Section 2

Gippsland Region

2.1 Gippsland Region overview

There are four systems in the Gippsland Region that can receive water from the VEWH's environmental entitlements: the Latrobe (including the Latrobe River and lower Latrobe wetlands), Thomson, Macalister and Snowy systems.

The Macalister and Thomson rivers are tributaries of the Latrobe River. The Macalister flows into the Thomson near Sale. The Thomson joins the Latrobe shortly downstream, where it flows past the Latrobe wetlands (Sale Common, Heart Morass and Dowd Morass) before entering Lake Wellington. These waterways and wetlands contain a range of environmental values and support irrigated agriculture, tourism and industry.

The Snowy River flows south from the Snowy Mountains in New South Wales and into Victoria and Bass Strait. Storages in the Snowy Mountains Hydro-electric Scheme are connected to the Murray and Murrumbidgee systems via a network of tunnels, pipelines and aqueducts through which water from the Snowy is transferred to supply irrigated agriculture in the Murray–Darling Basin.

Seasonal outlook 2016–17

Environmental water available for use in the Latrobe, Thomson and Macalister systems is held in Blue Rock Reservoir, Thomson Reservoir and Lake Glenmaggie respectively.

The Thomson system receives a secure annual allocation, which is available on 1 July each year. Water availability in the Thomson system may be bolstered by the recovery of an additional 8,000 ML of environmental water in 2016–17. In the Latrobe and Macalister systems, water availability depends more on seasonal conditions. Most inflows occur in winter and spring, so more will be known early in 2016–17.

Under moderate streamflow forecasts, environmental water is expected to be available to achieve the highest-priority watering actions in the Latrobe, Thomson and Macalister rivers. If necessary, additional water may be sought via transfers from within the Gippsland system or from another region.

The Latrobe wetlands receive most water from natural and unregulated flows. Water can also be actively diverted from the Latrobe River into Sale Common, Heart Morass or Dowd Morass when river levels are appropriate.

Planning and delivery of environmental water in the Snowy system is managed by the New South Wales Department of Primary Industries, which consults the Victorian and Australian governments and stakeholder groups about environmental water released to the Snowy River.

Australian grayling, by David Dawson

2.2 Latrobe system

Waterway manager – West Gippsland Catchment Management Authority

Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

The Latrobe system (which includes the Latrobe River and lower Latrobe wetlands) is one of the most modified rivers in Victoria, yet it still supports plant and animal species of high conservation significance including several threatened vegetation types and waterbird, fish and frog species. The Latrobe River also provides an essential source of freshwater to the Ramsar-listed Gippsland Lakes site, of which the lower Latrobe wetlands are an important component.

Engagement

Table 2.2.1 shows the partners and stakeholder organisations with which West Gippsland CMA engaged when preparing the Latrobe system seasonal watering proposal.

Seasonal watering proposals are informed by longer-term regional waterway strategies and environmental flow studies, which include environmental, cultural, social and economic considerations.

Table 2.2.1 Partners and stakeholders engaged in developing the Latrobe system seasonal watering proposal

Partner and stakeholder engagement
• Wetlands Environmental Taskforce, a registered environmental organisation that purchases and restores wetlands in Australia
• Field and Game Australia
• Southern Rural Water
• Parks Victoria
• Victorian Environmental Water Holder

2.2.1 Latrobe River

Environmental values

The Latrobe River contains estuarine and freshwater fish species including the black bream, Australian bass, grayling and short- and long-finned eel. Along the banks in the lower reaches there are intact stands of swamp scrub, an endangered vegetation type that is characterised by dense stands of swamp paperbark and tea tree. The upstream reaches contain some continuous stands of river red gums and a tall shrub layer. Mature river red gums are also adjacent to the lower Latrobe wetlands and provide nesting habitat for birds of prey (such as sea eagles) that hunt in the wetlands.

Social and economic values

The Latrobe Valley is the centre of Victoria's energy industry and water from the Latrobe River is essential for electricity generation. The lower Latrobe River is commercially fished for eel and carp. It also contains black bream and estuary perch, which are favoured by recreational fishers. The waterways in the Latrobe system hold significance for Traditional Owners. Waterways and wetlands in the region are important ceremonial places and for thousands of years the Latrobe River has provided resources such as food and materials to the Gunaikurnai people.

Environmental watering objectives in the Latrobe River	
	Enable formation of in-stream bars to help stabilise the structure and condition of the river channel. This will help to reduce the load of sediment and nutrients flowing into the Gippsland Lakes
	Establish native plants on bars and lower parts of the banks to stabilise the river channel
	Improve habitat for native fish including black bream and estuary perch

System overview

The Latrobe River originates on the Mount Baw Baw Plateau and flows into Lake Wellington, the westernmost point of the Gippsland Lakes. The upper Latrobe River is relatively intact, but the lower Latrobe River that flows through the Latrobe Valley is degraded due to historic river management practices. Most snags have been removed from the river and many sections have been artificially straightened. This reduces the diversity of habitat that aquatic plants and animals depend on.

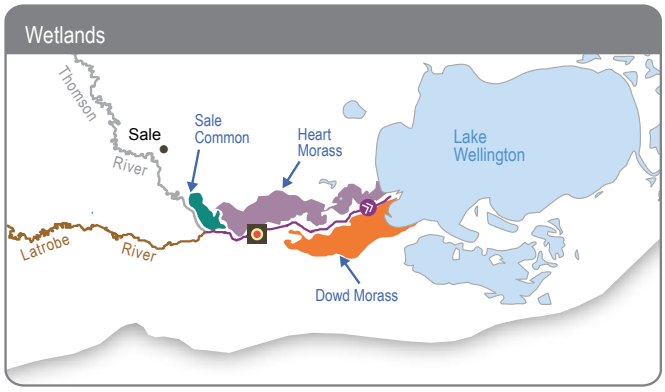
Environmental water is supplied from Blue Rock Reservoir on the Tanjil River. The reservoir also supplies water for other entitlement holders (such as the electricity generators in the Latrobe Valley).

