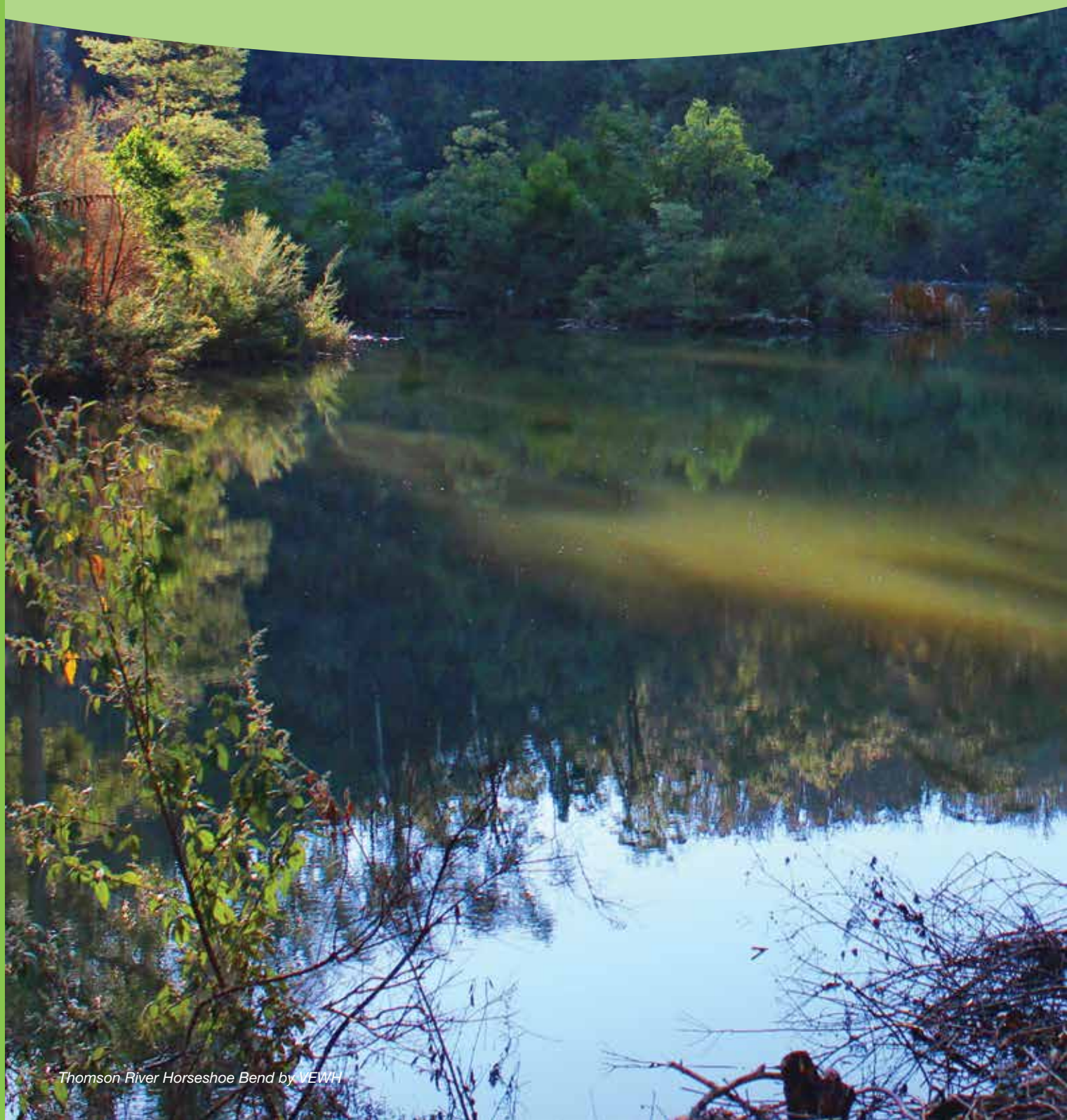
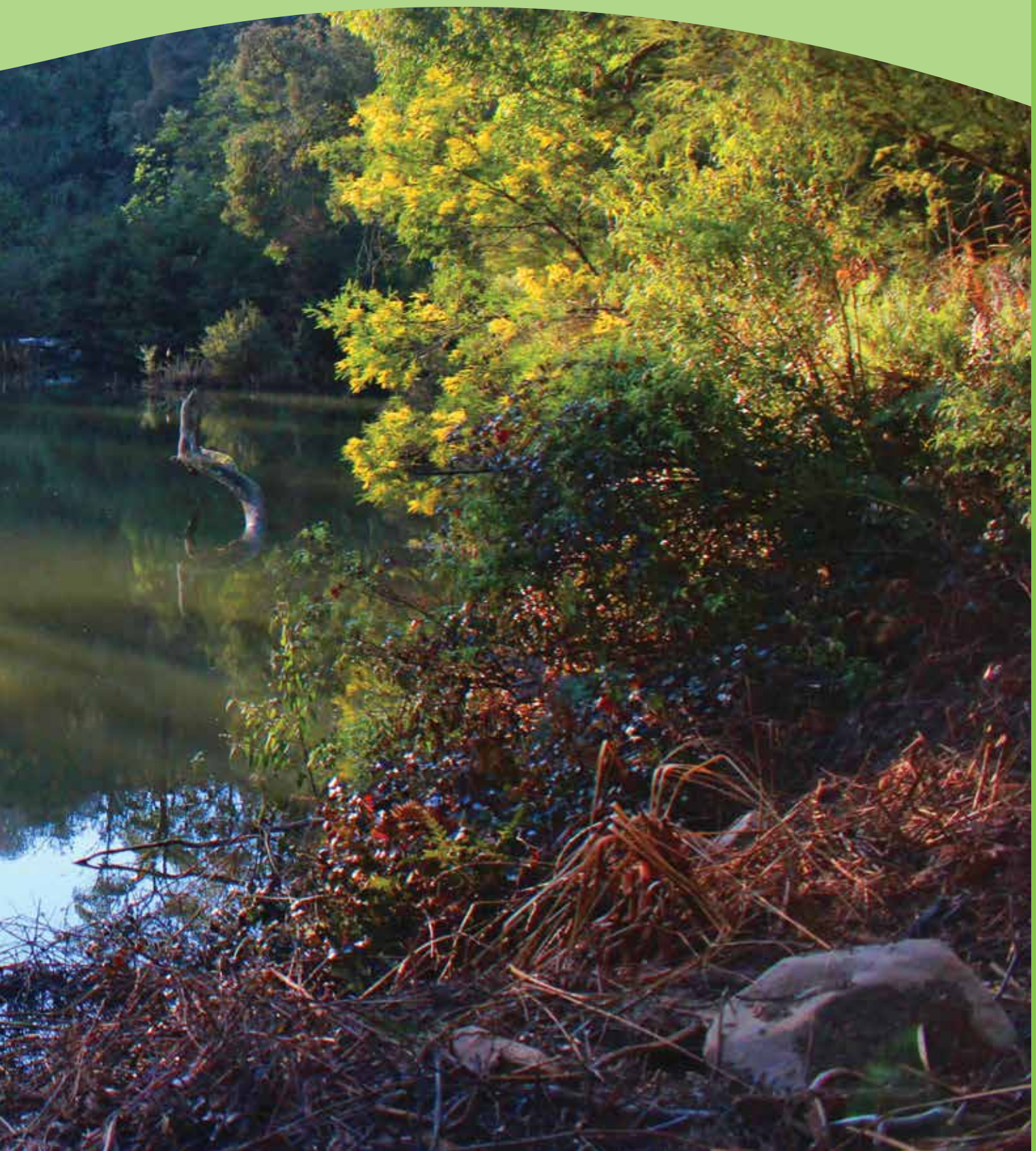


Thomson River Horseshoe Bend by VEWH

Section 2

Gippsland region



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2.1 Gippsland region overview

The systems in the Gippsland region that can receive water from the VEWH's environmental entitlements are the Latrobe River and wetlands, Thomson River and Macalister River. The Snowy River also receives water for the environment, but this is managed by the New South Wales (NSW) Department of Planning, Industry and Environment.

Environmental values, recent conditions, environmental watering objectives and planned actions for each system in the Gippsland region are presented in the system sections that follow this regional overview.

Traditional Owners in the Gippsland region

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

The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC), on behalf of the Gunaikurnai people, hold Native Title and is a Registered Aboriginal Party over an area that extends from near Warragul, east to the Snowy River and north to the Great Dividing Range. This area includes the Latrobe, Thomson, Macalister and Snowy rivers and the lower Latrobe wetlands covered by this section of the seasonal watering plan.

The State of Victoria has also entered into a Recognition and Settlement Agreement with the Gunaikurnai people. The Recognition and Settlement Agreement, executed under the *Traditional Owner Settlement Act 2010*, affords Gunaikurnai people rights relating to the use of public land within their agreement area.

Other Registered Aboriginal Parties in this geographic area are the Bunurong Land Council Aboriginal Corporation and Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, but their boundaries do not extend to the waterways managed with water for the environment in the Gippsland region.

Engagement

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

The International Association for Public Participation's Public Participation Spectrum (IAP2 Spectrum) has been used to categorise the levels of participation of stakeholders involved in the environmental watering planning process. Table 2.1.1 shows the IAP2 Spectrum categories and participation goals.

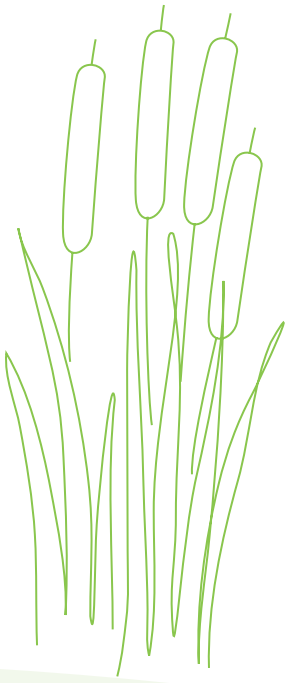


Table 2.1.1 International Association for Public Participation's Public Participation Spectrum categories and participation goals[1]

IAP2 level	Engagement goal
Inform	Provide balanced and objective information to assist understanding, alternatives, opportunities and/or solutions
Consult	Obtain feedback on analysis, alternatives and/or decisions
Involve	Work directly throughout a process to ensure that concerns and aspirations are consistently understood and considered
Collaborate	Partner in each aspect of the decision including the development of alternatives and the identification of the preferred solution
Empower	Place final decision making in the hands of the stakeholder

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

Table 2.1.2 shows the partners, stakeholder organisations and individuals with which West Gippsland CMA engaged when preparing the Latrobe River, lower Latrobe wetlands, Thomson and Macalister systems' seasonal watering proposals. This includes engagement conducted as part of developing the seasonal watering proposals as well as engagement during the preparation of key foundational documents that directly informed the proposals. VEWH staff were also consulted for operational information as part of the development of all annual seasonal watering proposals by CMAs.

The table also shows the level of engagement between West Gippsland CMA and stakeholders of the environmental watering program in the Gippsland region based on the CMA's interpretation of the IAP2 Spectrum.

The level of engagement differs between organisations and between systems, depending on the availability, capacity or interest of stakeholders to participate, roles and responsibilities of organisations in managing a site or system, and potential interaction of proposed watering with other activities on the waterway. For example, in the Gippsland region, Parks Victoria is more involved in planning and management of water for the environment for the lower Latrobe wetlands than for other systems, because it is the land manager for Dowd Morass and Sale Common and it operates the regulators used to release water to these sites.

Table 2.1.2 Partners and stakeholders engaged by West Gippsland CMA in developing seasonal watering proposals for the Latrobe River, lower Latrobe wetlands, Thomson River and Macalister River systems and other key foundation documents that have directly informed the proposals

	Latrobe River	Lower Latrobe wetlands	Thomson River	Macalister River
Community groups and environment groups	**IAP2 level: Inform** • Greening Australia • Latrobe Valley Field Naturalists • Native Fish Australia	**IAP2 level: Inform** • Greening Australia • Latrobe Valley Field Naturalists • Native Fish Australia	**IAP2 level: Involve** • Heyfield Wetlands Committee • Cowwarr Landcare Group • Waterwatch volunteers **IAP2 level: Inform** • Landcare groups • Birdlife Australia	**IAP2 level: Involve** • Environment Victoria • Maffra and districts Landcare network • Native Fish Australia

Table 2.1.2 Partners and stakeholders engaged by West Gippsland CMA in developing seasonal watering proposals for the Latrobe River, lower Latrobe wetlands, Thomson River and Macalister River systems and other key foundation documents that have directly informed the proposals *(continued)*

	Latrobe River	Lower Latrobe wetlands	Thomson River	Macalister River
Government agencies	**IAP2 level: Collaborate** • Parks Victoria	**IAP2 level: Collaborate** • Parks Victoria	**IAP2 level: Collaborate** • Melbourne Water • Southern Rural Water	**IAP2 level: Collaborate** • Southern Rural Water
	IAP2 level: Consult • Gippsland Water	**IAP2 level: Consult** • Gippsland Water	**IAP2 level: Involve** • Gippsland Water • Department of Environment, Land, Water and Planning - Water and Catchments	**IAP2 level: Involve** • Gippsland Water
	IAP2 level: Inform • Department of Land, Environment, Water and Planning (Latrobe Valley Regional Water Study) • Department of Land, Environment, Water and Planning (Waterways and Catchments) • East Gippsland CMA	**IAP2 level: Inform** • Department of Land, Environment, Water and Planning (Latrobe Valley Regional Water Study) • Department of Land, Environment, Water and Planning (Waterways and Catchments) • East Gippsland CMA		
Landholders/ farmers	**IAP2 level: Inform** • Individual landholders	**IAP2 level: Collaborate** • Field and Game Australia (Heart Morass)	**IAP2 level: Involve** • Individual landholders	**IAP2 level: Involve** • Macalister Irrigation District irrigators/ diverters • Other landholders
		IAP2 level: Inform • Individual landholders		
Local businesses	**IAP2 level: Inform** • Port of Sale Heritage River Cruises	**IAP2 level: Inform** • Port of Sale Heritage River Cruises		
Recreational users	**IAP2 level: Inform** • VRFish	**IAP2 level: Collaborate** • Field and Game Australia (Dowd Morass and Sale Common)	**IAP2 level: Involve** • Tourism operators • VRFish	**IAP2 level: Involve** • VRFish
		IAP2 level: Inform • VRFish		
Technical experts			**IAP2 level: Collaborate** • Arthur Rylah Institute (Department of Environment, Land, Water and Planning)	**IAP2 level: Collaborate** • Arthur Rylah Institute (Department of Environment, Land, Water and Planning)
Traditional Owners	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation	**IAP2 level: Involve** • Gunaikurnai Land and Waters Aboriginal Corporation

The NSW Government is responsible for planning environmental flows in the Snowy River in consultation with the Victorian Government. The Snowy Advisory Committee was formed in 2018 and provides community and expert advice about the pattern of environmental flows to the Snowy River. The committee's participants represent Aboriginal, local community and environmental interests, alongside NSW and Victorian government agencies. East Gippsland CMA is a member of the Snowy Advisory Committee, and the VEWH is an observer.

