and to Serpentine Creek to support environmental values and supply agriculture.

The highly regulated nature of the Loddon system provides challenges and opportunities for the effective management of water for the environment. The ability to manipulate the timing of releases at multiple locations can help achieve environmental outcomes at discrete locations. However, coordinating environmental and consumptive flows is difficult through the irrigation season, especially when irrigation demand is high or the flow in the river is highly variable. These issues can constrain the timing and delivery of water for the environment or lead to a flow that exceeds the recommended flow rates above Loddon Weir. The structures for managing irrigation water also form barriers in the waterway that restrict native fish movement throughout the river and make it difficult to meet environmental objectives.

Figure 5.7.1 The Loddon system



Environmental values

The Loddon River system supports platypus, rakali (water rats) and several native fish species (such as Murray cod, golden perch, silver perch, river blackfish and Murray-Darling rainbowfish). Streamside vegetation varies in condition depending on the recent water regime, the extent of clearing and historic and current land management practices. The remaining relatively intact areas support various woodland birds and other native animals. Important plant species across the system include cane grass, tangled lignum, black box and river red gum.

Although fish populations in the Loddon system are affected by the many barriers caused by weirs and reservoirs, many species are still found through the catchment. Native fish are most abundant and diverse in the upper catchment. River blackfish are found in Serpentine Creek, and Murray-Darling rainbowfish are found in the middle and lower sections of the Loddon River.

The highest-priority reach for water for the environment is from Loddon Weir to Kerang Weir. The reach does not carry irrigation water and relies heavily on environmental flows to maintain its environmental condition. Environmental flows to this reach aim to maintain water quality, increase the abundance and diversity of native fish and improve the condition of in-stream and streamside vegetation. Environmental flows are delivered to the upper Loddon River and Serpentine Creek to maintain or increase river blackfish and platypus populations.

Pyramid Creek and the lower Loddon River support large-bodied fish (such as golden perch, Murray cod and silver perch) and are important corridors for fish migration between the Loddon, Murray and Gunbower Creek systems. Engineering works to provide fish passage at the Chute and Kerang Weir on the Loddon River, Box Creek regulator on Pyramid Creek, Taylors Creek Weir on Taylors Creek, and Fish Point Weir and Little Murray Weir on the Little Murray River in recent years have been important in reopening these migration routes. The Arthur Rylah Institute has monitored fish movement and populations in Pyramid Creek and the lower Loddon River since 2017. The monitoring indicates that the combined flows in the lower Loddon River and Pyramid Creek stimulate native fish movement through the fishways.

Environmental objectives in the Loddon River system

	**CN1** – Maintain productive and dynamic food webs CN2 – Maintain the diversity and abundance of biofilms
	F1 – Increase the small- and large-bodied native fish populations **F2** – Provide habitat for fish to feed and breed and opportunities for movement between habitats
	**G1** – Enhance the channel form and features, including deep pools and benches **G2** – Maintain the condition of suitable substrate to maintain ecosystem processes **G3** – Engage flood runners, distributary channels, anabranches and backwaters
	**MI1** – Maintain the diversity and increase the abundance of waterbugs and waterbug functional feeding groups
	**PR1** – Increase the population and recruitment of platypus **PR2** – Maintain a stable rakali (water rat) population in the long term
	**V1** – Maintain the condition of streamside and floodplain vegetation **V2** – Maintain and increase the extent of in-stream vegetation
	WQ1 – Maintain water quality to support aquatic animals and minimise the occurrence of blackwater events

Traditional Owner cultural values and uses

The Dja Dja Wurrung People (Djaara), represented by the Dja Dja Wurrung Clans Aboriginal Corporation (trading as DJAARA), and Djaara (Dja Dja Wurrung People) are recognised as the Traditional Owners in the upper part of the Loddon catchment. The Barapa Barapa and Wamba Wemba people are recognised as Traditional Owners in the lower part of the catchment.

In the upper part of the catchment, the DJAARA Kapa Gatjin (Dja Dja Wurrung water knowledge group) and the North Central CMA work together to identify opportunities and sites where environmental water can support Djaara objectives for the Loddon River. A key aspiration is for Djaara to be more involved in managing and administering environmental water, with the aim of owning and managing it in future.

In the lower part of the catchment, the Barapa Barapa and Wamba Wemba Traditional Owners communicated their cultural objectives for the Loddon River and other waterways in the *Barapa Barapa Healthy Country Plan 2018-2021*. Objectives that relate to the Loddon River system include:

- that all wetlands surrounding the Murray River, Gunbower Forest, Loddon River and associated lakes will have good plant life and healthy native fish (cod and yellow belly), mussels and turtle populations by 2033
- by 2033, the Murray, Gunbower and Loddon rivers and associated lakes will have enough water, their water quality is improving and the water will be clear for most of the year in good years
- Barapa people are actively involved in water management
- there are fewer fish and plant deaths from toxic blackwater events.

In planning for environmental flows in the Loddon River system, Djaara, Barapa Barapa, Wamba Wemba and the North Central CMA have considered how environmental flows in the Loddon system can be managed to support their respective cultural values, priorities and uses, which the following table summarises.

DJAARA considers that for DJAARA to have agency in the RSA (Recognition and Settlement Agreement 2013) to be enabled and to identify and manage their cultural values associated with environmental water deliveries, DJAARA need to have a decision making role for environmental water deliveries on Djandak (Dja Dja Wurrung Country). In addition DJAARA need to have a planning and management role in environmental water deliveries on Djandak through DJAARA environmental water officers. A Cultural Water Management Plan (CWMP) preceded by Aboriginal Waterways Assessments (AWA) will enable DJAARA to comprehensively identify objectives and watering actions.