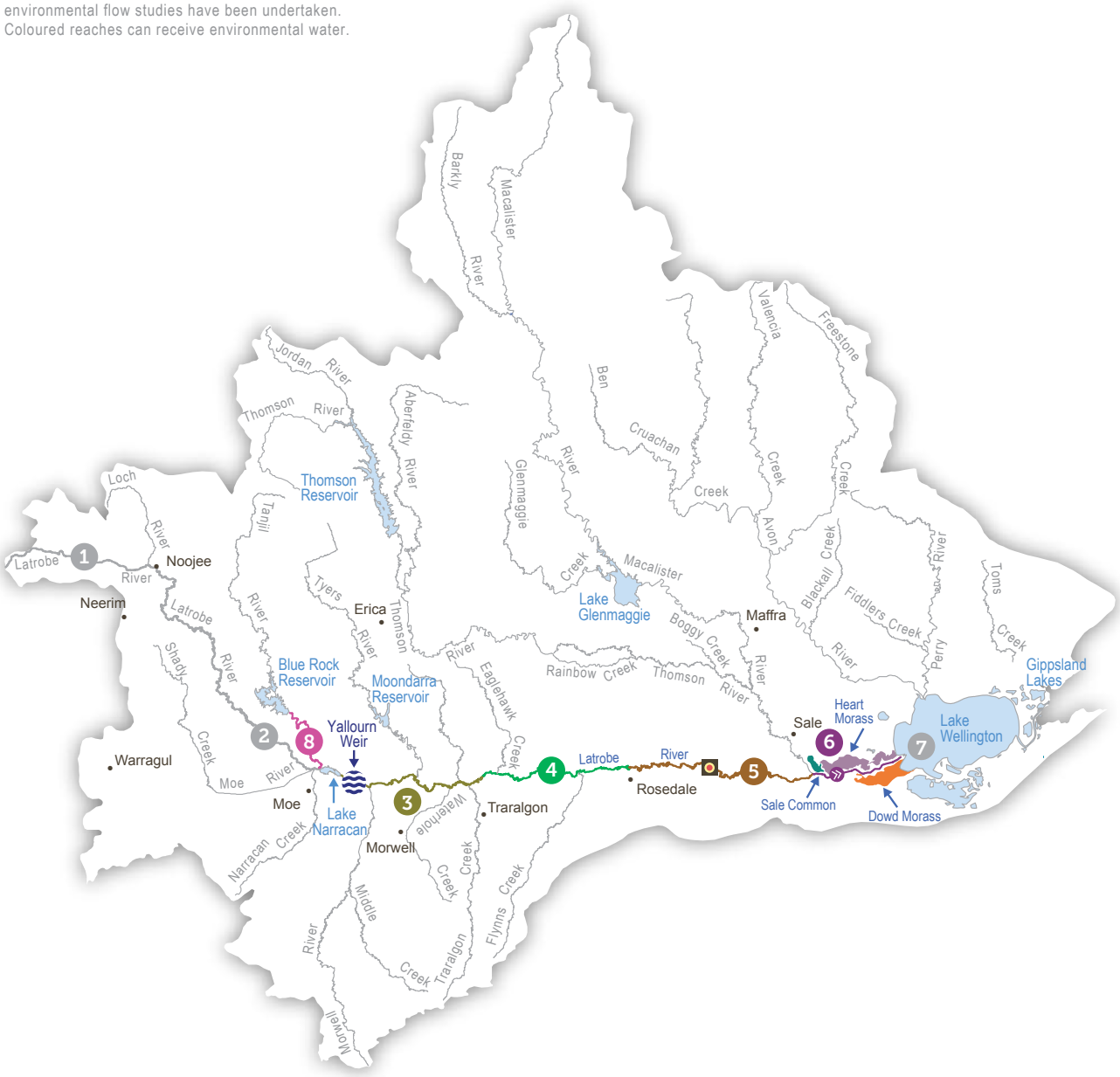
The Latrobe River from Rosedale to the Thomson River confluence (reach 5) is the priority for environmental watering because it contains endangered plant communities that have good potential for recovery. With an appropriate water regime it is possible to improve the quality of riparian vegetation. This in turn stabilises the river banks and provides improved habitat that has been lost due to historic efforts to straighten the channel and remove snags.

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 Rosedale
Reach 5 Rosedale 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.





Recent conditions

Rainfall for the Latrobe River catchment was lower-than-average in 2015–16, mostly due to a particularly dry spring. Although winter and spring were relatively dry, Blue Rock Reservoir was full at the start of the water year and spills occurred in winter and spring. The largest flow occurred in September 2015 and this caused minor flooding of the lower Latrobe River.

An autumn fresh of 1,300 ML per day was delivered from Blue Rock Reservoir in April and May 2015. The flow was delivered to improve vegetation condition and channel structure in the Latrobe River, and to improve water quality by flushing a salt wedge that forms in the lower Latrobe in summer and autumn when flows are low.

An exciting finding from 2014–15 was the capture of Australian grayling eggs during an environmental flow in autumn. The eggs were found in a reinstated meander bend. West Gippsland CMA has undertaken work to re-engage several meander bends in the Latrobe River which had flow diverted due to historical channel straightening and widening. The meander where the eggs were found has a gravel river bed, which is favourable habitat for Australian grayling spawning that has been degraded in most of the Latrobe River.

The environmental flow was not intended for Australian grayling spawning and further research is required to determine the significance of the finding and to inform future environmental recommendations for the Latrobe River.

Scope of environmental watering

Potential environmental watering actions and their environmental objectives are shown in Table 2.2.2.

Table 2.2.2 Potential environmental watering actions and objectives for the Latrobe River

Potential environmental watering	Environmental objectives
Spring/summer freshes (1,300 ML/day for 2–4 days in September–February)	• Improve vegetation diversity, condition and abundance along lower banks and increase recruitment of in-stream vegetation
Autumn/winter freshes (1,300 ML/day for 2–4 days in March–August)	
Winter/spring baseflows (690–1,500 ML/day from June–November)	• Facilitate the formation of in-stream bars (elevated deposits of sediment and gravel in the river channel)
Summer/autumn baseflows (up to 690 ML/day from December–May)	• Provide in-stream habitat for aquatic biota (especially waterbugs, fish and vegetation)

Scenario planning

Table 2.2.3 outlines the potential environmental watering and expected water usage under a range of planning scenarios.

