

Seasonal Watering Plan

2012–13



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I am proud to present the Victorian Environmental Water Holder's (VEWH) Seasonal Watering Plan 2012-13.

This second annual plan provides the blueprint for the Victorian environmental watering program. It builds on the solid foundation established in the 2011-12 plan, while incorporating learning and experience from the VEWH's first year of operation. In light of this, the plan incorporates a number of improvements and refinements, reflecting what we have learnt. This includes increasing the scope of the plan to allow for increased flexibility in decision making, and removing the need to have schedules by incorporating the key information for decision making throughout the year into this one document.

During 2011-12, Victoria's rivers, wetlands and floodplains benefited from another year of average to wet conditions. Many systems experienced their second or third consecutive year of natural flooding. This brought with it a number of challenges in regional communities, including flooding of private land and public infrastructure and several blackwater events. However, it also provided the opportunity for much-needed recovery of plant and animal populations following the extended and severe drought experienced since 1997. Environmental watering in 2012-13 will largely focus on building on this environmental recovery and further enhancing the priority environmental values of Victoria's rivers, wetlands and floodplains.

Since the development of the 2011-12 plan, the VEWH has developed its first corporate plan. It sets the strategic direction for the VEWH to achieve its mission of managing Victoria's environmental Water Holdings, in cooperation with partners, to improve the health of rivers, wetlands and floodplains. Sections 3-8 of this plan have been structured to reflect the six strategic programs identified in the corporate plan. This aligns two of the VEWH's flagship documents, providing a solid and consistent approach to managing Victoria's environmental Water Holdings.

Adaptively managing Victoria's Water Holdings continues to be a major focus of the seasonal watering plan. By planning to a wide range of scenarios, while managing to actual conditions, this robust plan allows decisions to be made quickly to take full advantage of opportunities and act in the face of challenges, ensuring the greatest environmental benefits can be realised.

To facilitate this decision making, the VEWH adopts a seasonally adaptive approach to plan for short-term climate variability. This planning framework involves developing scenarios that give a snapshot of what might happen, which helps identify where there may be a change in the priority of watering actions and provides a preview of decisions that may need to be made. This streamlines decision making and implementation throughout the season.

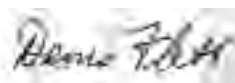
This year's plan also includes considerably more information about environmental objectives and priority watering actions for the northern Victorian wetlands and floodplains (section 9.17 and 9.18). This section includes the 'icon sites' identified as part of the Living Murray program and a range of other internationally, nationally and regionally-significant wetlands.

Management of the Water Holdings is focused on water use to take advantage of opportunities to deliver water to maximise environmental outcomes. The use of management tools such as carryover and water trading are also important; however, taking advantage of these tools for environmental purposes is a relatively new undertaking and environmental water managers have much to learn in this area. Current knowledge about water trading and carryover, and how they can complement environmental water delivery has been incorporated into this plan. In 2011-12, the VEWH traded relatively small amounts of allocation, gaining experience in the water market.

Finally, I would like to emphasise the importance of the VEWH's pivotal delivery partners, Victoria's waterway managers (catchment management authorities and Melbourne Water). Without the invaluable planning, consultation, implementation and reporting done by these dedicated organisations, Victoria's environmental watering program would not be possible. In particular, on behalf of the VEWH Commission and Office, I would like to extend my sincere thanks to waterway managers for their hard work in producing high-quality seasonal watering proposals, which are the key input for the development of this plan.

The VEWH looks forward to working with all our partners, including waterway managers, land managers, storage operators and other water holders, to implement this plan in 2012-13, as we all work towards improving the health of Victoria's rivers, wetlands and floodplains.

Denis Flett



Chairperson, Victorian Environmental Water Holder

The Seasonal Watering Plan 2012-13 is the second produced by the VEWH. It outlines the planned use of water from Victoria's environmental water entitlements (the Water Holdings), held in 13 source systems for delivery to 17 receiving systems. Delivery of water from the Water Holdings to rivers, wetlands and floodplains throughout Victoria will help maintain and improve priority environmental values.

The VEWH is made up of three part-time Commissioners who act as a board of governance in fulfilling the VEWH's mission: to manage Victoria's environmental Water Holdings, in cooperation with partners, to improve the environmental health of rivers, wetlands and floodplains.