Table 5.7.1 Traditional Owner values and uses, Loddon River system

Waterway and/or reach	Traditional Owner Group	Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
Loddon River Cairn Curran to Durham Ox, Tullaroop Creek, Serpentine Creek reach 1	• DJAARA Kapa Gatjin (Dja Dja Wurrung water knowledge group)	• Environmental water management helps preserve historical and contemporary values held highly by the Dja Dja Wurrung, including promoting a sense of place and spiritual connection. • The Loddon River is included in the Dja Dja Wurrung Country plan. • The Dja Dja Wurrung Traditional Owners are interested in seeing species that were more abundant within peoples' living memory return to the river, including platypus, turtles and yabbies. • Restoring a natural flow regime and improving water quality are overall cultural aspirations of the Dja Dja Wurrung for waterways management.	• Flows that are designed to support species of cultural value. • Kapa Gatjin and the North Central CMA have been working to identify opportunities and sites where environmental water can support the Dja Dja Wurrung's aspirations for the Loddon River. Further work is required. • Environmental water management helps preserve values held highly by Traditional Owners, including native fish, turtles and potentially crayfish (yabbies).

Waterway and/or reach	Traditional Owner Group	Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
Loddon River Durham Ox to the Little Murray River, Serpentine Creek, Pyramid Creek	• Barapa Barapa & Wamba Wemba (Water for Country Steering Committee)	• Healthy plant and fish life (Murray cod, golden perch) and other aquatic life (turtles and mussels). • Active involvement in water management on Country. • There are sites and artifacts of cultural significance (such as scar trees, campsites, meeting places and burial places) throughout the Loddon and Pyramid system and its floodplain, as well as food and fibre sources.	• Flows designed to support food and fibre species of cultural value and facilitate cultural activities. • Environmental water management helps preserve values held highly by Traditional Owner Groups, including native fish, turtles and potentially crayfish (yabbies).

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

Social, recreational and economic values and uses

Consistent with the 2016 *Water for Victoria* water plan and the Victorian *Water Act 1989*, waterway managers must consider shared benefits in environmental water and its planning. Shared benefits may be intrinsic or secondary opportunistic benefits, including economic, social, indigenous cultural, recreational and environmental benefits that arise from storing, delivering and using water.

The Loddon River system and Boort wetlands provide a diverse range of social, recreational and economic values. Recreation and tourism activities include camping, fishing, powered and non-powered boating, water sports, bird watching and hunting.

In planning the potential environmental watering actions in **Table 5.7.2**, the North Central CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as fishing, powered and non-powered boating, water skiing and water sports)
- riverside recreation and amenity (such as birdwatching, bushwalking, camping and cycling)
- community events and tourism (such as water skiing competitions at Bridgewater and associated visitation)
- socioeconomic benefits (such as diverters for domestic and stock uses, local and regional economic benefits from increased visitation and ecosystem services, including carbon storage, groundwater recharge and nutrient recycling).

Planned environmental flows may be modified to align with a community benefit so long as environmental outcomes are not compromised. The Bridgewater Weir pool is a nationally recognised waterskiing location, with national competitions held annually. The North Central CMA will work with Goulburn-Murray Water to manage the delivery of low flow rates and the timing of freshes over summer/autumn to support optimum conditions for these annual water skiing competitions, where possible. This is acknowledged in **Table 5.7.2** with the following icon (as explained in **Figure 1.2.3**).

Watering planned to support water sports activities (e.g. canoeing, kayaking, rowing, swimming, water skiing)

Scope of environmental watering

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

Table 5.7.2 describes the potential environmental watering actions in 2024-25, 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 5.7.2 Loddon River system potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Loddon River (targeting reach 4)		
Winter/spring low flow (50-100 ML/day during June to November)[1]	At 50 ML/day: • A low flow will provide a minimum level of continuous flow through the reach and maintain water quality and adequate depth in pools to provide habitat for aquatic plants, waterbugs, fish and rakali (water rats) At 100 ML/day: • Increase the water depth for fish, platypus and rakali (water rat) dispersal (especially for male juvenile platypus) to colonise new breeding territory in winter and provide foraging habitat • Prevent silt and fine sediment from settling on submerged wood and other hard surfaces • Inundate a variety of habitats to increase the growth of biofilms and support waterbug productivity • Inundate native fringing bank vegetation to support seed germination and growth and prevent the encroachment of exotic terrestrial plants in the river channel	 CN1 F1  G2  MI1  PR1  V1, V2
Winter/spring low flow trial(s) (one to three trials of 100-200 ML/day for 10 to 30 days during June to November if triggered by an unregulated flow event)	• Prolong the period that fish can move longitudinally through and between reaches to access new habitat	F2

Potential environmental watering action	Expected watering effects	Environmental objectives
Winter/spring high flow (one high flow of 400-450 ML/day for 10 days[2] during August to November)	• Provide sufficient velocity to scour accumulated sediment from pools and scour biofilms, promoting the growth of new biofilms and increasing waterbug productivity • Flush accumulated organic matter from the bank and benches to increase productivity and reduce the risk of a blackwater event in summer • Wet the banks to promote the recruitment and growth of streamside and emergent vegetation • Stimulate native fish movement and breeding	CN1, CN2 F1, F2 G1, G3 MI1 V1, V2 WQ1
Summer/autumn low flow (50 ML/day during December to May)	• Maintain an adequate depth in pools for aquatic plants and to provide habitat for waterbugs, fish and rakali (water rats) • Provide a continuous flow through all reaches • Maintain water quality throughout most of the reach, except the Loddon River west branch, during warm weather • Wet the banks and shallow riffles to support the growth of in-stream and fringing non-woody vegetation	F1 MI1 PR2 V1, V2 WQ1
Summer/autumn low-flow trial (50-100 ML/day for six weeks during December to May)	• Maintain water quality and mitigate against a hypoxic blackwater event in the Loddon River west branch • Prevent the emigration of native fish species due to poor water quality	F2 WQ1
Summer/autumn freshes (three freshes of 100 ML/day for three days during December to May)	• Increase the water level to promote seed germination and the growth of fringing emergent macrophytes • Increase connectivity between deep pools to promote the local movement of fish and prompt the dispersal of juvenile platypus in autumn • Generate sufficient force to flush fine sediment and old biofilms from submerged wood and other hard surfaces, promoting the growth of new biofilms and increasing waterbug productivity • Freshen water quality and reoxygenate pools	CN1, CN2 F2 MI1 PR1 V1 WQ1
Autumn high flow (one high flow of 400 ML/day for six days[3] during March to April)	• Trigger and facilitate the upstream movement of golden perch, silver perch and Murray cod older than one year • Facilitate the dispersal of juvenile platypus • Generate sufficient force to flush fine sediment and old biofilms from submerged wood and other hard surfaces, promoting the growth of new biofilms and increasing waterbug productivity	CN1, CN2 F2 G2 MI1 PR1