The long-term aim for the Latrobe River is to rehabilitate vegetation and improve the channel structure. Spring freshes are very important to achieve these objectives: they improve the growth of riparian vegetation which stabilises banks and increases habitat.

Climate and rainfall from July to November is therefore an important consideration in deciding when to use environmental water to meet vegetation objectives. In a dry year there is likely to be low natural achievement of spring and early summer freshes, so environmental water will be delivered to supplement flows, to achieve the desired flow rates for riparian vegetation.

If good inflows occur in winter and spring, Blue Rock Reservoir will spill and most spring priorities will be delivered naturally. If natural flows occur then environmental water will not be needed for spring releases and water can be reserved for use in late summer and autumn.

Dowd Morass, by West Gippsland CMA

Table 2.2.3 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 baseflows	• There will be some unregulated flows that contribute to baseflows and freshes, but extended periods of high flows will be absent and freshes will be infrequent • Consumptive demand from Blue Rock Reservoir will be high and contribute to baseflows	• Unregulated flows will provide baseflows and multiple freshes, most likely in winter and spring • A moderate amount of spills are likely and there will be releases for consumptive users which will partially contribute to baseflows	• Multiple spills from Blue Rock Reservoir will provide extended durations of high flows and overbank flows • No significant releases from consumptive entitlements in Blue Rock Reservoir are likely
Expected availability of environmental water	• 16,200 ML	• 18,200 ML	• 18,700–23,200 ML	• 18,700–31,200 ML
Potential environmental watering	• 1 spring/summer fresh • 1 autumn/winter fresh • Winter/spring baseflows	• Up to 3 spring/summer freshes • Up to 2 autumn/winter freshes • Winter/spring baseflows • Summer/autumn baseflows	• Up to 3 spring/summer freshes • Up to 2 autumn/winter freshes • Winter/spring baseflows • Summer/autumn baseflows	• Up to 4 spring/summer freshes • Up to 4 autumn/winter freshes • Winter/spring baseflows • Summer/autumn baseflows
Possible volume of environmental water required to achieve objectives	• 12,300 ML	• 11,200 ML	• 15,900 ML	• 0–11,000 ML

Risk management

In preparing its seasonal watering proposal, West Gippsland CMA considered and assessed risks, and identified mitigating strategies, relating to implementing environmental watering. Risks and mitigating actions are continually reassessed by program partners throughout the water year (see section 1.3.6).

2.2.2 Lower Latrobe wetlands

Environmental values

The Latrobe River provides a large source of freshwater to the Gippsland Lakes Ramsar site, of which the lower Latrobe wetlands are an important component. The lower Latrobe wetlands (Dowd Morass, Heart Morass and Sale Common) provide a variety of habitats that suit a range of different birds at different times. For example, colonial waterbirds (such as royal spoonbill and straw-necked and Australian white ibis) find breeding habitat among swamp paperbark trees in spring. Over summer during a drying phase, the mudflats provide feeding habitat for migratory shorebirds (such as sandpipers). Open water is important year-round for waterfowl and fish-eating birds (such as egrets).

In recent years, rare and threatened species (such as the freckled duck and green and golden bell frog) have been found at Heart Morass.

Social and economic values

Sale Common is a state game refuge located close to the town of Sale that provides an excellent opportunity to observe native plants and animals. Dowd Morass is a state game reserve commonly used by hunters, and Heart Morass consists of mostly private landholdings and is also used by hunters. An appropriate water regime in the lower Latrobe wetlands increases waterbird abundance and provide opportunities for bird watching and hunting when the wetlands are in a wet phase.

The lower Latrobe wetlands hold significance for Traditional Owners. Waterways and wetlands in the region are important ceremonial places and for thousands of years the lower Latrobe wetlands have provided resources such as food and materials to the Gunaikurnai people.

Environmental watering objectives in the lower Latrobe wetlands

	Promote dispersal and germination of wetland plants
	Provide habitat for waterbirds
	Control carp abundance, particularly at Sale Common and Dowd Morass

System overview

The lower Latrobe wetlands are Sale Common, Dowd Morass and Heart Morass. The wetlands are on the floodplain of the Latrobe River between its confluence with the Thomson River and Lake Wellington.

River regulation and water extraction from the Latrobe, Thomson and Macalister rivers has reduced the frequency of small- and medium-sized floods that naturally inundate the

wetlands. This problem is worsened by saline water intrusion into Dowd Morass and Heart Morass from Lake Wellington. Construction of levees and drains and the filling in of natural depressions have also altered water movement in and through the wetlands. However, the drainage and flooding regime in all three wetlands can be managed to some extent through the use of regulators connected to the Latrobe River.

Recent conditions

Natural flows to the wetlands were infrequent and small-scale in 2015–16. This resulted in a substantial drawdown of Sale Common and Heart Morass. A partial drawdown of Dowd Morass also occurred, but the extent of the drying was tempered by a small unregulated flow to Dowd Morass in September 2015.

The widespread drying was welcome because in previous years the Latrobe wetlands were continuously inundated, and only partial drawdowns occurred each summer. The drying improved vegetation diversity by allowing plants to germinate on exposed mudflats. It also provided some control of carp.

Waterfowl counts in autumn were lower than in previous years. This was partially attributable to the wetland drying that occurred. It was also a consequence of dryer conditions across all of south-east Australia, meaning that waterfowl were less abundant than usual.

An autumn wetting flow was delivered to Heart Morass in March to June 2016 to provide seed dispersal and support opportunities for waterbirds. This was the first time that water has been actively delivered to Heart Morass using the environmental entitlement for the Latrobe wetlands.

Scope of environmental watering

Potential environmental watering actions and their environmental objectives are shown in Table 2.2.4.