How have Traditional Owners' values and uses of waterways been considered?

The waterways of the Gippsland region are important resources for the Gunaikurnai people, with thousands of years of connection to Country evident through numerous registered Gunaikurnai cultural heritage sites. Today, water is no less important to the Gunaikurnai: access to water and being empowered to make decisions and manage natural resources including waterways and water bodies are integral to customary practices, to protecting cultural values and uses and to healing Country.

GLaWAC is the Registered Aboriginal Party for waterways managed with environmental flows in the Gippsland region, and it holds Native Title and a Recognition and Settlement Agreement over this area. GLaWAC representatives are working closely with the West Gippsland CMA to understand and find alignment between environmental watering objectives and cultural watering objectives.

GLaWAC has been represented on the environmental flows study review panels for the Thomson and Latrobe rivers. GLaWAC together with Gunaikurnai community members are undertaking Aboriginal Waterway Assessments in the Latrobe River system, and as part of this are assessing how to document, protect and further the cultural values and uses of waterways in the Gippsland region including the Thomson, Latrobe and Macalister rivers and Lower Latrobe wetlands which receive water for the environment.

GLaWAC and the West Gippsland CMA have a strong working relationship and a collaborative plan to nominate priority sites and determine flows that support Gunaikurnai cultural and environmental values during 2020–21. The teams share the CMA's Traralgon office. This proximity increases opportunities for knowledge exchange and an appreciation of the broader objectives of each organisation.

For the Thomson and Latrobe rivers, GLaWAC identified species of high cultural value that depend on water and water management that mimics nature. GLaWAC also expressed the importance of Sale Common and Dowd Morass and the need to protect the freshwater status as much as possible, and to manage invasive species that threaten native plants and animals.

Community benefits from environmental watering

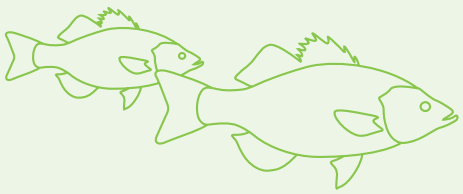
Healthy rivers and wetlands support vibrant and healthy communities. By improving the health of rivers, wetlands and floodplains, environmental flows also provide benefits to communities.

The VEWH and its program partners consider Aboriginal cultural values and uses and social and recreational values and uses of waterways when planning for environmental watering activities. Through engagement with community representatives, waterway managers aim to determine how community benefits from environmental flows can be optimised with environmental priorities for the year ahead.

Healthy waterways provide community benefits (such as providing nice places to walk or picnic and opportunities for recreational fishing). Community benefits can sometimes be enhanced by modifying environmental flows (such as timing a flow to support a community water skiing or fishing event), provided the environmental objective is not compromised.

Collaboration with Traditional Owner partners enables the VEWH and its partners to measure healthy waterways through a different lens: for instance for the Gunaikurnai, Country is connected, so achieving healthy Country means encouraging decision-making to benefit the whole system. For the Latrobe River system, that means from the source to the Gippsland Lakes, and not only what is in-stream but also the plants and animals on streamside land.

The VEWH and its partners seek to deliver these benefits throughout the water year, though opportunities can depend on the weather, climate or environmental conditions, water availability and the way the system is being operated to deliver water for other purposes.



How have economic, recreational and social values and uses of waterways been considered?

Environmental outcomes provide some direct economic, recreational, social benefits to communities. Waterway managers, in consultation with communities, have identified numerous opportunities to support these community benefits including activities such as tourism, kayaking, birdwatching, fishing, water skiing and hunting. Examples of these opportunities in the Gippsland region include:

- encouraging the spawning and recruitment of Australia bass, a popular recreational angling species in the Macalister and Thomson systems
- supporting waterbirds in the lower Latrobe wetlands, which are valued by birdwatchers and duck hunters. Duck-hunting seasons may be considered in the timing of wetland filling
- delivering flows in the Thomson River that refresh waterholes and improve summer swimming conditions. This is particularly important in the upper reaches of the river, where camping, hiking and swimming are popular recreational activities
- complementing community efforts to rehabilitate the Heyfield wetlands. An environmental watering trial in the western portion of the wetlands will assist the growth of native, semi-aquatic vegetation planted by students and other volunteers, support community educational programs, provide amenity adjacent to public walking tracks and provide opportunities to engage with nature
- increasing opportunities for canoers and kayakers to take advantage of high flows and white water on the Thomson and Snowy rivers.

Summaries of the social, recreational and economic values considered are provided for each system. Where the timing or management of planned environmental flows may be modified to align with a community benefit, this is identified alongside the potential watering actions.

Integrated catchment management

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

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

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

- works by West Gippsland CMA to protect and enhance stream banks along priority reaches of rivers and their tributaries including fencing to exclude stock, revegetation of riverbanks, willow removal and erosion control
- West Gippsland CMA's work with farmers along the Thomson and Macalister rivers on grazing and soil management, and on nutrient and water-use-efficiency projects that help to improve water quality and river health
- construction of a fishway on the Thomson River by West Gippsland CMA to improve fish passage near the heritage-listed Horseshoe Bend Tunnel, completed in August 2019. The fishway now allows Australian grayling, which are specifically targeted with releases of water for the environment, and other migratory fish, to access over 200 km of river habitat from the upper reaches of the Aberfeldy River down to the Latrobe River. Tupong have since been found above the Horseshoe Bend Tunnel in surveys conducted by the Arthur Rylah Institute
- a weed and willow control program by East Gippsland CMA in remote parts of the Snowy River catchment, which led to 200 km of the river now being willow-free: native vegetation is flourishing in areas where willows have been removed.

For more information about integrated catchment management programs in the Gippsland region, refer to the West Gippsland and East Gippsland regional catchment strategies and regional waterway strategies.

Risk management

During the development of the seasonal watering proposals for the Latrobe, Thomson and Macalister systems, environmental watering program partners assessed risks associated with potential environmental watering actions for 2020–21 and identified appropriate mitigating strategies. Risks and mitigating actions are continually assessed by program partners throughout the year (see subsection 1.3.6).

In the Snowy system, when weather conditions increase the risk of flooding, the NSW Department of Planning, Industry and Environment works with the NSW State Emergency Service, the Bureau of Meteorology, East Gippsland CMA and the VEWH to inform the community about the management of planned releases. Releases may be cancelled or rescheduled to limit flood impacts on private land.

Seasonal outlook 2020–21

Water for the environment for the Latrobe, Thomson and Macalister systems is held in Blue Rock Reservoir, Thomson Reservoir and Lake Glenmaggie respectively.

Environmental entitlements in these systems have unique characteristics that influence planning for environmental flows. The Thomson system receives a share of the daily inflows to the Thomson Reservoir and a secure annual allocation which is available on 1 July each year. In the Latrobe and Macalister systems, the availability of water for the environment depends on system inflows to Blue Rock Reservoir and Lake Glenmaggie respectively. Winter and spring are the peak inflow periods for all systems, so annual allocations are usually well-known before the start of summer. With several planned watering actions being met with natural flows in 2019–20 and the watering year ending with good inflows to storages, high carryover is likely in all systems and waterway managers will start 2020–21 with good water availability to deliver potential watering actions throughout the year.

During December 2019 and January 2020, severe bushfires burnt vast areas of east Gippsland. Heavy rainfall in these areas may wash ash and sediment into waterways including the Snowy River, which could have adverse effects on water quality and environmental values. Flushing flows planned for the Snowy River in winter and spring 2020 may help to mitigate some water quality impacts. West Gippsland was largely untouched by the recent bushfires, and waterways in that area may be essential for sustaining and restoring regional populations of aquatic animals. Environmental flows delivered to the Latrobe, Thomson and Macalister systems in 2020–21 aim to grow local populations of native fish, platypus and waterbirds, and some of these animals may disperse and contribute to the recovery of populations in nearby fire-affected areas in future years.

Most of the Gippsland region experienced below-average rainfall in 2017–18 and 2018–19, but climatic conditions varied considerably across the region in 2019–20. East Gippsland generally remained dry, although autumn rainfall was closer to the long-term average. West Gippsland had above-average rainfall in late winter 2019, near-average rainfall in spring 2019 and above-average rainfall in summer and autumn 2020. The higher rainfall and associated increase in natural streamflow in west Gippsland met many of the priority environmental watering actions for the Latrobe, Thomson and Macalister systems during 2019–20.

The Bureau of Meteorology climate outlook indicates wet conditions may continue into 2020–21, with winter rainfall predicted to be close to or slightly above the long-term average. Significant winter rain will deliver increased inflows to storages in west Gippsland that hold Victorian environmental water entitlements, and it may lead to high flow or overbank flows in some systems. Natural flows may meet many of the environmental flow requirements for the Latrobe, Thomson and Macalister systems early in 2020–21, and there may be opportunities to release environmental water — on top of natural freshes or as larger flows recede — to enhance environmental outcomes. For example, the duration of a fresh after a storage spill from Lake Glenmaggie could be extended to meet objectives for fringing vegetation and reduce the risk of bank slumping and flush the Latrobe River estuary to export excess salt from the upper water column. If conditions are drier through spring and summer 2020 and into autumn 2021, environmental water will be used to protect high-value environmental assets (such as by providing critical flows for threatened migratory fish, particularly with bushfire potentially affecting waterway habitat in east Gippsland), and set aside sufficient reserves to deliver early-season watering priorities in 2021–22.

Allocations across the west Gippsland systems are largely influenced by storage inflows during winter and spring, and so by late spring waterway managers can determine which potential watering actions they will likely be able to deliver for the rest of the 2020–21 water year. Where critical demands cannot be met by existing allocations, the VEWH and its program partners may investigate alternative supply options (such as transfers or trades). The VEWH also works with storage managers to identify opportunities to adjust the pattern of consumptive water deliveries to support environmental watering outcomes while still meeting the needs of consumptive water users.

The NSW Department of Planning, Industry and Environment plans and manages environmental flows in the Snowy system in consultation with Victorian and Australian governments and relevant stakeholder groups. The water year for the Snowy system starts in May and finishes in April the following year, which differs from how water is managed in the other Gippsland systems. The total volume for release and daily release targets for the Snowy River from May 2020 to April 2021 were endorsed by the Snowy Advisory Committee in February 2020, and daily releases will not vary unless flows increase the risk of flooding downstream or operational constraints prevent delivery.

2.2. Latrobe system

Waterway manager – West Gippsland Catchment Management Authority

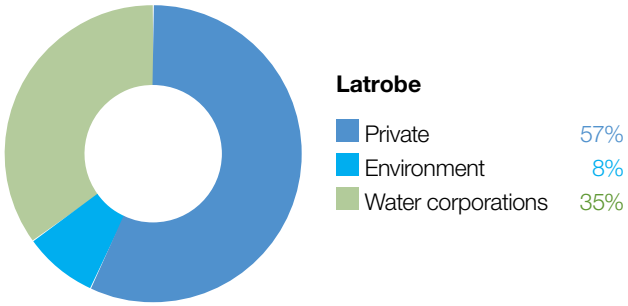
Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

Did you know...?

The Latrobe River is known to the Gunaikurnai people as *Durt-Yowan*, which means 'forefinger.'

The volume attributed to the environment in the Latrobe system does not include water that is available to the lower Latrobe wetlands because there is no limitation on the volume of water that can be supplied to the wetlands from the Latrobe River.



Proportion of water entitlements in the Latrobe basin held by private users, water corporations or environmental water holders at 30 June 2019

Top: Dowd Morass, Lower Latrobe wetlands, by West Gippsland CMA
Above: Lower Latrobe wetlands monitoring, by West Gippsland CMA

The Latrobe system includes the Latrobe River and lower Latrobe wetlands: Sale Common, Heart Morass and Dowd Morass.

2.2.1 Latrobe River

System overview

The Latrobe River originates on the Baw Baw Plateau and passes through relatively flat to undulating plains cleared for agriculture, before flowing into Lake Wellington (the westernmost point of the Gippsland Lakes). Notable tributaries include the Tanjil River, Narracan Creek, Morwell River, Tyers River, Traralgon Creek and the Thomson River.

Water for the environment is supplied to the Latrobe River from Blue Rock Reservoir on the Tanjil River. Blue Rock Reservoir also supplies water for electricity generators and a paper mill in the Latrobe Valley and urban supply.

The Latrobe River from Rosedale to the Thomson River confluence (reach 5) is the priority reach for water for environmental watering because it contains endangered plant communities that have good potential for rehabilitation.

Environmental values

The upper Latrobe River flows through state forest and is relatively intact and ecologically healthy. It contains continuous stands of river red gums and intact streamside vegetation, and it supports native animals including barred galaxias, river blackfish, Gippsland spiny crayfish and nankeen night herons.

The Latrobe River below Lake Narracan is regulated and highly degraded due to historic river management practices. Most large woody habitat has been removed from the river and many sections have been artificially straightened. These practices have caused significant erosion and widened the channel, which has in turn reduced the quality and quantity of habitat for aquatic plants and animals.

Endangered and vulnerable vegetation are found in all but the most modified sections of the Latrobe River. The banks along the lower reaches support stands of swamp scrub, characterised by swamp paperbark and tea tree. Mature river red gums grow adjacent to the lower Latrobe wetlands and provide nesting habitat for sea eagles and other birds of prey that hunt in the wetlands. The Latrobe River supports several native estuarine and freshwater fish including black bream, Australian bass, Australian grayling and short- and long-finned eel.