Potential environmental watering action	Expected watering effects	Environmental objectives
Year-round fresh (trigger-based, 100-200 ML/day for three to five days as required) *Triggers:* • *dissolved oxygen level below 5 mg/L* • *low or cease-to-flow river conditions* • *high water temperatures*	• Destratify pools and improve water quality (increase oxygen levels) along the river in reach 4, ensuring there is adequate oxygen to support aquatic animals (such as native fish and platypus)	WQ1
Pyramid Creek and Loddon River (targeting reach 5)		
Year-round low flow (90-300 ML/day at Box Creek regulator)	At 90 ML/day: • The low flow will maintain connectivity between pools, maintain water quality at a level that can support fish and macroinvertebrates and provide habitat for aquatic animals At 200 ML/day: • Increase longitudinal connectivity to allow native fish and platypus to access new habitats • Improve water quality by reducing salinity levels • Increase the wetted area to maintain and promote the growth of fringing emergent (non-woody) vegetation along the lower banks of the channel At 300 ML/day: • Facilitate greater movement for large-bodied native fish • Increase hydrodynamic diversity and improve the quality of flowing habitats	F1  MI1  PR1  V1 WQ1
Winter/spring high flow (one high flow of 650 ML/day at Kerang Weir for 10 days[4] during August to November)[5]	• Trigger the migration, spawning and recruitment of native fish species, including Murray cod • Maintain connectivity between habitats and improve water quality • Provide sufficient energy to flush accumulated sediment from pools and substrates	F1, F2  G1 WQ1
Autumn high flow (one high flow of 650 ML/day at Kerang Weir for 10 days[6] during March to April)[7]	• Trigger and facilitate the upstream movement of golden perch, silver perch and Murray cod older than one year • Maintain connectivity between habitats and improve water quality • Facilitate platypus dispersal • Provide sufficient energy to flush accumulated sediment from pools and substrates	 F1, F2  G1  PR1  WQ1

Potential environmental watering action	Expected watering effects	Environmental objectives
Serpentine Creek (targeting reach 1)[8]		
Winter/spring low flow (10-30 ML/ day during June to November)	At 10 ML/day: • Maintain connectivity between pools to allow the dispersal of small- to medium-bodied native fish • Provide a sufficient flow to maintain water quality by oxygenating pools • Maintain foraging habitat for platypus • Maintain the wetted area to support in-stream aquatic vegetation (such as water ribbons, eel weed and milfoil) At 20-30 ML/day: • Maintain habitat for larger native fish and facilitate movement for aquatic animals • Wet exposed roots, woody debris, emergent vegetation and leaf packs to provide habitat for aquatic animals • Inundate low benches, banks and some secondary channels to help increase macroinvertebrate productivity and native fish breeding, including river blackfish breeding • Provide flow variability to maintain the diversity of the fringing vegetation	
Winter/spring fresh (one fresh of 40-120 ML/day for two days during August to November)	• Provide connectivity for fish and waterbugs to access different habitat areas • Transport organic matter that has accumulated in the channel to facilitate its breakdown and incorporation into the food web, with a low risk of hypoxic blackwater • Wet the banks to promote the recruitment and growth of streamside and emergent vegetation At 120 ML/day: • Maintain the channel form and scour pools • Encourage female platypus to select nesting burrows higher up the bank to reduce the risk of a greater flow later in the year flooding burrows with juveniles in them • Flush accumulated leaf litter from the banks and low benches to reduce the risk of blackwater events during summer	

Potential environmental watering action	Expected watering effects	Environmental objectives
Summer/autumn low flow (10-20 ML/day during December to May)	At 10 ML/day: • Provide connectivity between pools to allow the dispersal of small- to medium-bodied native fish • Provide a sufficient flow to maintain water quality by oxygenating pools • Maintain foraging habitat for platypus • Maintain the wetted area to support in-stream aquatic vegetation (such as water ribbons, eel weed and milfoil) At 20 ML/day: • Maintain habitat for larger native fish and facilitate movement of aquatic animals • Wet exposed roots, leaf packs and woody debris to provide habitat for aquatic animals	F1  MI1  PR1  V2 WQ1
Summer/autumn freshes (three freshes of 40 ML/day for two days during December to May)	• Maintain the channel form by inundating benches • Generate sufficient force to flush fine sediment and old biofilms from submerged wood and other hard surfaces, promoting the growth of new biofilms, increasing waterbug productivity and replenishing the food supply for aquatic animals • Increase connectivity between pools to promote the local movement of fish and prompt the dispersal of juvenile platypus in autumn • Provide flow variability to maintain the diversity of fringing vegetation (such as emergent macrophytes) • Freshen the water to improve its quality by diluting salt, reoxygenating the water and flushing poor-quality water in pools, transporting accumulated nutrients and carbon downstream	 CN1, CN2 F1  G1  MI1  PR1  V2 WQ1

1 A winter/spring low flow of 50 ML per day is below the passing flow magnitude and will result in the VEWH banking passing flow savings for use in other potential watering actions.

2 The high flow of this event is planned to be delivered for 10 days, but there is an extended 10-to-14-day ramp-down period.