Table 2.2.4 Potential environmental watering actions and objectives for the lower Latrobe wetlands

Potential environmental watering	Environmental objectives
Sale Common	
Partial, substantial or complete drawdown (primarily August–March)	• Promote oxygenation of surface soils, breakdown of accumulated organic matter and nutrient recycling • Encourage the growth and reproduction of wetland plants across the wetland bed • Reduce the number and size of European carp
Wetting flow (February–May)	• Provide feeding and sheltering habitat for wetland animals, particularly waterbirds and frogs • Discourage the spread of giant rush
Partial wetting flow (August–November)	• Encourage the growth and reproduction of wetland plants, particularly tall marsh, aquatic herbland and aquatic sedgeland • Provide feeding and breeding habitat for wetland animals, particularly waterbirds and frogs
Wetting flow (anytime)	• Mimic the natural inundation regime • Control invasive vegetation
Dowd Morass and Heart Morass	
Partial drawdown (primarily August–March)	• Promote oxygenation of surface soils, breakdown of accumulated organic matter and nutrient recycling • Encourage the growth and reproduction of wetland plants, particularly swamp shrub, tall marsh, aquatic herbland and brackish herbland • Reduce the number and size of European carp
Wetting flow (February–May)	• Provide feeding habitat for wetland animals, particularly waterbirds
Wetting flow (anytime)	• Avoid/mitigate risks to wetland plants and waterbird habitat from adverse salinity and exposure of acid sulphate sediment • Mimic the natural inundation regime
Partial wetting flow (August–November)	• Encourage colonial waterbird breeding • Reduce salinity • Encourage the growth and reproduction of wetland plants, particularly swamp scrub, tall marsh, aquatic herbland and brackish herbland • Provide feeding and breeding habitat for wetland animals, particularly waterbirds and frogs

Scenario planning

Table 2.2.5 outlines the potential environmental watering and expected water usage under a range of planning scenarios.

Natural flows are very influential in the Latrobe wetlands. In a drought and dry year, extensive drawdowns will occur in all three wetlands. Partial drawdowns will occur in an average year, but if conditions are wet the ability to manage drawdown is diminished, and uncontrolled flows will provide widespread inundation throughout the year.

The approach in 2016–17 is to allow water levels to fluctuate according to natural seasonal conditions. At times some selective small-scale flooding and drainage may be managed to amplify the natural conditions and improve environmental outcomes. Short-duration wetting flows may be delivered at any time when water is needed to mitigate risks of salinity and acid sulphate soils or to provide habitat for waterbirds.

Table 2.2.5 Potential environmental watering for the lower Latrobe wetlands under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected catchment conditions	• No natural flows from the Latrobe River • Wetlands are likely to dry completely		• Moderate winter and spring flows and flushing flows • Wetlands could be filled or partially filled with a minor drawdown in summer	• Major flows in winter/spring and possibly autumn/winter • Wetlands will be filled naturally with very little drawdown over summer
Sale Common				
Potential environmental watering	• Complete drawdown (July–June) • Wetting flows (anytime)	• Substantial drawdown (August–April) • Wetting flows (anytime) • Wetting flows (February–May)	• Wetting flows (August–November) • Partial drawdown (August–March) • Wetting flows (anytime) • Wetting flows (February–May)	• Flushing/wetting flows (August–November) • Partial drawdown (December–March) • Wetting flows (February–May) • Wetting flows (anytime)
Possible volume of environmental water required to achieve objectives	• 0–1,300 ML	• 0–1,300 ML	• 1,300 ML	• 0 ML
Dowd Morass				
Potential watering actions	• Complete drawdown (July–June) • Wetting flows (anytime)	• Wetting flows (anytime) • Substantial drawdown (August–April) • Wetting flows (February– May)	• Wetting flows (August–November) • Wetting flows (anytime) • Substantial drawdown (August–March) • Wetting flows (February–May)	• Flushing/wetting flows (August–November) • Partial drawdown (December–March) • Wetting flows (February–May) • Wetting flows (anytime)
Possible volume of environmental water required to achieve objectives	• 0–5,800 ML	• 0–5,800 ML	• 5,800 ML	• 0 ML
Heart Morass				
Potential watering actions	• Complete drawdown (July–June) • Wetting flows (anytime)	• Wetting flows (anytime) • Partial drawdown (August–April) • Wetting flows (February–May)	• Wetting flows (August–November) • Partial drawdown (August–March) • Wetting flows (February–May) • Wetting flows (anytime)	• Flushing/wetting flows (August–November) • Partial drawdown (December–March) • Wetting flows (February–May) • Wetting flows (anytime)
Possible volume of environmental water required to achieve objectives	• 0–7,100 ML	• 0–7,100 ML	• 7,100 ML	• 0 ML

Risk management

In preparing its seasonal watering proposal, West Gippsland CMA considered and assessed risks, and identified mitigating strategies, relating to implementing environmental watering. Risks and mitigating actions are continually reassessed by program partners throughout the water year (see section 1.3.6).

2.3 Thomson system

Waterway manager – West Gippsland Catchment Management Authority

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

Environmental water holder – Victorian Environmental Water Holder

Environmental values

Australian grayling are a threatened fish species and the focus of environmental watering in the Thomson River. Australian grayling are known to spawn in response to autumn high flows, and the eggs and juveniles spend time at sea before returning to the freshwater sections of coastal rivers. In addition to Australian grayling a further six migratory fish species are found in the Thomson including the common galaxias, tupong and short-finned eel.

Vegetation is intact and near-natural upstream of Thomson Reservoir in the Baw Baw National Park. Riparian vegetation upstream of Cowwarr Weir is mostly in good condition, but infestations of blackberry and gorse are widespread. Downstream of the Cowwarr Weir, the vegetation is degraded due to stock access and widespread weed invasion.

Social and economic values

Thomson Reservoir is very important because it is the largest storage in Melbourne's water supply system. The system also supplies water to irrigators and towns in Gippsland.

The Thomson River downstream of Thomson Reservoir is popular for canoeing and kayaking. West Gippsland CMA provides flow information before releases so that people can safely take advantage of the improved paddling conditions provided by environmental water.

The waterways in the Thomson system (including the Thomson River) continue to hold significance for Traditional Owners. Waterways and wetlands in the region are important ceremonial places and for thousands of years the Thomson River has provided resources such as food and materials to the Gunaikurnai people.