Consultation plays a key role in environmental water planning. The VEWH consulted with waterway managers throughout 2011-12 to improve the development and implementation processes of the seasonal watering plan. Consultation with waterway managers will continue during 2012-13. In addition, the VEWH engages with other key partners for planning the delivery of Living Murray and Commonwealth environmental water. Waterway Managers engage communities for input on environmental watering priorities.

Seasonal watering proposals are developed by waterway managers to identify regional priorities for environmental water use. They provide a clear rationale to directly inform State-wide priorities forming the basis of this seasonal watering plan which outlines the full scope of priority watering actions for 2012-13. However, the priority watering actions that do get implemented ultimately depend on seasonal conditions and water availability. The plan considers a range of planning scenarios, from very dry through to an extremely wet year, and is adaptive to changing water resource conditions and opportunities throughout the water year.

The plan also considers how to coordinate delivery of water from the Water Holdings with environmental water managed by others, including the partners in the Living Murray program and Commonwealth Environmental Water. Opportunities to maximise the environmental benefits from consumptive water en route and unregulated (natural) flow events are also considered.

Seasonal watering statements will be issued to communicate decisions on priority watering actions. A statement can be made at any time during the season. Statements will relate to Waterway Managers and specific systems. Depending on the nature of the system and the entitlement being used, there may be one or multiple statements made for a particular system as conditions unfold and water becomes available (see section 5 for further information). In addition to communicating decisions on priority watering actions, seasonal watering statements authorise waterway managers to order and deliver water from the Water Holdings on behalf of the VEWH.

The VEWH will report on the management and use of the Water Holdings through its bi-monthly watering update, annual report and annual watering booklet, which includes results from monitoring of actual water delivery as well as some targeted ecological monitoring. The results of this monitoring are also fed into future planning as part of the VEWH's broader role of helping facilitate improvement in the field of environmental water management.

The priority watering actions for 2012-13 are detailed in section 9 of this plan.

Further information on the Seasonal Watering Plan 2012-13 is available at www.vewh.vic.gov.au or by calling (03) 9637 8951. For specific details about any of the systems included in this plan, please contact the appropriate waterway manager (see section 10 for contact information).

Environmental water management is a complex and evolving field. This section explains the importance of environmental watering and where the VEWB fits within the broader landscape of environmental water management.

The VEWB holds the environmental water entitlements which form the Water Holdings. The Water Holdings are actively managed to improve the health of Victoria's rivers, wetlands and floodplains, with discretion as to when, where and in what volumes water is delivered. The volume of water available from the Water Holdings varies in any given year due to seasonal conditions, including rainfall and runoff in the catchments.

Waterway managers are the key partners of the VEWB, engaging with public land managers and storage operators to manage water from the Water Holdings to implement priority watering actions.

The Water Holdings form only one part (representing about 5 percent) of Victoria's broader Environmental Water Reserve (EWR).

The EWR is the term used to describe the amount of water set aside to achieve environmental outcomes. In addition to the Water Holdings, the EWR includes water provided through:

- water set aside for the environment as obligations on consumptive water entitlements held by urban and rural water corporations – these are usually called 'passing flows' that must be released from storages or provided at a particular point of a river
- 'above cap' water provided once limits on consumptive water use have been reached or due to unregulated flows and spills from storages, usually created by heavy rainfall.

FACT #1

Why is environmental water important?

River systems across Victoria provide water that is important to our consumptive water supply and modern agriculture. As a result, many of Victoria's river systems have become highly regulated and now operate in a way that is significantly modified from natural conditions. For example, instead of water flowing uninterrupted from the top of a catchment to the sea, water is stored in dams and weir pools, diverted via pipelines and man-made channels, and used for towns, cities and irrigation. This regulation of water has effects on the health of Victoria's waterways.

Many plants and animals depend on water, just as humans do. For example, rivers, wetlands and floodplains support various plant communities, from in-stream reeds through to Australia's iconic river red gum forests and blackbox communities. These systems and their plant communities in turn support a range of animals such as waterbirds, fish, turtles and frogs.

These environmental values are what make Victoria's waterways so important to their local communities. It is a big part of the reason people enjoy camping, picnicking, walking or running beside them, boating, fishing or yabbing on them, or taking part in any other countless recreational activities associated with them.

This is why it is so important we continue to look after our rivers, wetlands and floodplains. And water is a major factor in this.