The Latrobe River and its tributaries provide an essential source of freshwater to the Gippsland Lakes system, of which the lower Latrobe wetlands are an important component.

Environmental watering objectives in the Latrobe River

	Maintain or increase native fish (migratory, resident and estuary) populations
	Maintain or increase in-stream geomorphic diversity
	Improve the condition and increase extent and diversity of submerged, emergent and streamside native vegetation Reduce the extent and density of invasive plants
	Increase the abundance of all macro- and micro-invertebrates
	Avoid adverse water quality conditions (such as high salinity) in the lower Latrobe River and estuary

Traditional Owner cultural values and uses

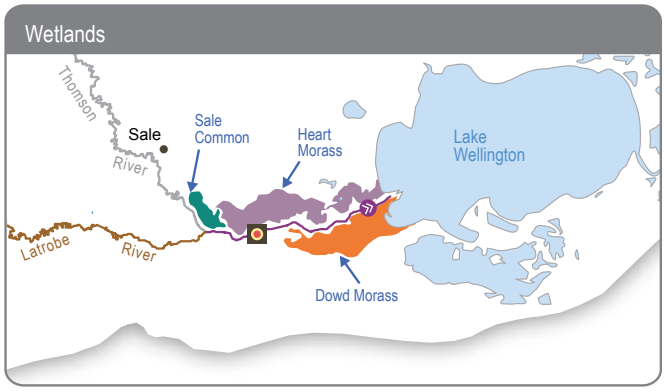
The Gunaikurnai have had a continued connection to Gunaikurnai Country for thousands of years, including with the waterways in the Latrobe River system. For the Gunaikurnai as traditional custodians there are immense challenges to heal, protect and manage Country which has been drastically altered since colonisation. Gunaikurnai see all of Country as connected with no separation between landscapes, waterways, coasts and oceans and natural and cultural resources – the cultural landscape is interdependent.

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of traditional custodians, with traditional knowledge.

Figure 2.2.1 The Latrobe system

Reach 1 Upstream of Willow Grove
Reach 2 Willow Grove to Lake Narracan
Reach 3 Lake Narracan to Scarnes Bridge
Reach 4 Scarnes Bridge to Kilmany South
Reach 5 Kilmany South to Thomson River confluence
Reach 6 Downstream of Thomson confluence
Reach 7 Lake Wellington
Reach 8 Tanjil River
Water infrastructure
Measurement point
Town
Indicates direction of flow

Grey river reaches have been included for context.
The numbered reaches indicate where relevant environmental flow studies have been undertaken.
Coloured reaches can receive environmental water.



For the Latrobe River system this has included:

- Aboriginal Waterway Assessments to examine cultural values and uses
- identification of primary objectives under the modified water regime
- expression of preliminary outcomes: watering actions that recognise and promote:
    - Healthy Country
    - the importance of the Latrobe River system to the Gunaikurnai songline of *Boran* (pelican) and *Tuk* (musk duck) and their respective water quality and habitat requirements
    - waterways as meeting places
    - preliminary accommodation of water quality and management requirements of species with cultural values and uses.

GLaWAC shared with the West Gippsland CMA plant and animal species of cultural significance in and around the waterways of the Latrobe Valley, and the importance of specific watering decisions to support them.

Watering requirements to support cultural values and uses include:

- timing of environmental watering planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody Healthy Country
- maintaining freshwater supply to Latrobe estuary, Dowd Morass, Sale Common and Heart Morass and associated freshwater habitats. The lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent plants and animals with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support health of native plants and animals with cultural values and uses of significance to the Gunaikurnai.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.2.1, West Gippsland CMA considered how environmental flows could support values and uses including:

- water-based recreation (such as water-skiing and fishing)
- riverside recreation and amenity (such as hunting)
- socio-economic benefits (such as commercial fishing, diverters for irrigation and farming, urban water supplies and power generation).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 2.2.1 with an icon.

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

West Gippsland CMA communicates with Lake Narracan Ski Club so environmental water releases can be timed to not affect the water levels in the lake during water skiing events, which typically take place between January and March.

Recent conditions

The Latrobe system experienced average to above-average rainfall throughout 2019–20, despite drier-than-average conditions occurring elsewhere in west Gippsland. By summer, environmental water allocations reached 100 percent of the entitlement volume.

Local rainfall and inflows from unregulated tributaries provided flow conditions that met all the watering actions that were planned for the Latrobe River from July 2019 until February 2020. High rainfall caused bankfull flows in winter and minor flooding in some reaches of the Latrobe River in late spring 2019, which provided ecologically important flow events that cannot be delivered through managed environmental flows. Water for the environment was used to partly deliver two freshes in mid-autumn 2020. Heavy rainfall occurred during these events, which reduced the amount of environmental water that needed to be released. The autumn freshes were timed to coincide with environmental flows in the Thomson and Macalister rivers to optimise outcomes for native fish (especially Australian grayling migration and spawning) and outcomes for the Latrobe estuary.

Scope of environmental watering

Table 2.2.1 describes the potential environmental watering actions in 2020–21, their functional watering objectives (that is, the intended physical or biological effect 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 functions.

Table 2.2.1 Potential environmental watering actions and objectives for the Latrobe River

Potential environmental watering action	Functional watering objectives	Environmental objectives
Summer/autumn low flow (250 ML/day or natural during December to May)	• Maintain an adequate depth in pool habitat to support aquatic animals and submerged vegetation • Limit encroachment by terrestrial vegetation and support the growth of emergent macrophyte vegetation • Maintain oxygen levels in pools • Maintain sediments in suspension to prevent pools filling	
Summer/autumn river fresh (one to four freshes of 920 ML/day for one to five days during December to May) 	• Wet benches to maintain habitat and support the growth of emergent macrophyte vegetation • Freshen water quality to support waterbug and zooplankton communities • Flush sediment (sands and silts) from pools and mix water in pools, helping to provide spawning conditions for Australian grayling and breeding substrate for river blackfish • Provide longitudinal connectivity for aquatic animals	
Summer/autumn estuary fresh (one to three freshes of 2,200 ML/day at reach 6 for seven to 10 days during December to May) 	Objectives listed for the summer/autumn river fresh and additional objectives for the Latrobe River estuary: • upper estuary: fully flush with freshwater to support submerged vegetation, provide suitable conditions including oxygen levels for aquatic animals, transport silt, wet benches and deliver freshwater to connected wetlands • mid-estuary: partially/fully flush the upper layer of the water column to improve water quality, support emergent macrophytes, provide freshwater habitat and associated food sources for freshwater fish and provide breeding opportunities for estuary fish • lower estuary: partially flush the upper layer of the water column; a flow of this magnitude will also provide opportunities to fill to the lower Latrobe wetlands Note: This event requires contributions of at least 1,280 ML/day from the Thomson River at Bundalaguah over the equivalent period to meet objectives	
Winter/spring fresh (one to two freshes of 3,200 ML/day at reach 6 for two days during June to November)[1]	Latrobe River objectives: • wet banks and higher benches to improve the condition of streamside vegetation • provide a variety of wetted areas for emergent macrophytes • maintain channel capacity and bench habitat Additional objectives for the Latrobe River estuary: • upper estuary: fully flush with freshwater to support submerged vegetation, increase oxygen levels for aquatic animals, transport silt, wet benches and deliver freshwater to connected wetlands • mid-estuary: partially/fully flush the upper layer of the water column to improve water quality, support emergent macrophytes, provide freshwater habitat and associated food sources for freshwater fish and provide breeding opportunities for estuary fish • lower estuary: partially flush the upper layer of the water column; a flow of this magnitude will also provide opportunities to fill to the lower Latrobe wetlands Note: Delivering the target flow event in the estuary will require contributions of 1,000–2,200 ML/day from the Thomson River at Bundalaguah over the equivalent period to meet objectives	

Table 2.2.1 Potential environmental watering actions and objectives for the Latrobe River *(continued)*

Potential environmental watering action	Functional watering objectives	Environmental objectives
Winter/spring low flow (620 ML/day during June to November)	• Wet benches to maintain habitat and support the growth of emergent macrophyte vegetation • Maintain oxygen levels in pools and maintain sediment (sands and silts) in suspension to prevent pools filling and depositing on substrates, helping to maintain habitat for waterbugs and breeding substrate for river blackfish • Longitudinal connectivity to allow movement/dispersal of aquatic animals	

[1] This fresh may involve inundating private land if delivered at higher magnitude, and it will be subject to obtaining landholder agreement. The magnitude of delivery depends on the relative contribution possible from the Thomson system.

Scenario planning

Table 2.2.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

Under all scenarios, summer/autumn freshes are a high priority in the Latrobe system. At durations of one to five days, these events aim to maintain the physical form of the river bed and improve water quality by flushing sediments and mixing water in pools, which supports aquatic animals including waterbugs. Longer duration freshes (seven to 10 days) will also meet water quality, fish and vegetation objectives for the Latrobe estuary and are a high priority under dry, average and wet scenarios. To meet the flow requirements for the Latrobe estuary, these longer-duration freshes need to coincide with releases in the Thomson River, as the full estuary fresh cannot be delivered from Blue Rock Reservoir without inundating some private land.

Summer/autumn low flows are a high priority under a drought scenario, to maintain oxygen and connectivity between pools. Water for the environment is unlikely to be required to deliver these flows under other scenarios because they are expected to be met naturally.

If more environmental water is available under a drought scenario, it may be used to increase the duration of summer/autumn low flows and/or deliver a summer/autumn estuary fresh. Under a dry scenario, extra environmental water would be used to deliver an additional summer/autumn estuary fresh.

Winter/spring freshes will improve environmental outcomes under average and wet scenarios. They are considered a high priority under a wet scenario, but there may not be enough available water to deliver them under an average scenario, so they are identified as a tier 1b priority. Large winter/spring freshes may wet private land and therefore landholder agreements will be needed before they are delivered as a managed environmental flow.

Winter/spring low flows and freshes are considered a lower priority under drought and dry scenarios. No tier 2 watering actions have been identified for the Latrobe River under average or wet scenarios, as natural inflows are expected to meet the remaining demands.

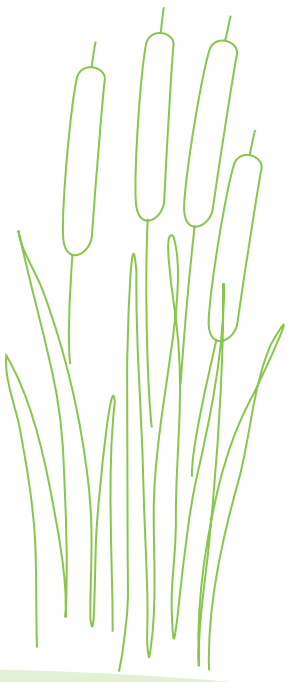


Table 2.2.2 Potential environmental watering for the Latrobe River under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Small contributions from unregulated reaches and tributaries of the Latrobe River with little opportunity for freshes to occur naturally • Consumptive demand from Blue Rock Reservoir will be very high and regular releases to the Tanjil River will contribute substantially to low flows	• There will be some natural flow that contributes to low flows and freshes • Consumptive demand from Blue Rock Reservoir will be high and contribute to low flows	• Natural flow will provide low flow throughout the year, and multiple freshes (most likely in winter/spring) • Some spills are likely and there will be releases for consumptive users which will partly contribute to low flows	• Natural flow will provide strong low flow throughout the year • Multiple spills from Blue Rock Reservoir will provide extended durations of freshes, high flows and overbank flows • No significant releases from consumptive entitlements in Blue Rock Reservoir are likely
Expected availability of water for the environment	• 15,000 ML	• 17,000 ML	• 22,000 ML	• 30,000 ML
Potential environmental watering – tier 1a (high priorities)	• Summer/autumn low flow (delivered in February to March) • Three summer/autumn river freshes (no extended freshes)	• Two summer/autumn river freshes • One summer/autumn estuary fresh (or river fresh if estuary freshening not required)	• One summer/autumn river fresh • Three summer/autumn estuary freshes (or river freshes if estuary freshening not required)	• One summer/autumn river fresh • Three summer/autumn estuary freshes (or river freshes if estuary freshening not required) • Two winter/spring freshes
Potential environmental watering – tier 1b (high priorities with shortfall)	• Summer/autumn low flow delivered continuously • One summer/autumn estuary fresh	• One additional summer/autumn estuary fresh	• One winter/spring fresh	• N/A
Potential environmental watering – tier 2 (additional priorities)	• Winter/spring low flow (deliver for one month)[1]	• One winter/spring fresh • Winter/spring low flow (deliver for one month)	• N/A	• N/A
Possible volume of environmental water required to achieve objectives[2]	• 12,800 ML (tier 1a) • 16,300 ML (tier 1b) • 9,000 ML (tier 2)	• 13,200 ML (tier 1a) • 7,200 ML (tier 1b) • 15,400 ML (tier 2)	• 7,400–15,200 ML (tier 1a) • 8,900 ML (tier 1b)	• 15,000–21,600 ML (tier 1a)
Priority carryover requirements	• N/A[3]			

[1] As low flows over winter and spring have a demand of 6,200–9,000 ML per month, only one month of continuous flow will likely be feasible.

[2] Environmental water requirements for tier 2 actions are additional to tier 1 requirements.

[3] There are no carryover provisions in the Blue Rock environmental entitlement.

2.2.2 Lower Latrobe wetlands

System overview

The lower Latrobe wetlands (Dowd Morass, Heart Morass and Sale Common) are an important component of the internationally recognised Gippsland Lakes Ramsar site and provide habitat for a variety of waterbirds of state, national and international conservation significance. The wetlands are located on the floodplain of the Latrobe River between its confluence with the Thomson River, and they form part of the Gippsland Lakes system.

River regulation and water extraction from the Latrobe, Thomson and Macalister rivers has reduced the frequency of small- and medium-sized floods that naturally wet the lower Latrobe wetlands. Construction of levees and drains and filling of natural depressions have also altered water movement into and through the wetlands. The drainage and flooding regime in all three wetlands is now managed to some extent with regulators connected to the Latrobe River.