Environmental watering objectives in the Thomson system

	Protect and boost populations of native fish, specifically Australian grayling, by providing pool habitat and flows for fish to move upstream and downstream, and by encouraging fish to spawn
	Scour silt build-up within the river bed to provide increased and diverse habitat for plants and animals to colonise
	Provide water for plant life to germinate, establish and grow on the river bank

System overview

The Thomson River flows from the slopes of Mt Whitelaw on the Baw Baw Plateau to join the Latrobe River south of Sale. The major tributaries of the Thomson River are the Aberfeldy, Jordan and Macalister rivers, with most unregulated flows originating from the Aberfeldy River.

Environmental water in the Thomson system is held in Thomson Reservoir. Reach 3 of the Thomson River (from the Aberfeldy River confluence to Cowwarr Weir) is the priority for environmental watering due to its heritage river status, relatively intact native riparian vegetation, high-quality in-stream habitat and low abundance of exotic fish species.

At Cowwarr Weir, the Thomson River splits in two and water can move down the old Thomson River course (reach 4a) and Rainbow Creek (reach 4b). The preference is to pass environmental water down the old Thomson course to enable fish migration, as Cowwarr Weir prevents migration through Rainbow Creek.

Recent conditions

In 2015–16 summer rainfall was near-average, but in the important winter and spring inflow periods, rainfall and river flows were well-below-average. Rainfall in autumn was also below-average. Despite the dry conditions there was sufficient environmental water available to deliver water to give Australian grayling and other fish species an opportunity to migrate and spawn. This was supported by a transfer of water from the Yarra system.

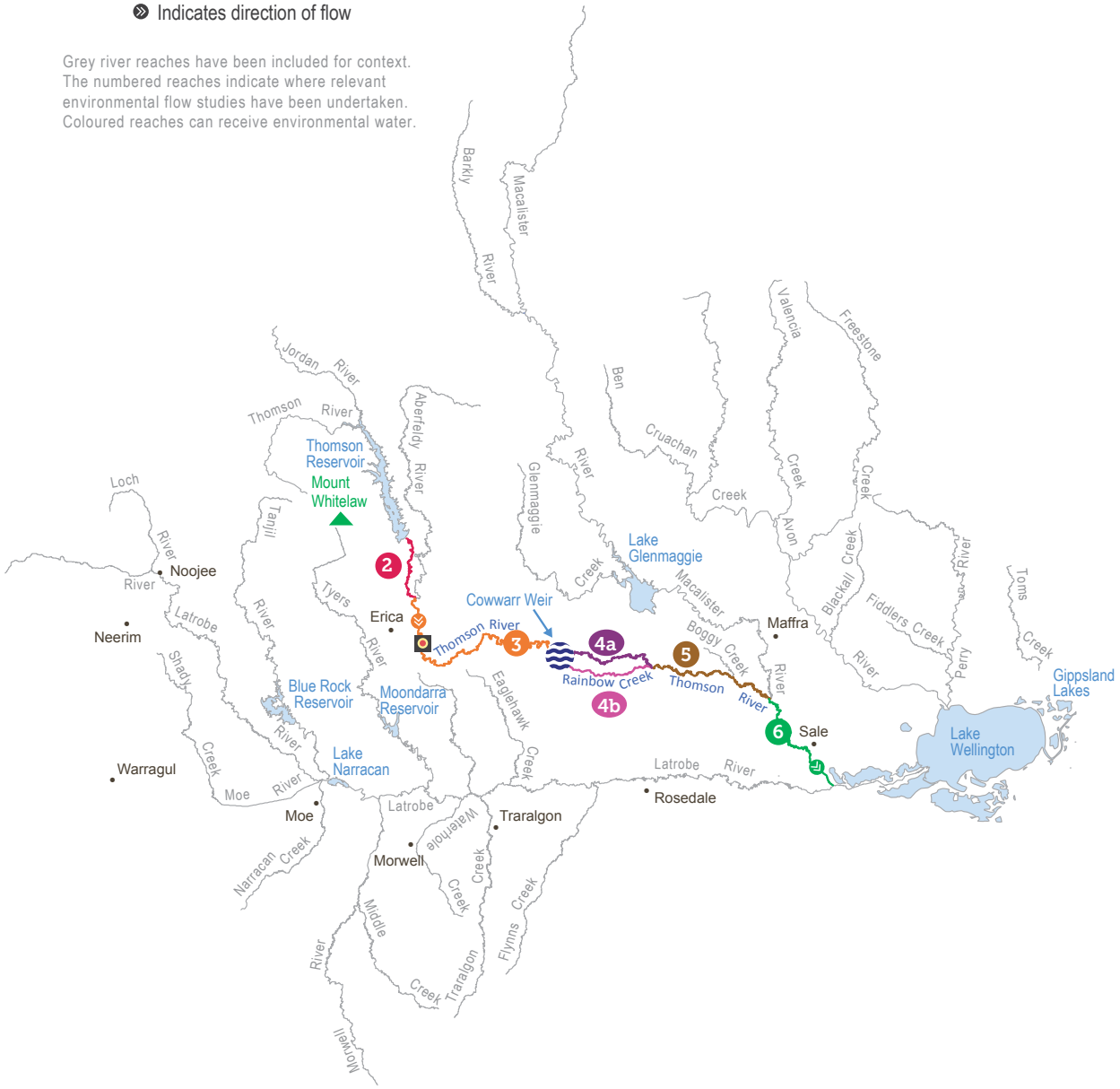
In 2015 the Australian grayling spawning response was the best ever recorded in this system, corresponding to the release of an autumn fresh in the Thomson River. Spawning responses were also observed in the previous three years and there is high certainty that flows of a specific magnitude and duration will elicit a spawning response.

Bankfull flows and winter freshes have not occurred often in recent years because the Thomson Reservoir substantially reduces the duration and frequency of high-volume flows. While these flows are important, there is insufficient water held in the Thomson River entitlement to provide them in addition to the highest-priority flows in spring and autumn.