3 The high flow of this event is planned to be delivered for six days, but there is an extended 10-day ramp-down period.

4 The high flow of this event is planned to be delivered for 10 days, but there is an extended, 14-day ramp-down period.

5 Winter/spring and autumn freshes are planned to occur at the same time in the Loddon River and Pyramid Creek, with the peaks timed to meet at Kerang Weir. 650 ML per day is the total combined target at Kerang Weir.

6 The high flow of this event is planned to be delivered for six days, but there is an extended, 10-day ramp-down period.

7 Winter/spring and autumn freshes are planned to occur at the same time in the Loddon River and Pyramid Creek, with the peaks timed to meet at Kerang Weir. 650 ML per day is the total combined target at Kerang Weir.

8 The flow delivered from Serpentine Weir may be restricted to manage end-of-system outfalls to avoid third-party impacts until an alternate solution is found.

Scenario planning

Table 5.7.3 outlines potential environmental watering and expected water use in various planning scenarios.

Loddon River

In the Loddon River, the delivery of a continuous, year-round low flow, three summer/autumn freshes and a winter/spring high flow are high priorities in all planning scenarios to maintain habitat for native fish, platypus and native vegetation and prevent poor water quality.

A flow of 50 ML per day is preferred during summer and autumn to minimise the risk of poor water quality during warm weather. Low-oxygen incidents in recent years have highlighted the need for a fresh that can be delivered at any time to respond to poor water quality. This watering action may be delivered up to a magnitude of 200 ML per day, based on the flow rate needed to improve water quality in 2017 and 2022, and it is a high priority in all planning scenarios. Coordinated winter/spring high flows in the Loddon River and Pyramid Creek are a high priority in all planning scenarios (and achieved with natural flow in wet conditions) to trigger the upstream movement of native fish from the Murray system for feeding and breeding and to remove accumulated organic matter on the banks and benches.

In drought-to-wet planning scenarios, the winter/spring low flow will be delivered between 50-77 ML per day in July and November to create a transition flow between the warmer and cooler seasons, although it will likely be delivered towards the upper range for longer if water availability allows. Delivering the winter/spring low flow at the greater magnitude aims to improve the condition of vegetation higher up the bank, improve water quality and increase the abundance of native fish and platypus.

Fish ecologists have recommended trialling different flow rates to improve fish outcomes in the Loddon River if sufficient water is available. The first trial involves increasing the winter/spring flow to 200 ML per day after an unregulated event to improve fish passage past low-level barriers. The second trial aims to increase the summer/autumn low flow to 100 ML per day during the warmest months — likely in January and February or if hot conditions are forecast at other times — to reduce the risk of fish emigration. It will also test whether adaptive flow management can mitigate water quality issues in the mid-Loddon River. The first trial is proposed in the average-to-wet planning scenarios in response to unregulated flows or spills at Loddon Weir. The second trial may be delivered in dry-to-wet planning scenarios. Each trial will only be implemented if appropriate monitoring is in place to assess their effect and to inform adaptive management.

An autumn high flow will likely be delivered in average and wet planning scenarios to cue the movement and dispersal of juvenile golden perch and silver perch from the Murray River into the Loddon River, Pyramid Creek and Gunbower Creek. This event is intended to be coordinated with a similar flow in Pyramid Creek. It will be a high priority if it is likely that there are large numbers of young native fish in the mid-Murray system, and it is not expected to be delivered in drought conditions.

Pyramid Creek

Pyramid Creek is regionally significant for native fish. Fish populations within Pyramid Creek have increased since the Millennium Drought, and removing fish barriers means it is now a vital dispersal corridor for fish moving between the Murray River, Kow (Ghow) Swamp and Gunbower Creek. Maintaining an adequate low flow to allow fish to remain in Pyramid Creek all year (including during the non-irrigation season) and delivering high flows to cue and facilitate fish movement at key times of the year are high priorities in all planning scenarios.

Modelling conducted as part of the FLOWS study indicates that maintaining a low flow of at least 200 ML per day throughout the year in Pyramid Creek is optimal for resident fish populations, but a flow of about 90 ML per day should provide minimum habitat requirements. Operational flow during the irrigation season usually provides a flow of about 300 ML per day, and water for the environment will likely be used to maintain a flow of 200 ML per day for as long as possible during the irrigation shutdown period.

The winter/spring high flow in Pyramid Creek has a target flow rate of 650 ML per day at Kerang Weir to cue and facilitate fish movement between the Murray River and the Loddon system during their breeding season. It is a high priority in all planning scenarios and requires coordinated releases in Pyramid Creek and reach 4 of the Loddon River. A similar-sized event in autumn is recommended for the dry-to-wet planning scenarios when large numbers of juvenile fish are likely to migrate from the Murray River into the Loddon system. The autumn high flow may also facilitate the dispersal of juvenile platypus in years following successful spring breeding.

Serpentine Creek

In Serpentine Creek, the main priority will be to maintain a low flow throughout the year to provide habitat for native fish, waterbugs, rakali (water rats) and platypus and to deliver freshes to improve water quality, allow fish and platypus movement and improve the condition of streamside vegetation. These flows are needed in all planning scenarios but will likely be delivered at the lower end of the recommended range to avoid inundating private property at the end of the system. Lower-magnitude flows are expected to maintain connectivity between habitats but will not provide as much habitat complexity for aquatic plants and animals as environmental flows delivered at the upper end of the recommended range.

Carryover of 3,000 ML is prioritised into 2025-26 in the drought planning scenario. If conditions are drier, this water will ensure delivery of the priority winter/spring high flow in the Loddon River. No carryover targets are set in the dry-to-wet planning scenarios, as early-seasonal allocations in 2025-26 are likely to be sufficient to meet winter/spring high-flow environmental flow demands.