Environmental values

Sale Common is one of only two remaining freshwater wetlands in the Gippsland Lakes system. It provides sheltered feeding, breeding and resting habitat for a large range of waterbirds, including the Australasian bittern.

Dowd Morass is a large, brackish wetland that regularly supports rookeries of colonial nesting waterbirds including Australian white ibis, straw-necked ibis, little black and little pied cormorants, royal spoonbills and great egrets.

Heart Morass is also a large brackish wetland, with open expanses providing shallow feeding habitat for waterbirds including black swans, Eurasian coots and a variety of ducks.

Together, the lower Latrobe wetlands function as a diverse and complementary ecological system. Colonial nesting waterbirds breed among swamp paperbark trees at Dowd Morass in spring. Migratory shorebirds feed on the mudflats that are exposed as the wetlands draw down and dry over summer. Waterfowl and fish-eating birds use open-water habitat at the wetlands year-round. The wetlands also support threatened vegetation communities including swamp scrub, brackish herbland and aquatic herbland.

Environmental watering objectives in the lower Latrobe wetlands

- Maintain the abundance of frog populations
- Maintain the abundance of freshwater turtle populations
- Maintain or restore a variety of self-sustaining submerged and emergent aquatic vegetation types
- Maintain or restore the diversity, condition and/or extent of native streamside vegetation fringing wetlands
- Discourage the introduction and spread, or reduce the extent and density of undesirable/invasive plants (Sale Common)
- Maintain or enhance waterbird breeding, recruitment, foraging and sheltering opportunities
- Provide suitable physio-chemical conditions to support aquatic life
- Avoid catastrophic water quality conditions (such as acid sulfate soil exposure) (Heart Morass)

Traditional Owner cultural values and uses

The Gunaikurnai have had a continued connection to Gunaikurnai Country for thousands of years, including with the waterways that feed into the lower Latrobe wetlands. For the Gunaikurnai as traditional custodians there are immense challenges to heal, protect and manage Country which has been drastically altered since colonisation. Gunaikurnai see all of Country as connected with no separation between landscapes, waterways, coasts and oceans and natural and cultural resources – the cultural landscape is interdependent.

GLaWAC are working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of traditional custodians, with traditional knowledge.

Leading up to the 2020-21 Seasonal Watering Plan, focus on the lower Latrobe wetlands has included:

- on Country discussions with GLaWAC and Gunaikurnai Elders and Community to examine cultural values and uses
- discussions regarding the importance of maintaining the wetlands as a freshwater system to support culturally significant species, including totem species
- the importance of the lower Latrobe wetlands to the Gunaikurnai traditionally, and today
- concerns regarding water quality, increasing salinity
- concerns regarding pest species including carp.

GLaWAC are sharing with the West Gippsland CMA plant and animal species of cultural significance in and around the waterways of the Latrobe Valley, and the importance of specific watering decisions to support them.

Watering requirements to support cultural values and uses include:

- timing of environmental watering planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody Healthy Country
- maintaining freshwater supply to Latrobe estuary, Dowd Morass, Sale Common and Heart Morass and associated freshwater habitats. The lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent flora and fauna with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support health of native flora and fauna with cultural values and uses of significance to the Gunaikurnai.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.2.3, the West Gippsland CMA considered how environmental flows could support values and uses including:

- water-based recreation (such as canoeing and fishing)
- riverside recreation and amenity (such as camping, birdwatching, duck hunting and amenity for access tracks)
- socio-economic benefits (such as commercial fishing).

Recent conditions

Climatic conditions in the lower Latrobe wetlands' catchment varied throughout 2019–20. Total rainfall was below average, but there were still some significant rain events that increased river levels throughout winter and spring 2019, particularly from the Latrobe River catchment, and they caused minor overbank flooding in late spring 2019 and again in late autumn 2020. The VEWH's entitlement for the lower Latrobe wetlands is not limited in volume, and regulator gates may be opened opportunistically based on water height in the Latrobe River at Swing Bridge.

Heart Morass, Dowd Morass and Sale Common were allowed to draw down in 2018–19 to allow the die-off of aquatic vegetation, promote nutrient cycling and allow terrestrial grasses and sedges to establish. Overbank flows in late winter and early spring 2019 partly refilled the wetlands. Environmental water was subsequently delivered as required (and when salinity in the Latrobe River estuary was not too high) to maintain water quality and habitat for aquatic and terrestrial animals, and to support the growth and flowering of semi-aquatic vegetation. Complete and near-complete fills were achieved at Dowd Morass and Heart Morass respectively in 2019–20, and a partial fill was achieved at Sale Common. A flushing flow was delivered to Heart Morass in spring 2019 to export salts and sulfates. Water levels at all wetlands were drawn down partially over summer to expose mudflats, which created feeding opportunities for wading birds and oxygenated soils to promote seed germination. High rainfall in late April and May 2020 caused minor flooding, allowing deliveries of freshwater to the lower Latrobe wetlands again in autumn.

Some water was retained in Dowd Morass and Sale Common to maintain habitat for Australasian bittern and other significant waterbirds that were observed at these sites during summer. Maintaining this habitat will likely be a priority throughout 2020–21.

Scope of environmental watering

Table 2.2.3 describes the potential environmental watering actions in 2020–21, their functional watering objectives (that is, the intended physical or biological effect of the watering action) and the longer-term environmental objective(s) they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological functions.

Table 2.2.3 Potential environmental watering actions and objectives for the lower Latrobe wetlands

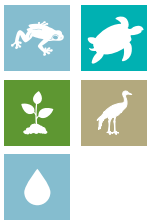
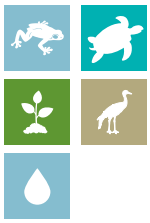
Potential environmental watering action	Functional watering objectives	Environmental objectives
Sale Common		
Partial fill (during July to December, with top-ups as required to maintain water height above 0.3m AHD [Australian Height Datum])	Maintain a water level at 50 percent or greater (0.3m AHD) to: • encourage the growth and flowering of semi-aquatic plants • provide appropriate wetland habitat for frogs and turtles • provide conditions that support waterbug communities and food resources for waterbirds • wet key habitats within the wetland for sufficient duration to discourage invasive plants, particularly the excessive spread of giant rush	
Fill (during August to November and maintain at full level for at least two months)[1]	• Wet the outer boundaries of the wetland to support the growth and flowering of streamside and fringing wetland plants, increasing foraging opportunities for waterbirds • Encourage bird breeding by providing nesting habitat to wet reed beds and provide deep water next to reedbeds • Provide connectivity between the river and wetlands and increase habitat and feeding opportunities for frogs and turtles	
Top-up (anytime, following bird breeding event if required)	• Prolong wetting of reed beds to maintain habitat and food resources for nesting waterbirds and protect chicks from predators	
Dowd Morass		
Partial fill (during April to December, with top-ups over summer to maintain surface coverage)[2]	• Provide seasonal variation in water depth throughout the wetland to support the growth and flowering of semi-aquatic plants • Wet vegetation and soils at middle elevations within the wetland to increase the abundance of waterbugs and other food resources for frogs, turtles and waterbirds • Provide connectivity between the river and wetlands and between wetlands, increasing available habitat for frogs and turtles • Support bird breeding (when delivered in spring/early summer following earlier fill) by maintaining wetted habitat around reed beds	
Fill (during August to November)	• Wet reed beds and deep water next to reedbeds to provide waterbird nesting habitat and to stimulate bird breeding • Wet high-elevation banks and streamside zone to support vegetation growth, creating nesting habitat for waterbirds • Wet vegetation and soils at higher elevations to stimulate ecosystem productivity and increase the abundance of waterbugs and other food resources for frogs, turtles and waterbirds • Provide connectivity between the river and wetlands and between wetlands, increasing available habitat for frogs and turtles	
Trigger-based fill or partial fill to control salinity (any time)[3]	• Dilute salt concentrations within the wetland that may be caused by king tides from Lake Wellington (likely occurring between March to May) or other sources • This watering action is likely to be triggered[4] if electrical conductivity is rising and reaches 7,000 µS/cm	
Top-up (anytime, following bird breeding event if required)	• Prolong wetting of reed beds to maintain habitat for waterbirds and protect chicks from predators, following an observed breeding event	

Table 2.2.3 Potential environmental watering actions and objectives for the lower Latrobe wetlands *(continued)*

Potential environmental watering action	Functional watering objectives	Environmental objectives
Heart Morass		
Partial fill (during August to December, with top-ups as required to maintain water level above -0.3 m AHD[5])	• Maintain water levels above -0.3 m AHD year-round to avoid exposing acid sulfate soils • Provide seasonal variation in water depth throughout the wetland to support the growth and flowering of semi-aquatic plants • Provide appropriate wetland fringing habitat for frogs and turtles • Provide conditions that support waterbug communities and food resources for frogs, turtles and waterbirds • Stimulate bird breeding by providing nesting habitat via inundating reed beds and deep water next to reedbeds	
Partial wetland flush (during June to November)	• Fill wetland to 0.5m AHD and allow water to flush through the wetland to export accumulated salts and sulfates • Allow the import and export of nutrients, dissolved organic carbon and seed dispersal between the Latrobe River and Heart Morass	
Trigger-based fill or partial fill to respond to acid sulfate soil exposure or control salinity (any time)[3]	• Respond to decreasing pH from the rewetting of exposed acid sulfate soils (most likely during high-wind events) • Dilute salt concentrations within the wetland that may be caused by king tides from Lake Wellington or other sources. This watering action is likely to be triggered[6] if wetland overtopping appears likely; based on rising water levels at Lake Wellington (reaching or exceeding +0.5m AHD)	
Top-up (anytime, following bird breeding event if required)	• Prolong wetting of reed beds to maintain habitat for waterbirds and protect chicks from predators, following an observed breeding event	

[1] While a full fill is the target, if salinity in the Latrobe River is too high a partial fill may be provided instead, helping to achieve some of the listed functional watering actions. This is most likely to eventuate under drought conditions.

[2] Timing of this flow changes depending on the scenario. An extended partial fill may be required under a drought scenario, however under dry to wet scenarios, partial fills either side of the full fill over late winter and spring are preferred. Top-ups over summer are unlikely under a drought scenario, as reduced flow in the Latrobe River is likely to increase salinity levels beyond a tolerable limit for wetland filling.

[3] Trigger-based events may override other planned watering actions if required, to maintain conditions at the site.

[4] If salinity level in the Latrobe River exceeds 15,000 µS/cm, a fill or partial fill will not be provided.

[5] Maintaining the water level above -0.3m AHD is a high priority, to avoid exposing acid sulfate soils.

[6] If the salinity level in the Latrobe River exceeds 10,000 µS/cm, a fill or partial fill will not be provided.

Scenario planning

Table 2.2.4 outlines the potential environmental watering and expected water use under a range of planning scenarios.

The planned approach in 2020–21 at the lower Latrobe wetlands is to mimic natural flows in the system by controlling flow through the regulators when water levels and water quality in the Latrobe River allow. Following extended drying in 2018–19 and 2019–20, actively-managed drying is not prioritised under any scenario, although this will likely occur naturally at all wetlands under drought, particularly as reduced flow in the Latrobe River leads to high salinity that may exceed recommended wetland tolerances.

The preferred watering regime for Sale Common involves:

- partially filling the wetland in winter and providing top-ups as needed to maintain water levels above 0.3 m AHD throughout the year to support wetland plant communities and habitat for frogs, turtles and waterbirds, and
- filling the wetland for at least two months from late winter or early spring to connect the wetland to the Latrobe River, stimulate the growth and recruitment of plant communities at the outer margins of the wetland and encourage waterbird breeding by providing appropriate nesting habitat.

Further top-ups may be delivered in response to a significant waterbird breeding event, if needed to protect the nests from ground-based predators and to maintain adequate food resources for nesting adults and chicks. Maintaining a target water level of 0.3 m AHD will wet about half of Sale Common, and it is considered important for ecological communities that experienced near-complete drying in 2018–19 and 2019–20. These watering actions are planned to be delivered under all scenarios, where possible.

The preferred watering regime for Dowd Morass involves:

- partially filling the wetland in autumn to maintain wetland plant communities and provide habitat and food resources for waterbirds, frogs and turtles
- filling the wetland in winter and spring to trigger waterbird breeding and improve the condition of streamside vegetation communities
- maintaining water at suitable levels through spring and summer to maintain habitat for aquatic plants and animals.

Additional water may be delivered to Dowd Morass at any time of year as needed and as water levels in the Latrobe River allow, to manage high salinity (caused by king tides from Lake Wellington) or to help waterbirds successfully fledge. The preferred water regime is likely to be delivered under dry, average and wet scenarios, but flow in the Latrobe River may not be high enough to allow Dowd Morass to fill under a drought scenario. Waterbird breeding is also a lower priority under a drought scenario, because there are unlikely to be sufficient resources in the surrounding landscape to support chicks and juveniles.

The preferred water regime for Heart Morass involves:

- maintaining water levels above -0.3 m AHD year round to prevent exposing acid sulfate soils
- partially filling the wetland from winter through to early summer to support wetland plant communities, maintain habitat and food resources for frogs, turtles and waterbirds, and to provide breeding opportunities for waterbirds
- briefly filling the wetland to allow a partial flush during a winter/spring high flow event in the Latrobe River to remove accumulated salt and sulphides.

Additional water may be delivered to Heart Morass at any time of year as needed and as water levels in the Latrobe River allow, to control water quality — that is, to respond to a low pH or a high-salinity event — or to help waterbirds successfully fledge. Water levels in the Latrobe River are not expected to be high enough to support a partial flush of Heart Morass under a drought scenario, and under a wet scenario the partial flush is likely to be replaced by a natural flood that will flush the whole wetland.