Figure 2.3.1 The Thomson system

Reach 2 Thomson River: Thomson Dam to Aberfeldy River
Reach 3 Thomson River: Aberfeldy River to Cowwarr Weir
Reach 4a Old Thomson River: Cowwarr Weir to Rainbow Creek
Reach 4b Rainbow Creek: Cowwarr Weir to Thomson River
Reach 5 Thomson River: Rainbow Creek/Old Thomson confluence to Macalister River
Reach 6 Thomson River: Macalister River to Latrobe 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.



Scope of environmental watering

Potential environmental watering actions and their environmental objectives are shown in Table 2.3.1.

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

Potential watering actions	Environmental objectives
Spring freshes (1–2 freshes of 800 ML/day for 4 days each in September–October)	• Provide a migration cue for juvenile Australian grayling • Inundate and regenerate riparian vegetation • Scour sediment exposing fresh habitat areas
Spring baseflows (230 ML/day from October–November)	
Autumn freshes (1–2 freshes of 600–800 ML/day for 4 days each in April–May)	• Provide a migration and spawning cue for Australian grayling and other aquatic species • Inundate and regenerate riparian vegetation • Scour sediment exposing fresh habitat areas
Autumn/winter baseflows (230 ML/day from May–June)	
Winter freshes (up to 4 freshes of 800 ML/day for 4 days in June–August)	• Maintain/enhance the native fish community structure by providing opportunities for localised fish movement between habitats
Summer/autumn freshes (up to 7 freshes of 230 ML/day for 4 days in December–April)	• Maintain/enhance the native fish community structure by providing habitat availability, large woody debris inundation • Inundate and regenerate riparian vegetation • Scour sediment exposing fresh habitat areas

Scenario planning

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

The highest priority in the Thomson River is to provide flows to promote spawning (in autumn) and recruitment (in spring) of Australian grayling. Australian grayling live for about three years, so it is important to provide optimal spawning conditions at least every two out of three years to maintain their long-term viability. Similarly, it is important to provide spring recruitment flows two out of every three years to attract juvenile Australian grayling into the Thomson River to sustain the local population.

Spawning flows have been delivered successfully for the last seven years in succession and great results have been achieved. Recruitment flows have been provided for the last two years. While the delivery of spawning and recruitment flows in consecutive years reduces the urgency to provide them in 2016–17, recruitment flows in spring are prioritised first because they were infrequent before the last two years.

In drought conditions, releases will focus on the delivery of baseflows in winter and spring to maintain suitable aquatic and riparian habitat. Spawning and recruitment flows are not delivered in a drought scenario.

In dry conditions and subject to water availability, spring freshes will be released along with baseflows to provide conditions for juvenile Australian grayling recruitment. Savings of water under drought and dry conditions will be carried over into 2017–18, by which time spawning and recruitment will be important to maintain the Australian grayling population.

If unregulated river flows are naturally high (such as under the average and wet scenarios), all available water may be used to maximise opportunities for Australian grayling spawning and recruitment. Matching releases with natural high-flow conditions will also improve habitat by scouring sediment and regenerating riparian vegetation.

Walhalla bridge, by West Gippsland CMA

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

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Unregulated flows very limited • Large volumes of consumptive water released from storage	• Unregulated flows from the Aberfeldy River and other tributaries contribute to baseflows and freshes • Moderate volumes of consumptive water released from storage	• Unregulated flows from the Aberfeldy River and other tributaries contribute to baseflows, freshes and high flows • Some consumptive water released from storage	• Unregulated flows from the Aberfeldy River and other tributaries contribute to baseflows, freshes and sustained high flows • Possible spills from Thomson Reservoir and minimal consumptive water released from storage
Expected availability of environmental water[1]	• 10,000–12,000 ML	• 10,000–14,000 ML	• 10,000–18,000 ML	• 18,000–23,000 ML
environmental watering – tier 1 (high priorities)	• Spring and autumn baseflows	• One spring fresh • Spring and autumn baseflows	• Two spring freshes • Spring and autumn baseflows • One autumn fresh	• Two spring freshes • Spring and autumn baseflows • One autumn fresh • One winter fresh
Potential environmental watering – tier 2 (additional priorities)	• One spring fresh • One autumn fresh • One summer fresh	• One autumn fresh • One summer fresh	• One winter fresh • One autumn fresh • One summer fresh	• One winter fresh • One summer fresh
Possible volume of environmental water required to achieve objectives[2]	• 5,600 ML (tier 1) • 8,900 ML (tier 2)	• 9,400 ML (tier 1) • 5,100 ML (tier 2)	• 18,000 ML (tier 1) • 10,000 ML (tier 2)	• 23,000 ML (tier 1) • 5,300 ML (tier 2)
Priority carryover requirements	• 4,600 to 6,400 ML		• 0 ML	

1 The first 10,000 ML of Thomson Reservoir inflows is allocated to the environment at the beginning of the water year. An additional 8,000 ML may be available in the system, subject to an entitlement amendment being completed to facilitate its use.

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

Risk management

In preparing its seasonal watering proposal, West Gippsland CMA considered and assessed risks, and identified mitigating strategies, relating to implementing environmental watering. Risks and mitigating actions are continually reassessed by program partners throughout the water year (see section 1.3.6).

Engagement

Table 2.3.3 shows the partners with which West Gippsland CMA engaged when preparing the Thomson system seasonal watering proposal.

Seasonal watering proposals are informed by longer-term regional waterway strategies and environmental flow studies, which include environmental, cultural, social and economic considerations.

Table 2.3.3 Partners engaged in developing the Thomson system seasonal watering proposal

Stakeholder engagement
• Southern Rural Water
• Melbourne Water
• Victorian Environmental Water Holder

2.4 Macalister system

Waterway manager – West Gippsland Catchment Management Authority

Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

Environmental values

There are seven migratory native fish species in the Macalister River that move between freshwater and marine environments to complete their life cycle. These are the Australian grayling, short- and long-finned eel, tupong, Australian bass, short-headed lamprey and common galaxias.