With significant amounts of water allocated for human use, water also needs to be set aside for the environment. The Water Holding are just one small but important part of the broader EWR (see information above).

After determining the environmental values of most importance to the community, scientific studies are undertaken to identify the environmental flows required to protect these values. Water from the Water Holdings is then released, as best it can be, to create the recommended flow patterns. Often these releases help mimic what would have happened in a river, wetland or floodplain under natural conditions. However, it is recognised that as most river systems are highly modified, they will not be returned to a pristine condition; rather the focus is on protecting and improving the important values that still remain.

Victorian river systems may also be allocated environmental water from other water holders, including partners in the Living Murray program, and Commonwealth Environmental Water. It is the role of the VEWH to coordinate with other holders of environmental water entitlements to maximise the benefits for Victorian waterways, and to ensure the delivery of this water will not have any adverse impacts in Victoria (see section 9.13-9.18 for more information).

It is not only environmental water that is beneficial to waterways. Other types of water can also provide environmental benefits, for example:

- consumptive water en route (that is, water on its way to being delivered to urban, rural and irrigation water users)

- system operating water (that is, water required to be released down regulated rivers and through channels to enable water to be delivered to consumptive users)
- unregulated flows (that is, water occurring naturally within the regulated rivers).

These other types of water are also considered in the development and implementation of the seasonal watering plan to ensure effective system operations, efficient use of water from the Water Holdings and to maximise environmental benefits. In many cases, timing of environmental releases can be combined with these other types of water to achieve greater environmental benefits than an environmental release alone could produce.

FACT #2

Complementary works and measures

Environmental water is just one factor that contributes to a healthy river, wetland or floodplain. Complementary works and measures protect other aspects including water quality, riparian land and in-stream habitat and can include:

- revegetation of waterways to provide habitat and prevent erosion
- streamside fencing to protect habitat from livestock damage and allow regeneration
- construction of fishways to allow fish passage
- better management of river banks to maintain and improve riparian vegetation, habitat and water quality.