Table 2.2.4 Potential environmental watering for the lower Latrobe wetlands under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• No natural inflows from the Latrobe River, and wetlands are likely to dry completely	• Minor natural inflows from the Latrobe River in winter/spring; expect moderate-to-substantial drying in summer	• Moderate winter/spring flows in the Latrobe River likely to fill or partially fill the wetlands; expect minor drying in summer	• Major flows in the Latrobe River in winter/spring and possibly autumn/winter likely to fill all wetlands with very little drying in summer
Sale Common				
Potential environmental watering – tier 1 (high priorities)[1]	• Partial fill (during July to December, with top-ups as required to maintain height above 0.3m AHD) • Fill (during August to November) • Top-up (anytime, following bird breeding)			
Dowd Morass				
Potential environmental watering – tier 1 (high priorities)[1]	• Partial fill (during April to December) • Trigger-based fill or partial fill (anytime) • Top-up (anytime, following bird breeding)	• Partial fill (during April to June and in December, with top-ups over summer to maintain surface coverage) • Fill (during August to November) • Trigger-based fill or partial fill (anytime) • Top-up (anytime, following bird breeding)		
Heart Morass				
Potential environmental watering – tier 1 (high priorities)[1]	• Partial fill (during August to December with top-ups as required to maintain water level above -0.3m AHD) • Trigger-based fill or partial fill (anytime) • Top-up (anytime, following bird breeding)	• Partial fill (during August to December with top-ups as required to maintain water level above -0.3m AHD) • Fill to 0.5 m AHD followed by partial flushing flow (during June to November) • Trigger-based fill or partial fill (anytime) • Top-up (anytime, following bird breeding)		• Partial fill (during August to December with top-ups as required to maintain water level above -0.3m AHD) • Trigger-based fill or partial fill (anytime) • Top-up (anytime, following bird breeding)

[1] Potential environmental watering at the lower Latrobe wetlands is not classified as tier 1a, tier 1b or tier 2, because there is no limitation on the volume of water that can be supplied to the site from the Latrobe River. Water can be diverted to the lower Latrobe wetlands at any time of the year when flows are above -0.7 m AHD at the Latrobe River at the Swing Bridge gauging station.

2.3 Thomson system

Waterway manager – West Gippsland Catchment Management Authority

Storage managers – Melbourne Water (Thomson Reservoir), Southern Rural Water (Cowwarr Weir)

Environmental water holder – Victorian Environmental Water Holder

Did you know...?

The Thomson River is known to the Gunaikurnai people as *Carran Carran*, which means 'brackish water.'

Top: Thomson River, by West Gippsland CMA
Above: Vegetation at Heyfield wetlands, by VEWH

System overview

The Thomson River flows from the slopes of the Baw Baw Plateau to join the Latrobe River south of Sale. The major tributaries of the Thomson River are the Aberfeldy and Jordan rivers in the upper reaches and the Macalister River in the lowest reach. Most natural flow originates from the Aberfeldy River. Two major structures regulate flow on the Thomson River: Thomson Reservoir — the largest water supply storage for metropolitan Melbourne — and Cowwarr Weir — a regulating structure which supplies irrigation water to parts of the Macalister Irrigation District.

Thomson Reservoir harvests most of the flow from the Thomson River upper catchment and has a significant effect on flow in all downstream reaches. Natural flow from the Aberfeldy River, which meets the Thomson River below Thomson Reservoir, is essential for providing natural freshes and high flows in the Thomson River.

Water for the environment is held in the Thomson Reservoir and released into the river as required. Reach 3 of the Thomson River (from the Aberfeldy River confluence to Cowwarr Weir) is the highest priority for environmental watering due to its heritage river status, high-value native streamside vegetation, high-quality in-stream habitat and low abundance of exotic fish species.

At Cowwarr Weir, the Thomson River splits into the old Thomson River course (reach 4a) and Rainbow Creek (reach 4b) (see Figure 2.3.1). Passing flows throughout the year are split two-thirds down reach 4a and one-third down 4b to avoid impacts to irrigators located on Rainbow Creek. Water for the environment is primarily delivered to the old Thomson River course (reach 4a) to support fish migration, because Cowwarr Weir impedes fish movement through Rainbow Creek.

The Heyfield wetlands is a cluster of several pools located between the Thomson River and the township of Heyfield. Due to the construction of levees and weirs along the Thomson River, natural wetting of river waters to the wetland rarely occurs; and while the largest pool receives stormwater from the Heyfield township, smaller ponds rely on rainfall or pumped water for the environment to maintain environmental values. These values include significant revegetation that has been done in recent years.

Environmental values

The Thomson River supports six native species of migratory fish that need to move between the sea and freshwater environments to complete their life cycles. A focus for environmental flows management is the Australian grayling, which is listed as a threatened species in Victoria. Australian grayling spawn in response to autumn freshes, and the larvae and juveniles spend time at sea before returning to the freshwater sections of coastal rivers.

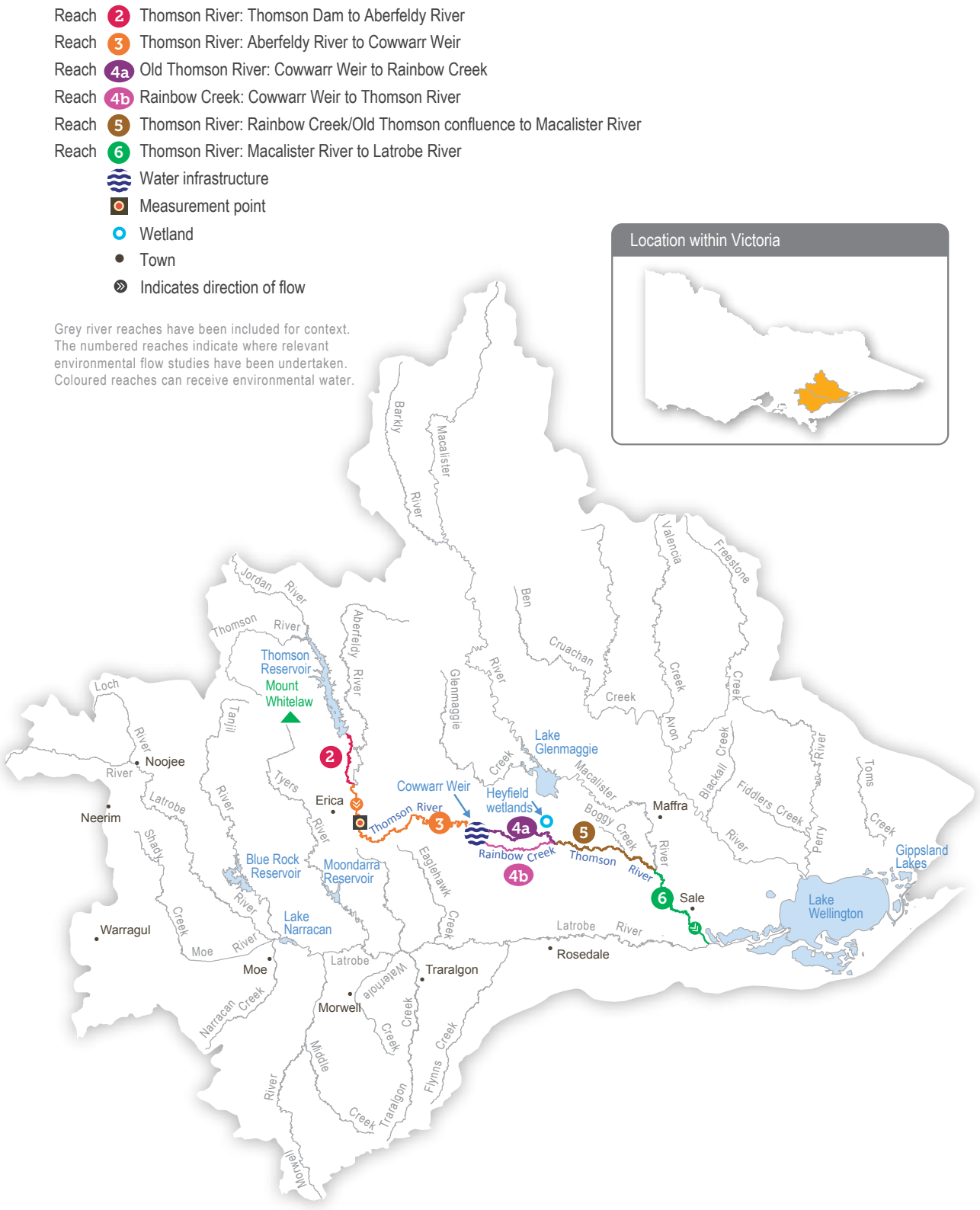
The composition and condition of streamside vegetation varies throughout the Thomson River catchment. The vegetation is intact and near-natural condition above Thomson Reservoir in the Baw Baw National Park. Streamside vegetation between Thomson Reservoir and Cowwarr Weir is mostly in good condition but is affected by exotic weeds including blackberry and gorse. Below the Cowwarr Weir, the vegetation is degraded due to stock access and widespread weed invasion.

The Heyfield wetlands are one of the few remaining freshwater wetland sites in the Gippsland Plains landscape area, and they are a source of habitat for aquatic and terrestrial animals that prefer shallow, slow-moving waterbodies, including threatened migratory birds.

Environmental watering objectives in the Thomson system

	Restore populations of native fish, specifically Australian grayling Maintain/enhance the structure of native fish communities Reduce competition from exotic fish
	Maintain the existing frog population and enhance opportunities for breeding
	Maintain channel form diversity including pools, to provide a variety of habitats for aquatic animals
	Increase the abundance of platypus
	Maintain and restore the structural diversity and zonation of streamside vegetation and reduce terrestrial encroachment/invasion (Thomson River) Increase the recruitment and growth of native in-stream, fringing and streamside vegetation (Thomson River) Maintain the existing vegetation, promote the growth and establishment of semi-aquatic species (Heyfield wetlands) Enhance the resilience of semi-aquatic and streamside woodland species (Heyfield wetlands)
	Restore and maintain the natural invertebrate community
	Provide freshwater habitat for migratory and non-migratory wetland birds within the Gippsland Plains landscape Continue to support observed terrestrial woodland and grassland birds by maintaining their streamside woodland habitat

Figure 2.3.1 The Thomson system



Traditional Owner cultural values and uses

The Gunaikurnai have had a continued connection to Gunaikurnai Country for thousands of years, including with the waterways in the Latrobe River system (which the Thomson River feeds into). For the Gunaikurnai as traditional custodians there are immense challenges to heal, protect and manage Country which has been drastically altered since colonisation. Gunaikurnai see all of Country as connected with no separation between landscapes, waterways, coasts and oceans and natural and cultural resources – the cultural landscape is interdependent.

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) are working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of traditional custodians, with traditional knowledge.

Traditionally, *Carran Carran* (Thomson River) was an important meeting place and a place to camp. Today, the majority of *Carran Carran* is inaccessible to the Gunaikurnai making it difficult to meet and yarn along the river. Assessments for watering requirements of *Carran Carran* for the Gunaikurnai have been based on cultural indicators, including:

- the condition of the lower Latrobe wetlands (which *Carran Carran* helps supply)
- the condition and prevalence of plants and animals with cultural values and uses
- species known to be indicators of water quality, water regimes and Healthy Country.

GLaWAC are sharing with the West Gippsland CMA plant and animal species of cultural significance in and around the waterways of the Latrobe Valley, and the importance of specific watering decisions to support them.

Watering requirements to support cultural values and uses include:

- timing of environmental watering planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody Healthy Country
- maintaining freshwater supply to Latrobe estuary, Dowd Morass, Sale Common and Heart Morass, and associated freshwater habitats. The lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent plants and animals with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support the health of native plants and animals with cultural values and uses of significance to the Gunaikurnai.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.3.1, West Gippsland CMA considered how environmental flows could support values and uses including:

- water-based recreation (such as kayaking, canoeing, fishing and swimming)
- riverside recreation and amenity (such as camping, hiking, duck hunting and birdwatching)
- community events and tourism (such as community education and events at the Heyfield wetlands, and visitation by locals and non-locals)
- socio-economic benefits (such as outdoor education companies).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 2.3.1 with an icon.

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

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

Autumn, winter and spring freshes create ideal whitewater rafting conditions for kayakers and canoers in the Thomson River. The timing of environmental flows may be adjusted to optimise opportunities to support these recreation activities, where it does not compromise environmental outcomes. Recreational kayakers and outdoor companies can take advantage of the whitewater rafting conditions as a result of these freshes.

For example, the spring fresh, which aims to cue the migration of Australian grayling, may be delivered over the Melbourne Cup racing carnival weekend in November when many people take advantage of the Tuesday public holiday to spend a long weekend kayaking on the Thomson River.

Recreational users interested in this shared benefit can register on the West Gippsland CMA website to receive a notification of the upcoming watering event.

Recent conditions

The start of the 2019–20 water year was warmer and drier than average in the Thomson River catchment, but above-average rainfall over summer increased inflows to the Thomson Reservoir and boosted water availability. Thomson Reservoir did not spill, so moderate releases were made throughout the year to supply minimum passing flow requirements, to meet irrigation demand and for environmental watering. Environmental watering actions were delivered in line with dry conditions during the first half of the year and average conditions from late summer.

Other than bankfull and overbank flows (which cannot be managed with water for the environment), all recommended environmental flows for the Thomson River were achieved through natural flows, managed environmental flows, operational deliveries or a combination of these.

Water for the environment was used to meet high-priority freshes in spring and autumn and to maintain target low flows as needed. The spring and autumn freshes are particularly important to cue native fish to move between habitats, supporting their breeding and recruitment.

Water for the environment was delivered to Heyfield wetlands in August and October 2019 to enhance the growth of recently planted aquatic and streamside vegetation and to increase feeding habitat for waterbirds.

Scope of environmental watering

Table 2.3.1 describes the potential environmental watering actions in 2020–21, their functional watering objectives (that is, the intended physical or biological effect 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 functions.