Along the river banks there are some areas of dense woody riparian vegetation dominated by shrubs. Where livestock is excluded, vegetation is in good condition: elsewhere it is degraded. The non-woody plants that colonise the fringes of the river (such as reeds, sedges and rushes) have declined in recent years, as has in-stream vegetation. While the reason for the decline is uncertain, water turbidity, erosion and lack of flow variability are thought to have an effect.

Social and economic values

The Macalister Irrigation District is the major economic driver in the area and water from the Macalister system is highly valued by the local community. As a result, there is a genuine interest in the health of the Macalister River, particularly about water quality, erosion and vegetation condition. People also use the river for recreational fishing and bird watching. The waterways in the Macalister system (including the Macalister River) continue to hold significance for Traditional Owners. Waterways and wetlands in the region are important ceremonial places and for thousands of years the Macalister River has provided resources such as food and materials to the Gunaikurnai people

Environmental watering objectives in the Macalister system

	Protect and boost populations of native fish (including Australian grayling, tupong and Australian bass) prompting fish to move upstream and downstream and between the river and the ocean, and to spawn
	Enable plants to germinate, establish and grow on the river bank
	Restore communities of waterbugs, which break down organic matter, provide a source of food for other animals and support the river's food chain

System overview

The Macalister River flows from Mt Howitt in the Alpine National Park to join the Thomson River south of Maffra. It mostly flows through cleared floodplain that is used for dairy farming. Lake Glenmaggie is the single major storage and supplies water to the Macalister Irrigation District, with flows regulated at Maffra Weir. Environmental water is stored in Lake Glenmaggie.

Before Lake Glenmaggie was built, the Macalister River would regularly receive large floods in winter and spring. Although Lake Glenmaggie regularly spills, floods are now less common. A notable impact from irrigation and water harvesting is reversed seasonality of flows between Lake Glenmaggie and Maffra Weir, where higher-than-natural summer flows occur due to the delivery of irrigation water. In the same reach, flows are lower-than-natural in the water harvesting period in winter. Downstream of Maffra Weir most flows are diverted for irrigation in summer and autumn. The changed hydrology affects the migration of fish as well as the growth and dispersal of aquatic and riparian plants.

Maffra Weir prevents fish passage from upstream and downstream of the weir and the priority reach for fish migration flows is therefore reach 2 which is downstream of Maffra Weir to the confluence with the Thomson River. Non-fish objectives can be achieved in both reaches 1 and 2.

Recent conditions

In 2015-16 inflows to Lake Glenmaggie were lower than the average of the last 10 years. While this reduced the magnitude of spills that typically occur in winter and spring, water allocations were sufficient to provide most of the planned environmental watering.

Winter baseflows were delivered in July 2015 using carryover water. Spills from Lake Glenmaggie in July–August were managed by the storage manager, Southern Rural Water, to align with winter environmental flow recommendations. Multiple autumn freshes, a winter fresh and winter baseflows were delivered in April–June 2016.

Figure 2.4.1 The Macalister system

Scope of environmental watering

Potential environmental watering actions and their environmental objectives are shown in Table 2.4.1.

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

Potential environmental watering	Environmental objectives
Macalister River reaches 1 and 2	
Autumn/winter baseflows (35–90 ML/day in May–July)	• Provide habitat for waterbugs and for local movement of fish • Maintain water quality in pools and connectivity for platypus • Provide slow-moving water for submerged aquatic vegetation
Spring fresh (1,500 ML/day for 3–5 days in September–October)	• Provide variability in water levels and wet the fringing woody vegetation
Macalister River reach 2	
Autumn fresh (350 ML/day for 4–5 days in April–May)	• Promote downstream migration and spawning of Australian grayling
Winter fresh (700 ML/day for 4–5 days in June–August)	• Promote downstream migration and spawning of tupong and Australian bass
Spring/summer fresh (700 ML/day for 5 days in September–December)	• Promote upstream migration opportunities for adults and juveniles of multiple fish species
Summer/autumn fresh (140 ML/day for 3 days in December–May)	• Flush pools to maintain water quality for invertebrates • Provide water-level variability for emergent vegetation

Scenario planning

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

The highest priority in 2016–17 is to provide flows that prompt migration, spawning and recruitment of native fish species that migrate between freshwater and estuarine environments, particularly the Australian grayling, Australian bass and tupong.

In drought conditions an autumn fresh will be provided for Australian grayling and a winter fresh will be provided for tupong, with any remaining water being utilised to continue winter baseflows. It is important to deliver a spawning flow for Australian grayling in a drought year because if conditions are dry a spawning flow may not be delivered in the Thomson River. This will also provide an opportunity to test if Australian grayling will successfully spawn with a release from the Macalister alone.

Autumn flows also remain a high priority when conditions are dry because these are the most impacted flows in reach 2, where most water is diverted for irrigation.

As water availability increases in dry and average conditions, spring and summer freshes will be delivered. The highest-priority spring freshes will provide a cue for juvenile Australian grayling, tupong, adult eels and short-headed lampreys to return upstream from estuarine and marine habitats.

In a wet year water will be available to provide summer freshes that provide connectivity all the way through reach 2. It will also be possible to increase the duration of some releases in line with wet-season flow recommendations.

Carryover of some water into July 2017 is a high priority under all conditions to provide baseflows through reaches 1 and 2 outside the irrigation season.