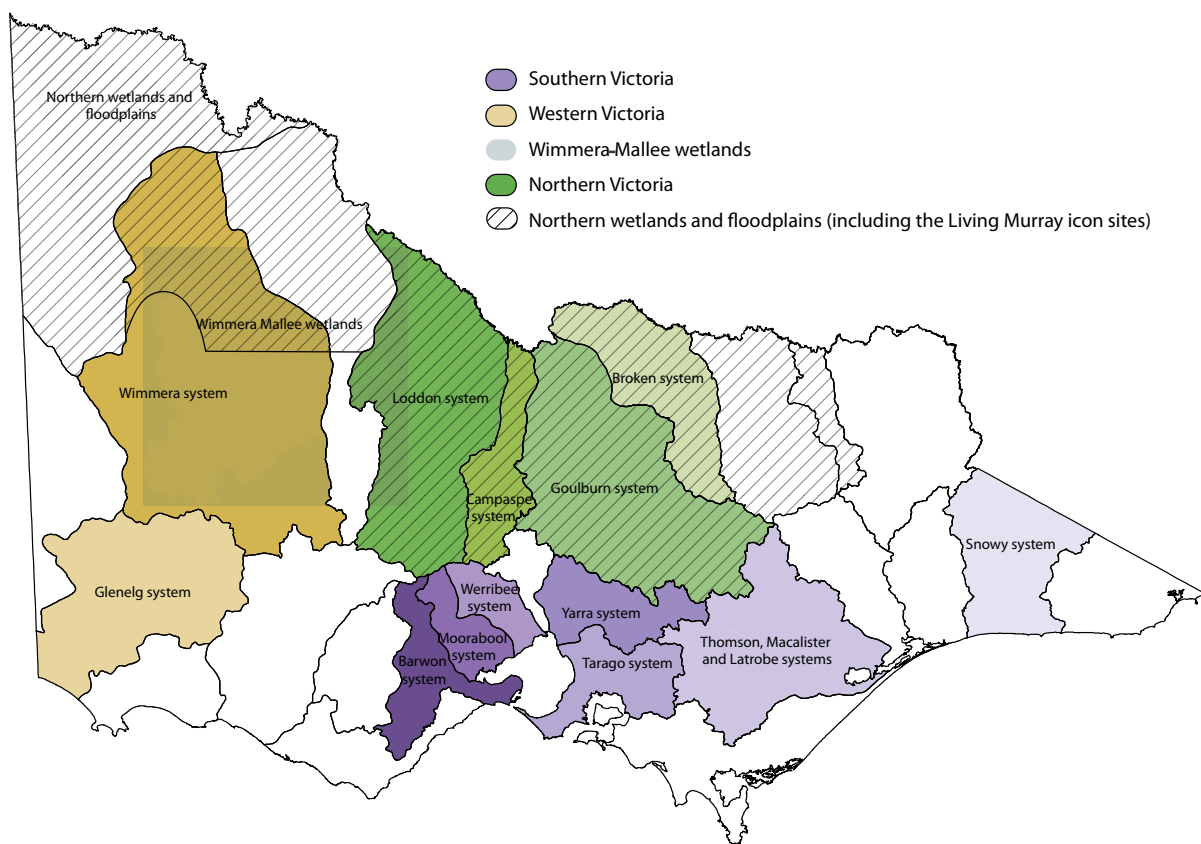


Lake Borrt, North Central Catchment Management Authority

Some river systems connect naturally, some are connected by man-made structures, and others do not connect at all. Environmental entitlements are sourced from reservoirs in one river system but may be able to be delivered and used in a number of river reaches and wetlands, depending on the specific rules of the entitlement and the physical connectivity between systems.

For example, an entitlement held in the Goulburn River may be available for use in River Murray wetlands. Figure 2.1 illustrates the systems where it is possible to deliver water from the Water Holdings.

Figure 2.1 Systems that receive water from the Water Holdings



FACT #3

What does using consumptive water en route mean?

Consumptive water is water provided for all human uses (ie. non-environmental uses).

Rivers, creeks and wetlands are often used to deliver consumptive water from storages to water users. The timing and route of this delivery can sometimes be altered to provide environmental benefit without impacting water users. Using consumptive water en route can also involve timing environmental releases with consumptive releases to achieve greater environmental benefits than an environmental release alone could produce. For example, environmental water can be used to build on flows for irrigation to water river red gums, which often requires a very high river flow. Environmental water can also be combined with consumptive water en route to reduce its potential negative impacts. For example, using environmental water to soften the rapid increase and decrease in flows by providing a gradual ramp up and down when large consumptive water releases are made.

The use of consumptive water en route can also reduce the amount of environmental water needed to meet specific objectives.

For example, in 2010-11 consumptive water alone was able to meet target flows in Gunbower Creek, with environmental water being used to cover the additional losses associated with the delivery of this water. This combined release supported fish breeding, with juvenile golden perch and silver perch moving through the system during the flow event. The watering event also succeeded in helping to mitigate declining dissolved oxygen levels in the Gunbower Creek by flushing the creek with fresh water.

Sections 3 to 8 of this plan provide some general information about the VEWH. They align with the strategic programs outlined in the VEWH's corporate plan, including the three core programs (planning, managing and reporting) and the three enabling programs (governance, relationships and engagement, and innovation and learning). Section 9 provides specific information about the priority watering actions for 2012-13 for each system in Victoria for which water from the Water Holdings may be available.

This plan and any variations will remain valid for the 2012-13 water year, and until the subsequent seasonal watering plan is released. This ensures priority watering actions that continue beyond the 2012-13 water year can continue if there are any unforeseen delays in the release of the 2013-14 plan.

Good governance arrangements and practices ensure the VEWH is independent, transparent and accountable. This section describes the roles and responsibilities of the VEWH in relation to its mission and the Water Act 1989. It also details the VEWH's Water Holdings.

3.1 The role of the Victorian Environmental Water Holder

The VEWH's mission is to manage Victoria's environmental Water Holdings, in cooperation with partners, to improve the environmental health of rivers, wetlands and floodplains.

In undertaking its mission, the VEWH has the following functions:

- making decisions on the most effective use of the Water Holdings, including use, trade and carryover
- authorising waterway managers to implement priority watering actions
- liaising with other water holders to ensure coordinated use of all sources of environmental water
- publicly communicating environmental watering decisions and outcomes
- commissioning targeted projects to demonstrate ecological outcomes of environmental watering at key sites.

The VEWH consists of three part-time Commissioners, supported by a small operations team. Denis Flett (Chairperson), Geoff Hocking (Deputy Chairperson), and Ian Penrose (Commissioner) act as a board of governance and were appointed by the Governor in Council on the recommendation of the Minister for Environment.