Table 2.3.1 Potential environmental watering actions and objectives for the Thomson River

Potential environmental watering action	Functional watering objectives	Environmental objectives
Autumn fresh (two freshes of 800 ML/day for seven days during April to May)	• Trigger the downstream migration (and spawning) of Australian grayling (April) • Trigger the downstream migration of tupong and Australian bass (May) • Carry plant seeds from the upper catchment for deposition downstream • Deposit sediments on benches, to provide substrate for vegetation • Wet the bank/bench to deliver dissolved and/or fine particulate organic matter • Scour substrates to remove accumulated fine sediment	
Spring fresh (one to two freshes of 800 ML/day for seven days during September to November) 	• Trigger upstream fish migration from marine/estuarine habitats and the recruitment of juvenile native species including Australian grayling and Australian bass (October to November) • Improve and maintain streamside vegetation by inundating the benches and providing variable water levels for plant zonation • Carry plant seeds from the upper catchment for deposition downstream • Deposit fine particulate sediments on the benches • Scour substrates to remove accumulated fine sediment	
Summer/autumn fresh (two freshes[1] of 230–350 ML/day for seven days during December to March)	• Increase the water depth to provide habitat for native fish • Wet aquatic and fringing vegetation to maintain its condition and support its growth • Maintain the physical form and functioning of the channel through mobilisation of fine sediments	
Autumn/winter/spring low flow (125–350 ML/day during May to November)[2]	• Increase the available habitat for waterbugs • Regulate the water temperature and wet large woody debris to provide food and shelter for waterbugs and fish • Increase the water depth to facilitate platypus and fish movement between localised habitats and increase foraging opportunities • Wet low-lying benches to prevent encroachment by invasive plants and permit seed dispersal	

[1] Additional summer freshes are likely to be met with operational water releases.

[2] Passing flows may be flexibly managed at rates less than 230 ML per day in July.

Table 2.3.1 Potential environmental watering actions and objectives for the Thomson River *(continued)*

Potential environmental watering action	Functional watering objectives	Environmental objectives
Summer/autumn low flow (340 ML/day at reach 6 during December to May)	• Partially flush the upper water column in the Thomson estuary, helping to sustain waterbug communities and fish by maintaining oxygen levels • Prevent high salinity levels, helping to maintain emergent macrophyte vegetation • Provide freshwater to the Latrobe River system	
Heyfield wetlands		
Fill (in August)	• Wet ponds to capacity, to stabilise the banks and support the spring growth of semi-aquatic vegetation • Provide freshwater habitat for waterbirds and frogs (such as growling grass frogs and golden bell frogs)	
Top-ups to maintain water level, as required (during October to November)	• Top up ponds before summer to maintain the existing vegetation and enhance its recruitment by triggering seed dispersal • Provide freshwater habitat for waterbirds and frogs (such as growling grass frogs and golden bell frogs)	
Partial drying (during December to February)	• Oxygenate surface soils, break down accumulated organic matter and cycle nutrients • Enhance waterbird food availability by exposing the mudflats and provide access to burrowing invertebrates	

Scenario planning

Table 2.3.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

The highest-priority potential watering actions in the Thomson River under all scenarios in 2020–21 are freshes in autumn, for which the primary objective is to trigger the migration and spawning of Australian grayling. It is critical to provide autumn freshes under all scenarios in 2020–21 to achieve the minimum two required spawning cues for Australian grayling over a three-year period: autumn freshes were achieved in 2019–20 but not delivered in 2018–19 due to construction of the Horseshoe Bend fishway. Spring freshes, smaller-magnitude summer/autumn freshes and winter/spring low flows are also planned to be delivered under all scenarios. The only difference between scenarios is the intention to deliver an extra fresh in early spring under average and wet conditions, to improve outcomes for streamside vegetation.

If possible, spring and autumn freshes in the Thomson system will be timed to coincide with releases in the Macalister and Latrobe systems, to optimise fish movement and optimise outcomes in the Latrobe estuary and lower Latrobe wetlands. Outcomes for the Latrobe estuary rely on flow contributions from all three systems.

The second of a two-year watering trial at the Heyfield wetlands is planned to continue in 2020–21 under all scenarios. The trial involves filling the wetlands in winter and providing top-ups as needed throughout spring, to maintain water levels for aquatic vegetation and to provide habitat for waterbirds and frogs. It is then intended the wetlands will be allowed to draw down over summer and autumn, to oxygenate the soil and allow nutrient cycling.

There are no critical watering actions that cannot be delivered with expected environmental water holdings (that is, there are no tier 1b priorities). Additional environmental watering priorities (tier 2) have been identified for the Thomson River under drought and dry scenarios. Additional water is required to deliver summer/autumn low flows in the Thomson River estuary (reach 6) to freshen water quality and support estuarine fish.

The tier 2 potential environmental watering actions identified are critical to achieving environmental objectives in the long term. They could be delivered in the current year if circumstances allow, but they can likely be deferred without significant environmental harm. The summer/autumn low flow targeting reach 6 is currently a tier 2 action, as further research is required to establish the specific salinity level tolerances and management triggers for determining when critical flushing of the Thomson River estuary is required, including whether the salt wedge pushing too high upstream could affect breeding and egg drift. In 2020–21 this watering action is not prioritised over freshes and winter/spring low flows, as it requires a significant volume of water and it can be partially met by passing flows from both the Thomson and Macalister rivers. In addition, freshes in both rivers may be timed to coincide, potentially achieving some of the functional objectives.

Under all scenarios, 5,500 ML of water for the environment is prioritised for carryover at the end of 2020–21, to meet critical early season demands in the Thomson River — spring low flows and freshes — under a drought scenario in 2021–22.

Table 2.3.2 Potential environmental watering for the Thomson River under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Limited natural flow • Large volume of consumptive water released from storage	• Natural flow from Aberfeldy River and other tributaries contributes to low flow and freshes • Moderate volume of consumptive water released from storage	• Natural flow from Aberfeldy River and other tributaries contributes to low flow, freshes and high flows • Small volume of consumptive water released from storage	• Natural flow from Aberfeldy River and other tributaries contributes to low flow, freshes and sustained high flows • Minimal volume of consumptive water released from storage
Expected availability of water for the environment	• 29,000 ML	• 32,000 ML	• 35,000 ML	• 38,000 ML
Potential environmental watering – tier 1a (high priorities)	• Two autumn freshes • One spring fresh • Two summer/autumn freshes • Winter/spring low flow		• Two autumn freshes • Two spring freshes • Two summer/autumn freshes • Winter/spring low flow	
Potential environmental watering – tier 1b (high priorities with shortfall)	• N/A			
Potential environmental watering – tier 2 (additional priorities)	• Summer/autumn low flow			• N/A
Possible volume of environmental water required to achieve objectives[1]	• 27,000 ML (tier 1a) • 16,700 ML (tier 2)	• 31,200 ML (tier 1a) • 16,700 ML (tier 2)	• 34,500 ML (tier 1a) • 6,300 ML (tier 2)	• 37,300 ML (tier 1a)
Priority carryover requirements	• 5,500 ML[2]			
Heyfield wetlands				
Potential environmental watering – tier 1a (high priorities)	• Fill (in August) • Top-ups to maintain water level as required (during October to November) • Partial drying (during December to February)			
Possible volume of environmental water required to achieve objectives	• 15–25 ML (tier 1a)		• 10–17 ML (tier 1a)	• 7–12 ML (tier 1a)

[1] Environmental water requirements for tier 2 actions are additional to tier 1 requirements.

[2] Priority carryover volumes have been incorporated into tier 1a demands.

2.4 Macalister system

Waterway manager – West Gippsland Catchment Management Authority

Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

Did you know...?

Australian grayling, short-finned eels, long-finned eels, tupong, Australian bass, short-headed lamprey and common galaxias all migrate between the Macalister River, its estuary and the sea to complete their life cycles with the help of environmental flows.

Top: Macalister River at Lanigans Bridge, by West Gippsland CMA
Above: Monitoring, by West Gippsland CMA

System overview

The Macalister River flows from Mt Howitt in the Alpine National Park and joins the Thomson River south of Maffra. The river winds its way in a south-easterly direction through mostly forested, confined valleys and narrow floodplains above Lake Glenmaggie. The downstream reaches flow through wide alluvial floodplains that have been cleared for agriculture. The Wellington River and Glenmaggie Creek are the main tributaries of the Macalister River.

Lake Glenmaggie is the major water-harvesting storage regulating the Macalister River. Maffra Weir is a small diversion weir located further downstream in Maffra.

Before the construction of Lake Glenmaggie, the Macalister River would regularly receive high and medium flows in winter and spring. Although Lake Glenmaggie regularly spills, high flows are less frequent than natural because much of the water is captured by the storage. A notable impact of irrigation and water-harvesting is reversed seasonality of flows between Lake Glenmaggie and Maffra Weir. Summer flows through this reach are much higher than natural due to the delivery of irrigation water. Winter flows in this reach are lower than natural because a high proportion of the inflows are captured and there are no irrigation demands over winter. Below Maffra Weir, most flows are diverted for irrigation in summer/autumn. The changed hydrology restricts fish migration, limits the growth and recruitment of in-stream and streamside plants and reduces the quality of in-stream habitat.

Water for the environment is stored in Lake Glenmaggie and released to the Macalister River. The river is divided into two reaches for the purposes of managing environmental flows: Lake Glenmaggie to Maffra Weir (reach 1) and Maffra Weir to the Thomson River (reach 2).

Maffra Weir is a major barrier to fish movement along the river, so environmental watering for migratory fish objectives mainly focus on reach 2. All other objectives apply to both reaches 1 and 2.

Environmental values

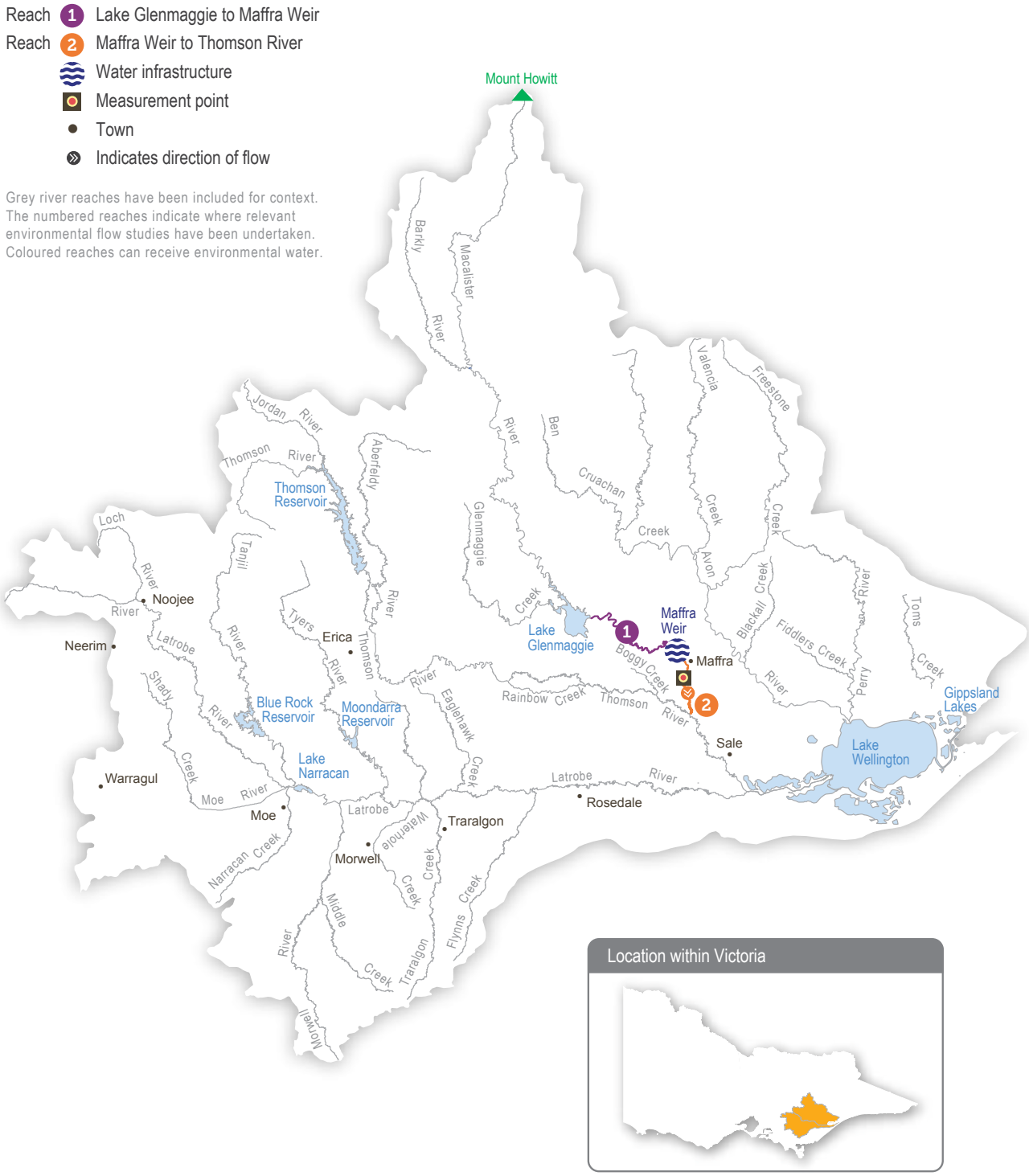
There are seven migratory native fish species that move between the Macalister River, the estuary and the sea to complete their life cycle. These species include the Australian grayling, short-finned eel, long-finned eel, tupong, Australian bass, short-headed lamprey and common galaxias. Yellow-eye mullet, which is an estuarine species, has been recorded in the river. Platypus and rakali (water rats) are widely distributed through the Macalister River and its tributaries.

The streamside vegetation corridor along the regulated reaches of the Macalister River is fragmented. Immediately below Lake Glenmaggie, the vegetation is in good condition and includes remnant river red gums and good-quality stands of shrubs, particularly in areas where revegetation has occurred in combination with stock exclusion. Further downstream, the vegetation is degraded. In recent years, the cover of in-stream vegetation has declined, which may be due to a combination of increased water turbidity, erosion and a lack of an appropriate water regime to encourage plant growth. The cover of non-woody plants (such as reeds, sedges and rushes) along the fringes of the river is patchy.

Environmental watering objectives in the Macalister River

	Increase the distribution, recruitment and abundance of all native fish, and increase opportunities for the spawning and recruitment of native migratory fish (such as the Australian grayling)
	Improve and maintain the form of the riverbank and bed to provide physical habitat for aquatic animals and plants
	Increase the abundance of platypus and rakali (water rats)
	Improve native emergent (non-woody) and fringing (woody) vegetation in the streamside zone Reinstate or instate submerged aquatic vegetation
	Increase the abundance and number of functional groups of waterbugs

Figure 2.4.1 The Macalister system



Traditional Owner cultural values and uses

The Gunaikurnai have had a continued connection to Gunaikurnai Country for thousands of years, including with the waterways in the Latrobe River system (which the Macalister River feeds into). For the Gunaikurnai as traditional custodians there are immense challenges to heal, protect and manage Country which has been drastically altered since colonisation. Gunaikurnai see all of Country as connected with no separation between landscapes, waterways, coasts and oceans and natural and cultural resources – the cultural landscape is interdependent.