Table 5.7.3 Loddon River system environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• Negligible contributions from unregulated reaches and tributaries of the Loddon River • Consumptive water deliveries in the irrigation season (but not in reach 4) • Combined volume in storages above 60 GL	• Small inflows from unregulated reaches and tributaries of the Loddon River contributing to low flow • Consumptive water deliveries in the irrigation season (but not in reach 4)	• The natural flow will provide a low flow and multiple freshes, most likely in winter/spring • Consumptive water deliveries in the irrigation season (but not in reach 4) • Spills from Loddon system storages are possible	• Spills from Loddon system storages will provide an extended-duration high flow • Overbank flow is most likely in winter/spring
Expected availability of water for the environment	• 21,931 ML	• 24,135 ML	• 24,135 ML	• 20,576 ML

Planning scenario	Drought	Dry	Average	Wet
Loddon River (targeting reach 4)				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Winter/spring low flow (delivered at 50-77 ML/day) • Winter/spring high flow (one high flow) • Summer/ autumn low flow (delivered at 50 ML/day) • Summer/ autumn freshes (three freshes) • Year-round fresh if triggered	• Winter/spring low flow (delivered at 77-100 ML/day[1]) • Winter/spring high flow (one high flow) • Summer/ autumn low flow (delivered at 50 ML/day) • Summer/ autumn low flow trial • Summer/ autumn freshes (three freshes) • Year-round fresh if triggered	• Winter/spring low flow (delivered at 77-100 ML/day[1]) • Winter/spring high flow (one high flow) • Summer/ autumn low flow (delivered at 50 ML/day) • Summer/ autumn low flow trial • Summer/ autumn freshes (three freshes) • Autumn high flow (one high flow) • Year-round fresh if triggered	• Winter/spring low flow (delivered at 77-100 ML/day) • Winter/spring low flow trial, if triggered • Winter/spring high flow (one high flow) • Summer/ autumn low flow (delivered at 50 ML/day) • Summer/ autumn low flow trial • Summer/ autumn freshes (three freshes) • Autumn high flow (one high flow) • Year-round fresh if triggered
	Tier 1b (supply deficit)			
	• Summer/ autumn low flow trial	• Autumn high flow (one high flow)	• Winter/spring low flow trial, if triggered	• N/A
Potential environmental watering – tier 2 (additional priorities)	• Winter/spring low flow trial, if triggered • Autumn high flow (one high flow)	• Winter/spring low flow trial, if triggered	• N/A	
Possible volume of water for the environment required to achieve objectives	• 20,500 ML (tier 1a) • 4,900 ML (tier 1b) • 6,500 ML (tier 2)	• 22,400 ML (tier 1a) • 4,500 ML (tier 1b) • 2,000 ML (tier 2)	• 22,400 ML (tier 1a) • 2,000 ML (tier 1b)	• 14,700 ML (tier 1a)

Planning scenario	Drought	Dry	Average	Wet
Pyramid Creek and Loddon River (targeting reach 5)				
Potential environmental watering – tier 1 (high priorities)	• Year-round low flow • Winter/spring high flow (one high flow)	• Year-round low flow • Winter/spring high flow (one high flow) • Autumn high flow (one high flow)		
Potential environmental watering – tier 2 (additional priorities)	• Autumn high flow (one high flow)	• N/A		
Possible volume of water for the environment required to achieve objectives[2]	• 4,000 ML (tier 1) • 2,000 ML (tier 2)	• 6,000 ML (tier 1)		
Serpentine Creek (targeting reach 1)				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Winter/spring low flow (delivered at 10 ML/day) • Winter/spring fresh (one fresh delivered at 40 ML/day) • Summer/ autumn low flow (delivered at 10 ML/day) • Summer/ autumn freshes (three freshes)	• Winter/spring low flow (delivered at 10 ML/day) • Winter/spring fresh (one fresh) • Summer/ autumn low flow (delivered at 10 ML/day) • Summer/ autumn freshes (three freshes)	• Winter/spring low flow (delivered at 10 ML/day) • Winter/spring fresh (one fresh) • Summer/ autumn low flow • Summer/ autumn freshes (three freshes)	• Winter/spring low flow (delivered at 10 ML/day) • Winter/spring fresh (one fresh) • Summer/ autumn low flow • Summer/ autumn freshes (three freshes)
	Tier 1b (supply deficit)			
	• Winter/spring low flow (delivered at 10-20 ML/day) • Winter/spring fresh (tier 1a fresh delivered at 120 ML/day) • Summer/ autumn low flow (delivered at 10-20 ML/day)	• Winter/spring low flow (delivered at 10-20 ML/day) • Summer/ autumn low flow (delivered at 10-20 ML/day)	• Winter/spring low flow (delivered at 10-30 ML/day) • Summer/ autumn low flow (delivered at 10-20 ML/day)	• Winter/spring low flow (delivered at 10-30 ML/day) • Summer/ autumn low flow (delivered at 10-20 ML/day)

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 1,300 ML (tier 1a) • 3,730 ML (tier 1b)	• 1,430 ML (tier 1a) • 2,500 ML (tier 1b)	• 1,300 ML (tier 1a) • 3,500 ML (tier 1b)	• 1,160 ML (tier 1a) • 3,500 ML (tier 1b)
Priority carryover requirements for 2025-26	• 3,000 ML	• N/A		

1 A winter/spring low flow of less than 77 ML per day can be delivered in dry conditions to reflect natural inflows.

2 Pyramid Creek is supplied by Murray River storages, not Loddon River storages.

5.7.2 Boort wetlands

System overview

The Boort wetlands are on the floodplain west of the Loddon River, below Loddon Weir. They consist of temporary and permanent freshwater lakes and swamps: Lake Boort, Lake Leaghur, Lake Yando, Little Lake Meran and Lake Meran. Together, the Boort wetlands cover over 800 ha. Numerous other wetlands in the district are not currently managed with water for the environment.