The objectives and functions of the VEWH are set out in sections 33DA-33DZA of the *Water Act 1989*.

The VEWH also acts in accordance with Victorian Government policy including:

- any rules issued by the Minister for Environment under section 33DZA of the *Water Act*
- regional sustainable water strategies
- the Victorian River Health Strategy (soon to be replaced by the Victorian Strategy for Healthy Rivers, Estuaries and Wetlands).

The VEWH reports to the Minister for Environment. The Department of Sustainability and Environment has a role in advising the Minister of the VEWH's performance.



L-R – Geoff Hocking, Denis Flett and Ian Penrose

3.2 The Water Holdings

The Water Holdings are the environmental water entitlements held by the VEWH. Table 3.1 details the environmental entitlements and bulk entitlements held by the VEWH as at 30 April 2012, including those held in trust for the Living Murray program.

Further information about the Water Holdings is provided in section 9.

Further details about the Water Holdings can be viewed online at the Victorian Water Register (www.waterregister.vic.gov.au) or at the VEWH website (www.vewh.vic.gov.au)

Table 3.1 The Water Holdings (as at 30 April 2012)

System	Entitlement	Volume (ML)	Reliability
Latrobe	Latrobe River Environmental Entitlement 2011	n/a ¹	Unregulated
Thomson	Bulk Entitlement (Thomson River – Environment) Order 2005	10,000	High
		n/a	Passing flows
Macalister	Macalister River Environmental Entitlement 2010	7,111	High
		3,555	Low
Yarra	Yarra Environmental Entitlement 2006	17,000	High
		55	Unregulated
		n/a	Passing flows
Tarago	Tarago and Bunyip Rivers Environmental Entitlement 2009 ²	3,000 ²	% share of inflows
		n/a	Passing flows
Werribee	Werribee River Environmental Entitlement 2011	n/a ²	% share of inflows
		n/a	Passing flows
Barwon	Barwon River Environmental Entitlement 2011	n/a ¹	Unregulated
Moorabool	Moorabool River Environmental Entitlement 2010 ²	2,500 ²	% share of inflows
		n/a	Passing flows
Wimmera and Glenelg	Wimmera and Glenelg Rivers Environmental Entitlement 2010 ⁸	41,560	High
		n/a	Passing flows
Goulburn	Environmental Entitlement (Goulburn System – Environmental Water Reserve) 2010	0 ⁴	n/a
	Goulburn River Environmental Entitlement 2010	1,432	High
	Environmental Entitlement (Goulburn System – Living Murray) 2007	39,625	High
		156,980	Low
	Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004	16,812	High
	Water Shares – Snowy River Environmental Reserve	6,121	High
		17,852	Low
	Silver and Wallaby Creeks Environmental Entitlement 2006	n/a	Passing flows
Campaspe	Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007	126	High
		5,048	Low

System	Entitlement	Volume (ML)	Reliability
Loddon	Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005 ⁸	2,000	High
		7,490	Trigger based
		2,024	Low
	Environmental Entitlement (Birch Creek – Bullarook System) 2009	100	Trigger based
		n/a	Passing flows
	Water Shares – Snowy River Environmental Reserve	470	High
Murray	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	27,600	High
		40,000	Unregulated
	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Barmah-Millewa Forest Environmental Water Allocation ¹³	50,000	High
		25,000	Low
	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Living Murray	5,710	High
		101,850	Low
		34,300	Unregulated
	Environmental Entitlement (River Murray – Environmental Water Reserve) 2010	0 ⁴	n/a
	Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004	29,794	High
	Water shares – Snowy Environmental Reserve	10,544	High
		6,415	Low

Notes:

n/a = not applicable

1. Use of these entitlements is dependent upon suitable river heights, as specified in both the Latrobe and Barwon environmental entitlements.

2. This volume represents the average annual entitlement volume. The entitlements consist of passing flows and a percentage share of inflows into storage (10.3 percent – Tarago; 10 percent – Werribee; 11.9 percent – Moorabool), with the actual volume available in any year varying depending upon inflow conditions.

3. In addition to volumetric entitlement, the entitlement also consists of above cap water.

4. The volume available under this entitlement will be amended upon confirmation of water savings associated with Stage 1 of the Northern Victoria Irrigation Renewal Program (NVIIP). In the interim period, the environment's 1/3 share of the annual water savings achieved from Stage 1 of NVIIP are provided under a supply agreement, with actual volumes determined and allocated after audit of water savings in July each year. The long-term average audited savings for the environment from 2011 are: Murray 4,539 ML; and Goulburn 24,375 ML.