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) are working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of traditional custodians, with traditional knowledge.

GLaWAC expressed that more water needs to go down the Macalister River between Lake Glenmaggie and Lake Wellington, to improve water quality including the threat of salinity, and support plants and animals with cultural values and uses.

Timing of watering events has also been raised by GLaWAC. This includes providing increased water depth to promote downstream fish migration and spawning, deeper water pools to prevent water quality degradation, and more variation to water levels to better mimic natural conditions.

Traditionally the landscape – which includes the Macalister River, anabranches, and associated floodplains – has been a rich source of food, medicine and resources for the Gunaikurnai people. In the area, there are many sites of cultural significance near the river and around Lake Glenmaggie. The Gunaikurnai people have moved through the landscape along the waterways for thousands of years, sourcing food and plants along the way.

From the perspective of the Gunaikurnai people, the land and waterways flowing to the Gippsland Lakes are interconnected and cannot be considered separately where decisions made can impact downstream. The lower Latrobe wetlands and the rivers that feed them, including the Macalister, have important cultural significance to the Gunaikurnai people.

Watering requirements to support cultural values and uses include:

- timing of environmental watering planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody Healthy Country
- maintaining freshwater supply to Latrobe estuary, Dowd Morass, Sale Common and Heart Morass, and associated freshwater habitats. The lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent plants and animals with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support the health of native plants and animals with cultural values and uses of significance to the Gunaikurnai.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.4.1, West Gippsland CMA considered how environmental flows could support values and uses including:

- water-based recreation (such as kayaking, fishing and swimming)
- socio-economic benefits (such as preventing erosion and potential land loss for local landholders).

Recent conditions

The Macalister River catchment has observed ongoing very dry climatic conditions over the last three years. Rainfall has been below average and temperatures warmer than average. In June 2019, the storage level at Lake Glenmaggie was exceptionally low: just 6.1 percent of the full reservoir capacity. Opening allocations of 45 percent towards high-reliability water shares were declared by the storage manager, and this increased to 80 percent by mid-August after inflows improved the water storage level. Despite the dry start, continued inflows over spring led to full allocations for high-reliability water shares by the end of September 2019, boosting water available for environmental watering. Low-reliability water shares also increased throughout the year in response to inflows, reaching full allocation in April 2020.

As of 1 June 2020, Lake Glenmaggie had not spilled in 2019–20. This is an unusual occurrence: historically, Lake Glenmaggie spills most years, as it is a relatively small reservoir in a productive water catchment. 2019–20 was the second consecutive year without a spill, demonstrating how dry the system has been in recent times. Without a spill, the natural high and bankfull flows that usually occur in the Macalister River in winter/spring were absent, but above Maffra Weir the river flowed steadily for most of the year, because water for irrigation and urban supply is delivered between Lake Glenmaggie and the offtake at Maffra Weir. Below Maffra Weir, some moderate natural flows occurred in spring and late summer after heavy rainfall.

Environmental flows were delivered year-round to provide several objectives in the Macalister system. Flows were delivered over winter to maintain habitat for aquatic animals and to support the establishment of in-stream vegetation. This included a winter fresh in August 2019, and again in June 2020, which aimed to cue the downstream migration of tupong and Australian bass towards the Latrobe estuary for breeding and spawning. A spring fresh was delivered in early November 2019, to encourage juvenile fish to migrate into the Macalister River from their estuary nurseries as well as to wet bankside vegetation and enable native seed dispersal.

In autumn 2020, a fresh to cue the downstream migration of Australian grayling towards the Latrobe River estuary for spawning was delivered. This event coincided with an equivalent fresh in the Thomson River system to optimise fish responses across both systems.

All tier 1a watering actions planned for 2019–20 under both a dry and average scenario were met. As Lake Glenmaggie did not spill, there were no tier 1b actions, either with releases of water for the environment or natural and operational flows in the system.

Scope of environmental watering

Table 2.4.1 describes the potential environmental watering actions in 2020–21, their functional watering objectives (that is, the intended physical or biological effect of the watering action) and the longer-term environmental objective(s) they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological functions.

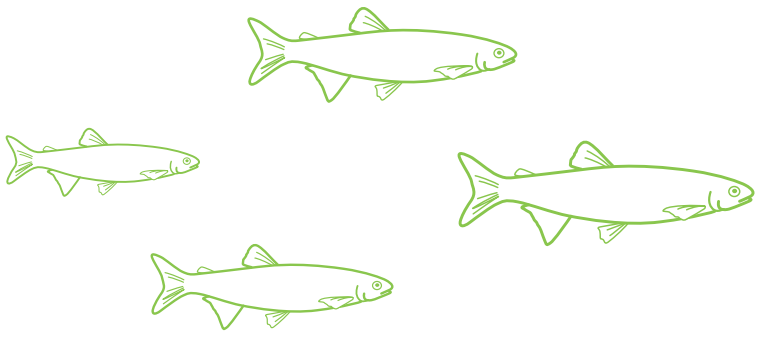


Table 2.4.1 Potential environmental watering actions and objectives for the Macalister River

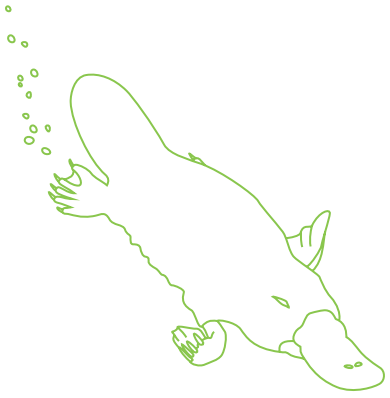
Potential environmental watering action	Functional watering objectives	Environmental objectives
Macalister River reaches 1 and 2		
Autumn/winter low flow (90 ML/day during March to August)	• Provide minimum depth over riffles for fish species that are migrating (i.e. Australian grayling) or about to migrate (i.e. tupong and Australian bass) downstream towards estuary habitat for spawning or breeding • Provide permanent wetted habitat for waterbugs through minimum water depth in pools • Provide connectivity throughout the river for the local movement of platypus and rakali (water rats), as well as protection from predation, access to food sources and to maintain refuge habitats • Provide flows with low water velocity and appropriate depth to improve water clarity and enable establishment of submerged vegetation • Provide sustained wetting of low-level benches (increasing water depth) to limit terrestrial vegetation encroachment	
Spring/summer low flow (90 ML/day during September to January)	• Maintain the water depth in pools and hydraulic habitat for native fish • Maintain permanent wetted habitat in pools and riffles for waterbugs • Maintain shallow, slow-flowing habitat to enable the establishment of in-stream vegetation • Maintain a minimum depth in pools to allow for turnover of water and to slow degradation of water quality to support aquatic life • Expose and dry lower channel features for re-oxygenation	
Spring/summer fresh (one to two freshes of 1,500 ML/day for three days during September to December)[1]	• Cue the upstream migration of adult fish (e.g. short-headed lamprey), and the recruitment of juveniles (e.g. Australian grayling, tupong, common galaxias, Australian bass, short and long-finned eels) from marine/estuarine environments • Wet a greater area of the stream channel (increasing water depth) to limit terrestrial vegetation encroachment • Wet mid- and higher-level benches to water woody vegetation • Flush pools to improve the water quality and increase wetted habitat for waterbugs • Provide flows with sufficient shear stress to flush fine sediment from small gaps to improve geomorphic habitat	
Macalister River reach 2		
Autumn fresh (one fresh of 350 ML/day for three to seven days during April to May)	• Cue the downstream migration for Australian grayling towards the estuary for spawning • Fully flush the upper Thomson estuary (when delivered for greater than three days and combined with freshes in the Thomson River) to flush sediments from substrates, provide water quality conditions that support waterbugs and to provide freshwater to the lower Latrobe River and wetlands	
Winter fresh (one to two freshes of 700 ML/day for four to five days during June to August)	• Cue the downstream migration towards the estuary of Australian bass for spawning and of tupong for breeding	

Table 2.4.1 Potential environmental watering actions and objectives for the Macalister River *(continued)*

Potential environmental watering action	Functional watering objectives	Environmental objectives
Spring fresh (one fresh of 700 ML/day for five days during September to November)	• Cue the upstream migration of adult fish (e.g. short-headed lamprey), and recruitment of juveniles (e.g. Australian grayling, tupong, common galaxias, Australian bass, short and long-finned eels) from marine/estuarine environments • Wet a greater area of the stream channel (increasing water depth) to limit terrestrial vegetation encroachment • Wet low and mid-level benches to facilitate the dispersal of emergent and fringing vegetation throughout the reach	
Summer/autumn fresh (one to three freshes of 140 ML/day for three to 10 days during December to May)	• Increase the depth to allow fish to move throughout the reach • Flush pools to maintain water quality for aquatic animals • Flush substrates and improve the quality of existing waterbug habitat and food supply • Wet low benches to facilitate the longitudinal dispersal of emergent vegetation • Provide flows with sufficient shear stress to flush fine sediment from small gaps to improve geomorphic habitat	
Trigger-based summer/autumn low flow (35–60 ML/day during December to May)[2]	• Maintain permanent wetted habitat in pools and riffles for aquatic animals • Maintain shallow, slow-flowing habitat to maintain in-stream vegetation • Maintain a minimum depth in pools to allow for turnover of water and to slow degradation of water quality to support aquatic life	

[1] This fresh is only planned to be delivered following a spill in Lake Glenmaggie (if the magnitude is lower than minor flood level), to extend or slow the rate of ramp-down. If a spill occurs, delivering this fresh will meet the functional flow objectives of the lower magnitude spring/summer fresh.

[2] A low flow of 35–60 ML per day may be triggered if passing flows from Maffra Weir reduce or cease.



Scenario planning

Table 2.4.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

The assumed supply of environmental water for 2020–21 enables planning for a suite of freshes and low flows in winter, spring and autumn under all climate scenarios. An autumn fresh to cue the downstream migration of Australian grayling is the highest-priority fresh, to achieve the minimum two required spawning cues for this species over a three-year period; autumn high flows were achieved in 2019–20 but not delivered in the Macalister or Thomson rivers during 2018–19 due to construction of the Horseshoe Bend fishway.

A winter fresh to cue the downstream movement of tupong and Australian bass towards the Latrobe estuary for breeding and spawning, and a spring fresh to cue the upstream migration of adult fish from estuarine environments and promote the recruitment of juveniles are also planned. Low flows may be delivered either side of freshes or when operational flows supplying irrigators are insufficient to maintain water quality and connectivity through the river system, particularly below Maffra Weir and during autumn and winter when there is little delivery of water to supply irrigation customers. Depending on the magnitude of the fresh and whether or not it follows a storage spill, additional objectives for watering floodplain vegetation and flushing pools may be achieved.

In a dry, average or wet scenario, a spill at Lake Glenmaggie is expected in spring. Water for the environment may be used following the peak of the spill to extend the event and ensure the water level does not drop off too suddenly. Freshes in spring aim to cue the upstream migration of adult migratory fish from estuarine environments and promote the recruitment of juveniles. Under a drought scenario, Lake Glenmaggie is not expected to spill, and a smaller fresh will likely be delivered in late spring instead (still meeting flow objectives for migratory fish), followed by low flows to maintain water depth and hydraulic habitat for native fish. During summer and autumn, small-magnitude freshes (to improve water quality and maintain connectivity between habitats for aquatic animals) are planned under all scenarios, but the duration and frequency of the freshes is variable. For example, under drought and dry scenarios, it may be necessary to increase the duration of summer autumn freshes from three to 10 days to prevent pools stagnating. If passing flows provided below Maffra Weir reduce or cease under a drought scenario, water for the environment may be used to supplement reduced passing flows to maintain connectivity and oxygen levels below Maffra Weir.

If additional water for the environment is available under any scenario, it will potentially be used to extend the duration and magnitude of winter/spring low flows or to deliver an additional winter/spring fresh to increase flow variability and provide more opportunities for fish and platypus to move throughout the system.

A critical carryover volume of at least 1,500 ML is identified into 2021–22 under all scenarios, to ensure there is enough water to deliver winter low flows in July and August 2021.