The natural watering regimes of wetlands throughout the broader Loddon system have been substantially modified by the construction of levees and channels across the floodplain and by constructing and operating reservoirs and weirs along the Loddon River. Water is delivered to the Boort wetlands through Loddon Valley Irrigation Area infrastructure.

The availability of water for the environment for the Boort wetlands is closely linked to water available for the Loddon River system. Channel capacity constraints sometimes limit the ability to deliver water for the environment to the wetlands. The VEWH and the North Central CMA work with the storage manager (Goulburn-Murray Water) to best meet environmental objectives within capacity constraints.

Environmental values

The Boort wetlands provide habitat for a range of plant and animal species. At Lake Yando, 12 rare plant species have been recorded, including the jerry-jerry and water nymph. Bird species recorded at Lake Boort, Lake Leaghur and Lake Meran include the white-bellied sea eagle, Latham's snipe and eastern great egret. Little Lake Meran is a swampy woodland with black box trees on the higher wet margins and river red gums fringing the waterline.

Environmental objectives in the Boort wetlands	
	A1 – Increase the size and diversity of the native frog population, including by enhancing breeding opportunities
	**B1** – Support a high diversity of wetland birds by enhancing feeding and breeding conditions
	F1 – Increase the large and small-bodied fish populations
	**T1** – Maintain the freshwater turtle population, in particular Murray River turtles
	**V1** – Rehabilitate and increase the extent of emergent and aquatic vegetation (aquatic herblands, tall marsh), intermittent swampy woodland and riverine chenopod woodland **V2** – Maintain the health and restore the distribution of river red gums and associated understorey species **V3** – Maintain the extent and restore the health of black box vegetation on the fringes of the wetlands **V4** – Maintain the extent of the culturally significant spiny flatsedge, which can be used for basket weaving

Traditional Owner cultural values and uses

In planning for environmental flows in the Boort wetlands, the North Central CMA works with Barapa Barapa and Wamba Wemba Traditional Owners and the Dja Dja Wurrung Clans Aboriginal Corporation (DJAARA). Lake Boort is within the Dja Dja Wurrung Registered Aboriginal Party boundary. Boort wetlands to the north of Lake Boort are on Barapa Barapa Country. **Table 5.7.4** summarises Traditional Owner values and uses in the Boort wetlands.

Table 5.7.4 Traditional Owner values and uses, Boort wetlands

Traditional Owner Group	Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
Barapa Barapa and Wamba Wemba Traditional Owners	• Cultural plants and cultural practices	• Environmental water and natural flooding support the growth of culturally important plants that Barapa Barapa and Wamba Wemba Traditional Owners value and allow the continuation of cultural practices, including harvesting food, medicine and weaving plants (e.g. harvesting nardoo at Lake Yando). • Barapa Barapa and Wamba Wemba Traditional Owners recognise the value of resources that occur on the drawdown after inundation of wetlands, providing food for animals and cultural plants (such as old man weed). This aspiration can be supported by allowing wetlands to draw down naturally after receiving water to expose mudflats. This is a consideration at Little Lake Meran, Lake Yando and Lake Leaghur. • Having diverse habitat and vegetation responses is a priority for Barapa Barapa and Wamba Wemba Traditional Owners. They highlighted the importance of having a range of water depths across wetlands, which creates a more diverse vegetation response and results in a range of resources becoming available over a longer timeframe. • Barapa Barapa Traditional Owners have undertaken revegetation activities as part of the Decision Support Tool Wetland Revegetation Project at Lake Leaghur. There are other opportunities to get Traditional Owners involved with monitoring and revegetation at some wetlands. • Environmental water deliveries can be managed in the future so that the revegetated areas at Lake Leaghur are provided with an appropriate water regime (i.e. plants receive water but are not drowned) to ensure their ongoing survival and provide opportunities for natural recruitment.
	• Cultural animals and cultural practices	• Environmental water can help preserve and improve cultural animals (i.e. totem species). Also, the delivery of environmental water will aim to ensure that culturally important animals (food sources, such as black swans) have sufficient feeding and breeding habitat to build their populations.

Traditional Owner Group	Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
(continued) **Barapa Barapa and Wamba Wemba Traditional Owners**	• Healthy Country	• Providing drought refuges for frogs, turtles and birds and maintaining areas with healthy habitat is a high priority for Barapa Barapa and Wamba Wemba Traditional Owners. Current conditions provide for this, but once wetlands dry out, they consider it important to ensure that water is delivered to healthy areas that elicit a good vegetation response and can support wetland animals. • Future water for the environment actions will ensure water is present in high-priority wetlands regardless of whether natural flooding occurs., This will provide refuge habitat for waterbirds, woodland birds, turtles and frogs and ensure high-quality feeding and breeding habitat is available.
	• Cultural heritage	• Cultural heritage artefacts are at the wetlands as they have been important gathering sites for Traditional Owners. The loss of fringing trees and changes to the natural watering regime have exposed sediments around these wetlands for prolonged periods, resulting in some cultural artefacts being uncovered. • Delivering environmental water can support fringing red gum trees and tall marsh growth, reduce erosion at these wetlands, and help keep cultural heritage artefacts covered.
Lake Boort		
Kapa Gatjin (Dja Dja Wurrung water knowledge group)	• Environmental water management helps preserve historical and contemporary values held highly by the Dja Dja Wurrung. This includes promoting a sense of place and spiritual connection. Lake Boort is a priority in the Dja Dja Wurrung Country Plan.	• The drawdown after the 2024 flood will be monitored and DJAARA and the Yung Balug family group will be given the opportunity to assess current communities of culturally significant plants. This monitoring is one component of a monitoring Country program that DJAARA aim to implement and coordinate through a DJANDAK environmental water officer program.