4 Relationships and engagement

Environmental watering occurs through the collaboration of a range of agencies and individuals, ensuring it is coordinated and effective, bringing about the best outcomes for Victoria's rivers, wetlands and floodplains. This section outlines how the VEWH and waterway managers engage with their respective key partners to facilitate and support effective environmental watering.

4.1 Environmental watering partners

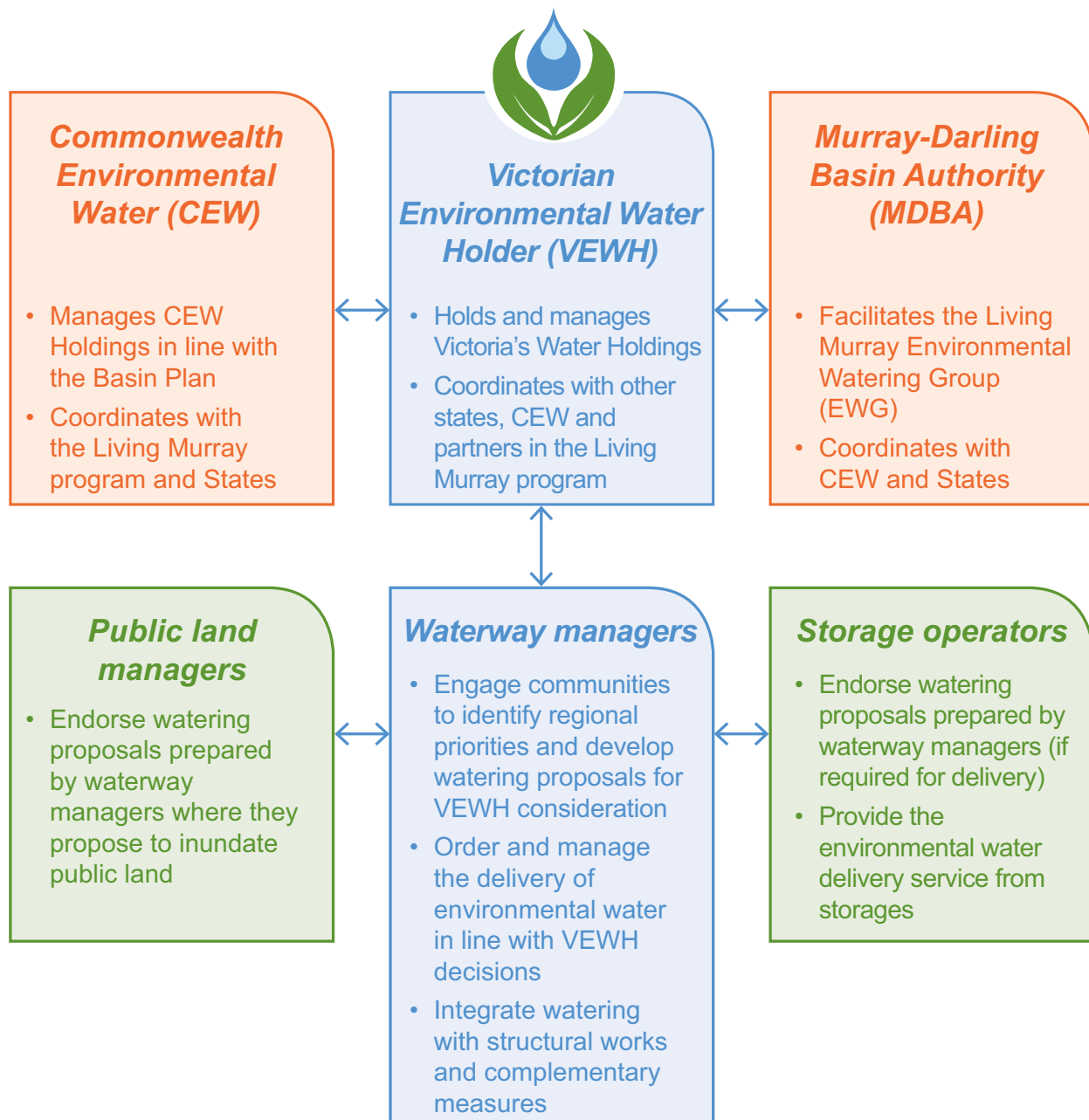
Waterway managers play the key role of engaging with public land managers, storage operators, local landholders and communities in the development of their seasonal watering proposals.