Macalister River, by West Gippsland CMA

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

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• No unregulated flows • 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 flood levels may occur • Passing flows at Maffra Weir may be reduced, with savings accrued in summer for use in autumn	• Large and frequent spills from Lake Glenmaggie, moderate to major flood levels may occur • Passing flows at Maffra Weir may be reduced, with savings accrued in summer for use in autumn
Expected availability of environmental water	• 9,400 ML	• 13,000 ML	• 14,400 ML	• 22,600 ML
Potential environmental watering – tier 1 (high priorities)	• One autumn fresh • One winter fresh • Autumn/winter baseflows	• One autumn fresh • One winter fresh • One spring fresh • Autumn/winter baseflows	• One autumn fresh • One winter fresh • One spring fresh • Autumn/winter baseflows	• One autumn fresh • One winter fresh • One spring fresh • One summer fresh • Autumn/winter baseflows
Potential environmental watering – tier 2 (additional priorities)	• One spring fresh • One summer fresh	• Increase duration of winter baseflow • One summer fresh	• Increase magnitude of spring fresh • One summer fresh	• Increase duration of spring fresh
Possible volume of environmental water required to meet objectives[1]	• 9,400 ML (tier 1) • 4,600 ML (tier 2)	• 13,000 ML (tier 1) • 1,700 ML (tier 2)	• 13,400 ML (tier 1) • 4,200 ML (tier 2)	• 18,000 ML (tier 1) • 2,900 ML (tier 2)
Priority carryover requirements	• 1,000 to 1,200 ML			

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

Risk management

In preparing its seasonal watering proposal, West Gippsland CMA considered and assessed risks, and identified mitigating strategies, relating to implementing environmental watering. Risks and mitigating actions are continually reassessed by program partners throughout the water year (see section 1.3.6).

Engagement

Table 2.4.3 shows the partners, stakeholder organisations and individuals with which West Gippsland CMA engaged when preparing the Macalister system seasonal watering proposal.

Seasonal watering proposals are informed by longer-term regional waterway strategies, environmental water management plans and environmental flow studies, which include environmental, cultural, social and economic considerations.

Table 2.4.3 Partners and stakeholders engaged in developing the Macalister system seasonal watering proposal

Stakeholder engagement
• Southern Rural Water
• Victorian Environmental Water Holder
• Gippsland Water
• VRFish
• Environment Victoria
• Maffra & Districts Landcare Network
• Native Fish Australia
• Macalister Irrigation District irrigators and diverters
• Gurnaikurnai Land and Waters Aboriginal Corporation
• Wellington Shire Council

2.5 Snowy system

Waterway managers – New South Wales Department of Primary Industries (Water) and East Gippsland CMA

Storage manager – Southern Hydro Limited

Environmental water holder – Victorian Environmental Water Holder and New South Wales Department of Primary Industries (Water)

Environmental values

The Snowy River contains freshwater-dependent fish species in the upper reaches and tributaries (such as the river blackfish and Australian grayling). Fish species that migrate between saltwater and freshwater (such as the estuary perch and Australian bass) occur in the lower reaches. The estuary contains estuarine and saltwater species (such as the flathead, mulloway and black bream). The floodplain wetlands of the Snowy River near Marlo provide feeding and breeding areas for wetland and migratory birds.

Social and economic values

Electricity generation through the Snowy Mountains Hydro-electric Scheme provides substantial economic value and Snowy water supports irrigated agriculture in New South Wales and Victoria. The Snowy River and estuary are a drawcard for the many tourists who enjoy rafting, boating, swimming and recreational fishing.

The waterways of the Snowy system (including the Snowy River) hold significance for the Aboriginal communities in the region. The Snowy River is also an iconic and culturally significant Australian river made famous by Banjo Patterson's poem *The Man from Snowy River*.

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 before flowing through the Snowy River National Park in Victoria and emptying into Bass Strait.

There are four major dams and multiple diversion weirs in the Snowy River catchment. The Snowy Mountains Hydro-electric Scheme diverts water to the Murrumbidgee and River Murray valleys and previously resulted in the diversion of 99 percent of the Snowy River's mean annual natural flow at Jindabyne. Travelling downstream, the hydrological effects of the scheme are still substantial but are mitigated by the contribution of flows from tributaries (such as the Delegate River in New South Wales and the Buchan River in Victoria).

While playing an important role in electricity generation and irrigation supply, flow diversion and other activities have affected the river's hydrology and resulted in a significant deterioration in the health of the Snowy River. The Victorian, New South Wales and Commonwealth governments have recovered water (equivalent to 21 percent of the average natural flow) to help restore damage done by decades of limited flow.

Victorian environmental water 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 environmental water replaces water that was earmarked for transfer from the Snowy to Victoria to support irrigation demands.

New South Wales Department of Primary Industries does the planning for environmental flows in the Snowy River, and consults the Victorian and Australian governments and stakeholder groups about environmental water released to the Snowy River.

Recent conditions

In the 2015–16 water year, 147,884 ML of environmental water was released to the Snowy River. The releases aim to rehabilitate the Snowy River below Jindabyne Dam into a smaller but healthy river, recognising that it is not possible to restore the Snowy River to its former size with one-fifth of its former flow volume.

Over time, environmental water releases will improve ecosystem function by scouring fine sediment to improve in-stream habitat and by flushing plant matter and other material into the river to stimulate the food chain. The flows also mix pools in the upper reaches and improve the salinity dynamics in the Snowy Estuary. Repairing these river functions helps the river support healthier aquatic communities.

Recent investigations have shown that high flows delivered to the Snowy River from Lake Jindabyne can mobilise the fine sediment within the channel. This improves habitat quality and increases potential sites for benthic biofilms (for example, algae attached to surfaces) to colonise and increase river productivity. The studies have improved understanding of the required magnitude and frequency of flows and the optimal intervals between events. This knowledge is incorporated into the annual planning for 2016–17.

Figure 2.5.1 The Snowy system

Scope of environmental watering

Environmental water releases are planned to occur every day from May 2016 to April 2017 and aim to mimic the typical flow pattern of a mixed snowmelt/rainfall river system characteristic of the Snowy Mountains. The flow regime provides hourly, daily, seasonal and annual flow variability within the bounds of a natural but smaller Snowy Montane River.

Five high flows are scheduled in winter/spring 2016. A large flushing flow is scheduled for early October 2016 and includes an eight-hour peak of over 8,000 ML per day.

Other peak flows mimic winter rainfall events. These peak flows aim to improve the physical attributes of the river by scouring sediment and limiting the growth of riparian plants (which can block the river channel).

High flows are sustained from July–December to assist with water mixing in the estuary for the benefit of plants and fish (such as Australian bass). Low flows will then be released until the end of the water year in April 2017.

The total volume planned for release in 2016–17 (including contributions from water savings in Victoria and New South Wales) is 131,071 ML.

Moorabool River, by Chloe Wiesenfeld, Victorian Environmental Water Holder