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

Social, recreational and economic values and uses

No environmental water deliveries are planned for the Boort Wetlands in 2024-25. However, as the wetlands draw down, the North Central CMA has considered how the wetlands could support social, recreational and economic values and uses, including:

- water-based recreation (such as fishing and water sports)
- waterway recreation and amenity (such as birdwatching, camping and duck hunting)
- community events and tourism (such as attracting locals and visitors for birdwatching and hunting)
- socioeconomic benefits (such as aesthetic benefits for landholders, groundwater recharge and appropriate water levels and quality for flood mitigation, nutrient treatment and carbon storage).

Scope of environmental watering

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

Table 5.7.5 describes the potential environmental watering actions in 2024-25, 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 5.7.5 Boort wetlands potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
• No deliveries of water for the environment are planned in 2024-25		

Scenario planning

Table 5.7.6 outlines potential environmental watering and expected water use in various planning scenarios.

Wet conditions in spring 2022 caused widespread flooding across the Loddon system that filled all the Boort wetlands except Little Lake Meran, which was filled with environmental water. Regular rainfall in 2023 and flooding in January 2024 topped up all wetlands in this system. All of the Boort wetlands have recommended wetting and drying regimes and, given the wetlands have had high water levels for at least 18 months they will be allowed to draw down during 2024-25, unless they are naturally flooded, to support dry-phase ecological processes.

No carryover targets into 2025-26 have been set for the Boort wetlands. Many wetlands will still be in their drawdown or drying phases, and seasonal allocations will likely be sufficient to meet expected environmental demands next year.

Table 5.7.6 Boort wetlands environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• No natural inflow to wetlands • Storages above 60 GL	• Minimal natural inflow to wetlands from local catchment run-off is possible	• Moderate inflow from local catchment run-off, but little if any inflow from nearby creeks or flood runners	• Extended durations of high flow and overbank flow from creeks and flood runners, which fill most wetlands
Expected availability of water for the environment[1]	• 21,931 ML	• 24,135 ML	• 24,135 ML	• 20,576 ML
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• N/A: no deliveries of water for the environment are planned in 2024-25			
	Tier 1b (supply deficit)			
	• N/A			
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• N/A			
Priority carryover requirements for 2025-26	• N/A			

1 Loddon system entitlements are shared between the Loddon River system and the Boort wetlands.

5.7.3 Birchs Creek

System overview

Birchs Creek is a tributary of the Loddon River located in the southernmost part of the catchment. The creek rises in the ranges northeast of Ballarat and flows northwest through Newlyn and Smeaton before joining Tullaroop Creek near Clunes. The lower parts of the catchment are extensively cleared, where the creek meanders through an incised basaltic valley. The creek contains a regionally significant platypus community and a vulnerable river blackfish population.

Birchs Creek is part of the broader Bullarook system, which contains two small storages — Newlyn Reservoir and Hepburn Lagoon — that provide water for irrigation and urban supply. The storages fill and spill during winter or spring in years with average or above-average rainfall. The VEWH holds water for the environment in Newlyn Reservoir but none in Hepburn Lagoon.

Birchs Creek receives tributary inflows from Rocky Lead, Langdons, Lawrence and Tourello creeks. Groundwater provides reliable baseflows to the downstream reaches of Birchs Creek in most years.

The VEWH is allocated 100 ML in Newlyn Reservoir on 1 December each year, provided that seasonal determinations in the Bullarook system are at least 20 percent. Any unused allocation from 1 December can be carried over until 30 November of the following water year, but if Newlyn Reservoir spills from 1 July to 30 November, the volume held in carryover is lost. Any water remaining on 30 November is forfeited. When seasonal determinations are below 20 percent, the VEWH does not receive an allocation, and the system's resources are used to protect essential human needs.

Environmental values

Birchs Creek supports threatened aquatic plants, and its deep pools provide habitat for aquatic animals during dry periods. The creek contains native fish, including regionally significant populations of river blackfish and mountain galaxias, as well as flat-headed gudgeon and Australian smelt. Recent monitoring indicates that platypus are present throughout the entire creek.

Environmental objectives in Birchs Creek

	F1 – Maintain the abundance and diversity of small- and medium-bodied native fish, including river blackfish, mountain galaxias, flat-headed gudgeon and Australian smelt
	**MI1** – Maintain the waterbug population and the diversity of functional groups to drive productive and dynamic food webs
	**PR1** – Maintain the platypus population
	**V1** – Maintain the diversity and abundance of in-stream aquatic plants **V2** – Maintain a diverse variety of native fringing plants and communities of plants growing on the water's edge
	WQ1 – Maintain water quality to support aquatic life and environmental processes

Traditional Owner cultural values and uses

Birchs Creek is on the Country of the Djaara people, represented by the Dja Dja Wurrung Clans Aboriginal Corporation (DJAARA). In November 2023, DJAARA launched its water strategy, ***Dhelkunyangu Gatjin: working together to heal water***, setting a *baring* (pathway) for Djaara to work in partnership with authorities and the community to manage water for a healthy, sustainable future.

The ***Djaara Nation Statement*** in ***Water is Life: Traditional Owner Access to Water Roadmap 2022*** and the ***Dhelkunya Dja (Healing Country) Country Plan 2014-2034*** also describe Djaara objectives for managing water on their Country. In planning for environmental flows in Birchs Creek, DJAARA and the North Central CMA have identified the creek as a potential site for future projects. The ***Dhelkunya Dja: Dja Dja Wurrung Country Plan 2014-2034*** can provide the foundation to identify and integrate cultural values, which **Table 5.7.7** shows, into Bullarook System environmental water planning.

DJAARA objectives and watering actions need to be established through the development of a comprehensive Cultural Water Management Plan (CWMP), built off the foundation of Aboriginal Waterways Assessments (AWA) to enable DJAARA values to inform watering and to enable DJAARA to protect and enhance their cultural values.