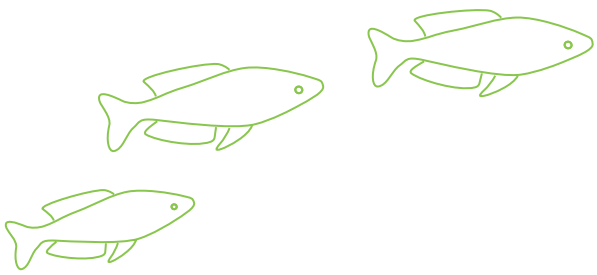


Table 2.4.2 Potential environmental watering for the Macalister River under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• No natural flow • Passing flows at Maffra Weir reduced	• Possible spills from Lake Glenmaggie in spring, minor flood levels may occur • Passing flows at Maffra Weir may be reduced	• Regular spills from Lake Glenmaggie in spring, minor to moderate flood levels may occur	• Large and frequent spills from Lake Glenmaggie, moderate to major flood levels may occur
Expected availability of water for the environment	• 16,500 ML	• 19,800 ML	• 21,800 ML	• 26,300 ML
Potential environmental watering – tier 1a (high priorities)	• One autumn fresh (reach 2) • Autumn/winter low flow (reach 1 and 2) • Spring/summer low flow (reach 1 and 2) • One winter fresh (reach 2) • One spring fresh (reach 2) • One summer/autumn fresh (reach 2) • Trigger-based summer/autumn low flow (reach 2)	• One autumn fresh (reach 2) • Autumn/winter low flow (reach 1 and 2) • Spring/summer low flow (reach 1 and 2) • One winter fresh (reach 2) • One spring fresh (reach 2) or spring/summer fresh (reach 1 and 2) following spill • One summer/autumn fresh (reach 2) • Trigger-based summer/autumn low flow (reach 2)	• One autumn fresh (reach 2) • Autumn/winter low flow (reach 1 and 2) • Spring/summer low flow (reach 1 and 2) • One winter fresh (reach 2) • One spring fresh (reach 2) or spring/summer fresh (reach 1 and 2) following spill • One summer/autumn fresh (reach 2)	• One autumn fresh (reach 2) • Autumn/winter low flow (reach 1 and 2) • Spring/summer low flow (reach 1 and 2) • One winter fresh (reach 2) • One spring/summer fresh (reach 1 and 2) following spill • One summer/autumn fresh (reach 2)
Potential environmental watering – tier 1b (high priorities with shortfall)	• Two additional summer/autumn freshes (reach 2)	• Two additional summer/autumn freshes (reach 2) • Extend low flow duration through winter/spring if Lake Glenmaggie spills	• Extend low flow duration through winter/spring following Lake Glenmaggie spill	• Extend low flow duration through winter/spring following Lake Glenmaggie spill
Potential environmental watering – tier 2 (additional priorities)	• Extend duration of delivering low flows through winter/spring months	• One additional winter fresh (reach 2)	• One additional winter fresh (reach 2)	• One additional spring/summer fresh (reach 2)
Possible volume of environmental water required to achieve objectives[1]	• 16,200 ML (tier 1a) • 6,600 ML (tier 1b) • 1,200–3,600 ML (tier 2)	• 18,000 ML (tier 1a) • 7,800–10,200 ML (tier 1b) • 4,900 ML (tier 2)	• 20,400 ML (tier 1a) • 1,200–3,600 ML (tier 1b) • 4,900 ML (tier 2)	• 25,800 ML (tier 1a) • 1,200–3,600 ML (tier 1b) • 4,900 ML (tier 2)
Priority carryover requirements	• 1,500–1,900 ML[2]			

[1] Environmental water requirements for tier 2 actions are additional to tier 1 requirements.

[2] Priority carryover volumes have been incorporated into tier 1a demands.

2.5 Snowy system

Waterway managers – East Gippsland Catchment Management Authority and New South Wales Department of Planning, Industry and Environment

Storage manager – Snowy Hydro Limited

Environmental water holders – Victorian Environmental Water Holder, New South Wales Department of Planning, Industry and Environment

Did you know...?

The Snowy River is a popular spot for whitewater rafting, canoeing and kayaking. Most flows from the upper Snowy River catchment are captured in lakes Eucumbene and Jindabyne. Environmental flows released from Lake Jindabyne provide important paddling opportunities that are no longer available from natural flows.

Top: Snowy River rafting, by East Gippsland CMA
Above: Swans on the Snowy River at Marlo, by Bruce Paton, VEWH

System overview

The Snowy River originates on the slopes of Mount Kosciuszko. It drains the eastern slopes of the Snowy Mountains in New South Wales (NSW) before flowing through the Snowy River National Park in Victoria and into Bass Strait.

There are four major dams and multiple diversion weirs in the upper Snowy River catchment that divert water to the Murrumbidgee and Murray River valleys. The hydrological effects of the Snowy Mountains Scheme are substantial, but they are partly alleviated by the contribution of flows from tributaries (such as the Delegate River in NSW and the Buchan and Brodribb rivers in Victoria).

Construction and operation of the Snowy Mountains Hydro-electric Scheme previously diverted 99 percent of the Snowy River's mean annual natural flow at Jindabyne. The loss of flow changed the structure and function of the river, reduced the opening of the Snowy River entrance to Bass Strait and resulted in a decline in environmental values.

The Victorian, NSW and Commonwealth governments have recovered water to help restore damage done by decades of limited flow. Victorian water for the environment available for use in the Snowy system is held in the Murray, Goulburn and Loddon systems. This water is made available for environmental flows in the Snowy River via a substitution method, whereby Victorian water for the environment replaces water that was earmarked for transfer from the Snowy to Victoria to support irrigation demands. The NSW Department of Planning, Industry and Environment plans environmental flow releases in the Snowy River, in consultation with the Victorian Government.

Environmental values

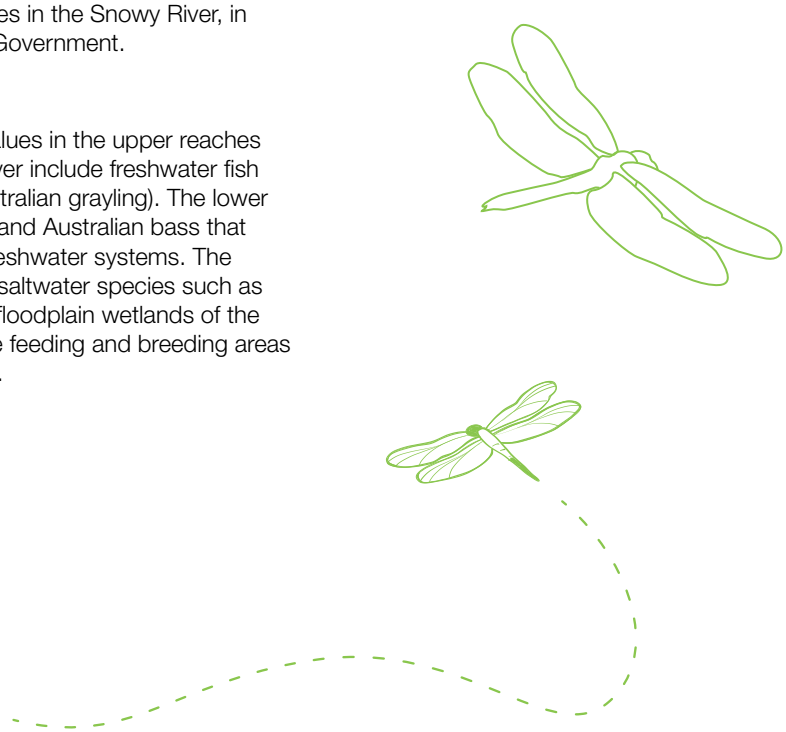
The remaining environmental values in the upper reaches and tributaries of the Snowy River include freshwater fish (such as river blackfish and Australian grayling). The lower reaches support estuary perch and Australian bass that move between saltwater and freshwater systems. The estuary contains estuarine and saltwater species such as flathead and black bream. The floodplain wetlands of the Snowy River near Marlo provide feeding and breeding areas for wetland and migratory birds.

Recent conditions

Drought conditions in 2018–19 resulted in reduced environmental flow allocations for the Snowy River in 2019–20, which resulted in smaller peaks to high flows and shorter durations of freshening flow events. The Snowy River catchment continued to experience below-average rainfall and above-average temperatures throughout 2019–20. Below-average inflows to Lake Jindabyne occurred, which similarly have influenced the magnitude and duration of high flow events in 2020–21. In Victoria, most of the Snowy River catchment experienced below-average rainfall and above-average temperatures for most of 2019–20, with this easing to average conditions in autumn 2020.

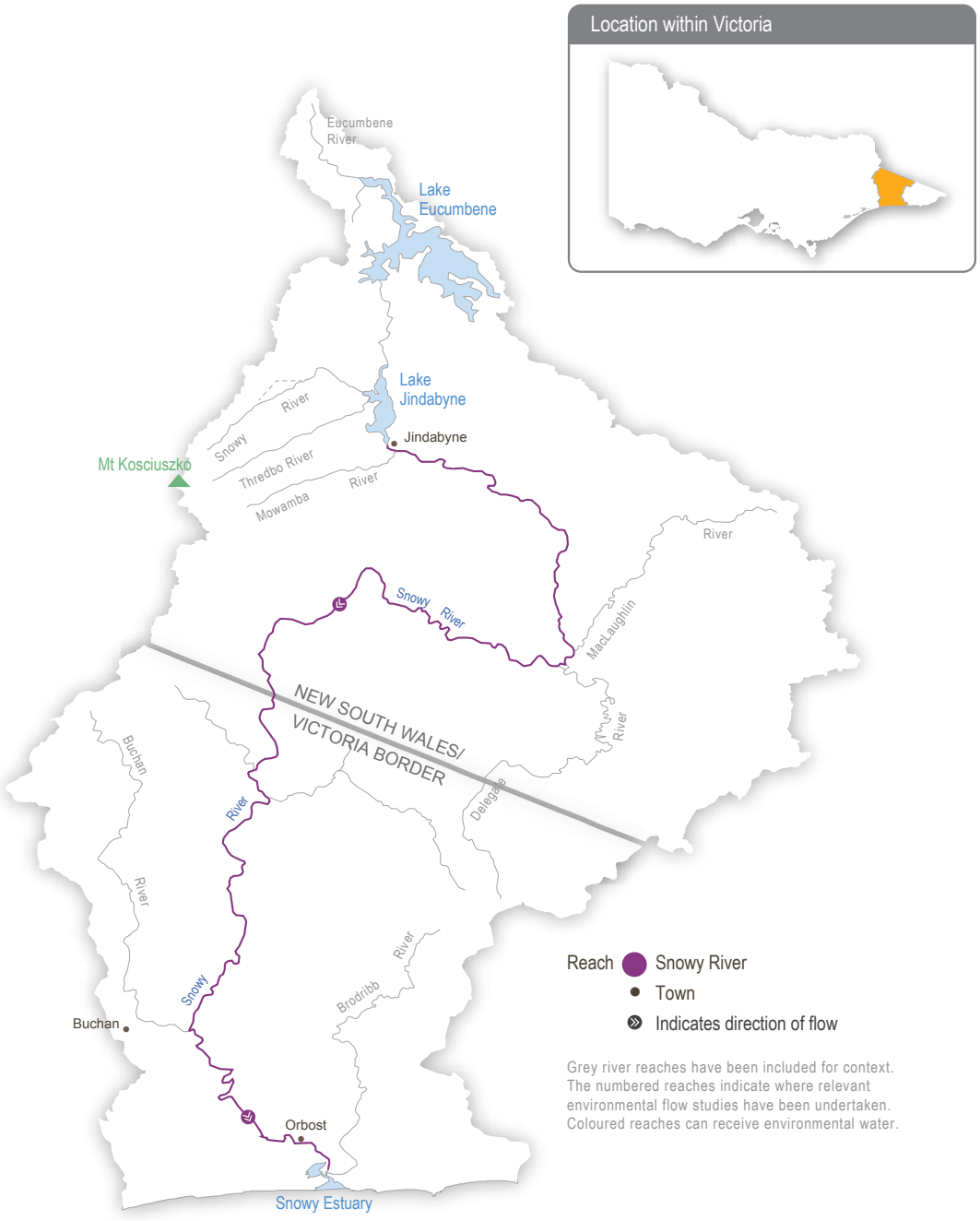
The water year in the Snowy system runs from May to April. In 2019–20, approximately 117,871 ML[1] of water for the environment was used to deliver five winter/spring high-flow events in the Snowy River. A major flushing flow occurred in October 2019.

The Snowy River catchment above Lake Jindabyne in NSW was not severely impacted by the widespread bushfires in south-eastern Australia in December 2019 and January 2020. The catchment area within Victoria, particularly near the estuary mouth in East Gippsland, was severely burnt. If there is heavy rainfall in fire-damaged catchments, it is likely to flush sediment and ash into waterways and degrade water quality in the Snowy River, which may have flow-on effects for river ecology in 2020–21.



[1] Preliminary figure of total releases in 2019–20. This volume may alter slightly due to accounting adjustments, and it will be verified in Snowy Hydro Limited's annual water operating plan.

Figure 2.5.1 The Snowy system



Scope of environmental watering

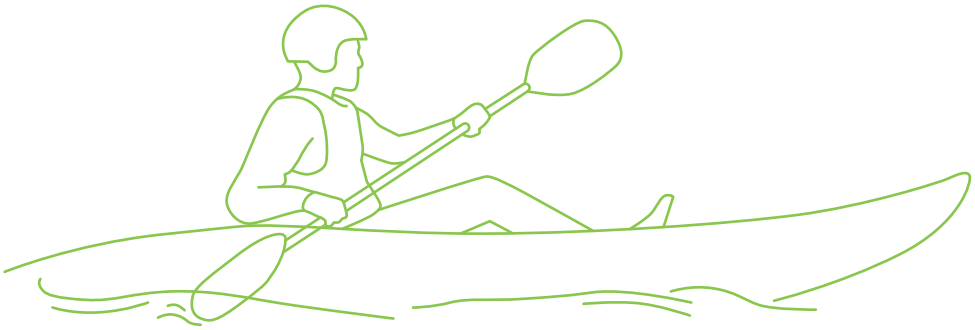
The total volume planned for release to the Snowy River in 2020–21 is 91,476 ML[2].

Due to operating rules in the system, the flow regime that will be delivered in 2020–21 is pre-planned: the storage manager will make daily releases of varying magnitude from Lake Jindabyne between May 2020 and April 2021 to mimic the typical flow pattern of a mixed snowmelt/rainfall river system characteristic of the Snowy Mountains. The continuous daily releases will aim to support ecological processes in the Snowy River below Jindabyne Dam and maintain a healthy river that is much smaller than the natural channel that existed before the river was regulated.

Following several years of dry conditions resulting in lower water availability, fewer high flow events and lower peak magnitudes are planned in 2020–21, but overall flow patterns will be similar. Four high-flow releases are scheduled between June and November 2020. This includes a large flushing flow in early September 2020, which involves an eight-hour peak at a rate equivalent to 4,500 ML per day. Other peak flows will mimic winter rainfall events. This variable flow regime aims to improve the physical attributes of the river by scouring and depositing sediment and increasing available aquatic habitat. High flows will be sustained from July to December, to help mix water in the estuary to benefit plants and fish (such as Australian bass). Low flows will then be released until the end of the water year in April 2021.

Daily releases from Lake Jindabyne will help to mitigate water quality impacts caused by rain that flushes in water from fire-damaged land; but due to the pre-planned annual flow regime process for this system, there is no opportunity to release environmental water in response to serious water quality risks.

East Gippsland CMA has monitored the lower reaches and estuary over the past eight years. The results show that the managed environmental flows help improve physical and ecological processes, increase ecosystem productivity and improve aquatic habitat.



[2] Including contributions from water savings in Victoria and New South Wales.