Table 5.7.7 Traditional Owner values and uses, Birchs Creek (all reaches)[1]

Values, uses, objectives & opportunities	How will this opportunity be considered in environmental watering in 2024-25?
• Environmental water management helps preserve historical and contemporary values held highly by the Dja Dja Wurrung. This includes promoting a sense of place and spiritual connection.	• Kapa Gatjin and the North Central CMA have been working to identify opportunities and sites where environmental water can support the Dja Dja Wurrung's aspirations for the Creek. Further work is required.
• The Dja Dja Wurrung Traditional Owners are interested in seeing species that were more abundant within peoples' living memory return to the river, including platypus, turtles and yabbies. • Restoring a natural flow regime and improving water quality are cultural aspirations of the Dja Dja Wurrung for waterways management.	• Environmental water helps preserve values held highly by Traditional Owner groups, including native fish, turtles and potentially crayfish (yabbies).

1 The Traditional Owner group is Kapa Gatjin (Dja Dja Wurrung water knowledge group).

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

The Recognition and Settlement Agreement 2013 (RSA) between DJAARA and the State of Victoria provides DJAARA with the right to participation, employment and incorporation of traditional ecological knowledge into natural resource management. To activate DJAARA's right in environmental water management and provide DJAARA with agency to identify and manage their cultural values, DJAARA considers that an approval step for DJAARA to sign off on environmental water deliveries on Djandak (Dja Dja Wurrung Country) is needed along with the introduction of DJAARA environmental water officers with a collaborative role in environmental water planning.

Social, recreational and economic values and uses

Consistent with the *Water for Victoria* and the *Water Act 1989*, CMAs must consider shared benefits in environmental water and planning. Shared benefits may be intrinsic or secondary opportunistic benefits, including economic, social, Aboriginal cultural, recreational and environmental benefits arising from storing, delivering and using water.

In planning the potential environmental watering actions in **Table 5.7.8**, the North Central CMA considered how environmental flows could support values and uses, including:

- water-based recreation (e.g. fishing)
- riverside recreation and amenity (e.g. cycling and walking, particularly in Newlyn, Smeaton and Clunes, and improved amenity at key community spaces like Andersons Mill)
- improved water quality (e.g. domestic and stock use)
- socioeconomic benefits (e.g. increased tourism and visitation to key community spaces).

Scope of environmental watering

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

Table 5.7.8 describes the potential environmental watering actions in 2024-25, 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 5.7.8 Birchs Creek potential environmental watering actions, expected effects and environmental objectives

Potential environmental watering action	Expected watering effects	Environmental objectives
Birchs Creek (targeting reach 2)[1]		
Winter/spring fresh (one fresh of 27 ML/day for three days during June to November)	• Maintain and support the growth and germination of streamside vegetation by increasing soil moisture and depositing sediment on the bank and benches • Scour old biofilms and organic matter that has accumulated in the channel and cycle nutrients throughout the creek • Improve water quality by freshening refuge pools and provide connectivity between pools for fish and platypus movement	F1, MI1, PR1, V2, WQ1
Summer/autumn freshes (three freshes of 10-15 ML/day for three days during December to May)	• Increase the water depth to maintain and support seed germination and the growth of in-stream aquatic vegetation • Top up pools to refresh water quality (particularly oxygen levels) and enhance connectivity between pools for fish and platypus movement	F1, PR1, V1, WQ1

1 Environmental flows target outcomes in reach 3, but compliance can only be assessed in reach 2.

Scenario planning

Table 5.7.9 outlines potential environmental watering and expected water use in various planning scenarios.

Water for the environment in Birchs Creek is primarily used to deliver winter/spring freshes and summer/autumn freshes, where these are not met by the natural flow or consumptive water deliveries. The volume of available water for the environment is insufficient to deliver any other environmental flows recommended for the system.

Regular winter/spring freshes are important to cycle nutrients throughout the system and wet higher channel features to increase connectivity between habitat types for aquatic animals. Summer/autumn freshes are needed to maintain water quality in the warmer months and ensure pools do not dry out. While both watering actions are important, summer/autumn freshes may be prioritised in dry-to-average planning scenarios, if required and where allocation allows to avoid critical loss of environmental values when the system is likely under the greatest stress. Summer/autumn freshes should be delivered at the upper magnitude where possible, either by augmenting natural or consumptive flows or using water for the environment to deliver greater-magnitude freshes after one fresh has been met naturally. In the drought planning scenario, the environment is unlikely to receive its allocation in December, so carryover from 2023-24 should be used to deliver a winter/spring fresh before the water is forfeited on 30 November. Winter/spring freshes will likely be delivered naturally by reservoir spills in average and wet planning scenarios.

Table 5.7.9 Birchs Creek environmental watering planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected conditions	• The reservoir is unlikely to spill • Extremely low flow in winter/spring • Limited irrigation releases due to low allocations	• Reservoir spill is possible • Low flow in winter/spring if no spills occur • Moderate irrigation releases	• Reservoir spills are certain in winter/spring • Some natural flow through summer/autumn • Groundwater contributes to baseflow throughout the year	• Reservoir spills are certain in winter/spring • Natural flow through summer/autumn • Groundwater contributes to baseflow throughout the year
Expected availability of water for the environment	• 100 ML (2023 carryover)	• 100-200 ML (2023 carryover and likely 2024 allocation)	• 100 ML (2024 allocation)[1]	
Birchs Creek (targeting reach 2)				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Winter/spring fresh (one fresh for three days)	• Winter/spring fresh (one fresh for three days) • Summer/autumn freshes (three freshes)		
	Tier 1b (supply deficit)			
	• Summer/autumn freshes (three freshes)	• N/A		
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 100 ML (tier 1a) • 135 ML (tier 1b)	• 200 ML (tier 1a)	• 100 ML (tier 1a)	• 0 ML (tier 1a)
Priority carryover requirements for 2025-26	• If the 100 ML allocation is received on 1 December 2024 and water for the environment is not required to achieve summer/autumn freshes, it will be carried over into 2025-26 for use by 30 November 2025.			

1 In the average and wet planning scenarios, it is likely that Newlyn Reservoir will spill before 30 November 2023, losing the 100 ML carryover from December 2023