The VEWH works closely with other water holders, such as Commonwealth Environmental Water, the Murray-Darling Basin Authority and other partners in the Living Murray program, to negotiate use of their water in Victorian rivers, wetlands and floodplains. Figure 4.1 outlines the VEWH's key environmental watering partners.



Yarra River release, Melbourne Water

Figure 4.1 Key environmental watering partners in Victoria



4.2 Victorian Environmental Water Holder engagement activities

The VEWH engages directly with waterway managers through the development of seasonal watering proposals and the development and implementation of the seasonal watering plan.

The proposals and this plan are also fed through to other water holders to ensure planning is aligned and coordinated.

VEWH consultation and engagement activities in 2011-12 included:

- holding a planning session with waterway managers to modify the seasonal watering proposal guidelines to facilitate improved and more consistent planning across Victoria
- ongoing liaison with waterway managers during the development of seasonal watering proposals
- regular attendance at Environmental Water Reserve Working Group and Victorian River Health Manager Forum meetings
- ongoing involvement in the Murray-Darling Basin Authority's Environmental Watering Group, which is responsible for planning the delivery of the Living Murray program environmental water
- fortnightly teleconferences and regular meetings with both Commonwealth Environmental Water Office and the Murray-Darling Basin Authority
- ongoing communication with waterway managers on the implementation and outcomes of seasonal watering statements.

The VEWH will continue consulting with waterway managers and other water holders during the implementation of this plan, and the development and implementation of future plans.

4.3 Broader stakeholder and community consultation

Waterway managers engage public land managers and storage operators, largely to ensure that appropriate delivery arrangements are possible or in place to allow environmental watering to take place. In the case of public land managers, this also includes endorsement of the objectives underlying priority watering actions.

Other stakeholders with an interest in environmental watering include environmental groups, local government, other water entitlement holders, landholders and local communities. Waterway managers are the key link between water holders and these other important stakeholders. They undertake a range of consultation activities to ensure the views of stakeholders are captured in identifying priority river reaches, wetlands and floodplains, setting priority environmental objectives and understanding the associated priority watering actions. Some stakeholders may also wish to indicate any additional benefits or potential outcomes they see associated with the intended watering actions; for example, this is particularly important for landholders adjacent to watering sites.

In some systems, consultation is undertaken through the establishment of formal advisory groups; some specific to environmental watering, others more general in nature. In other systems, consultation is more targeted, with the level of consultation tailored to the level of interest and availability of particular interest groups and individuals.

The specific consultation and engagement activities undertaken by waterway managers during the development of their seasonal watering proposals and implementation of priority watering actions are detailed in section 9 of this plan.

However, this consultation does not only occur during the development of seasonal watering proposals and implementation of the seasonal watering plan. It is also a key component of the development of regional waterway strategies, which identify priority sites and values, and environmental water management plans, which identify long-term objectives and environmental flow requirements. See section 5 for more information on these other planning documents.

Any community members interested in sharing their views on environmental watering are encouraged to contact their local waterway managers (see section 10 for contact details).

Having a robust planning framework in place ensures the Water Holdings can be managed to maximise environmental benefits. This section outlines Victoria's environmental water planning framework and the other factors considered when planning for effective management of the Water Holdings.

5.1 Victoria's environmental water planning framework

The planning process for environmental watering in Victoria is summarised in Figure 5.1.

Seasonal watering proposals produced by waterway managers identify the regional priorities for environmental water use in each system under a range of planning scenarios. The proposals provide a clear rationale to directly inform the State-wide priorities in the seasonal watering plan. The VEWH produces a set of detailed guidelines for waterway managers to base their proposals on, encouraging an improved and consistent approach to environmental water planning across Victoria.

Seasonal watering proposals are informed by relevant regional waterway strategies, developed in consultation with the community and other partners. In addition, scientific studies into the magnitude, timing, duration and frequency of environmental flows required for each system (known as environmental flow studies), provide the scientific basis for seasonal watering proposals. These studies will also inform environmental water management plans which outline long term environmental objectives, desired flow regimes and management arrangements for each system, river reach and site identified as a long-term priority for environmental watering.

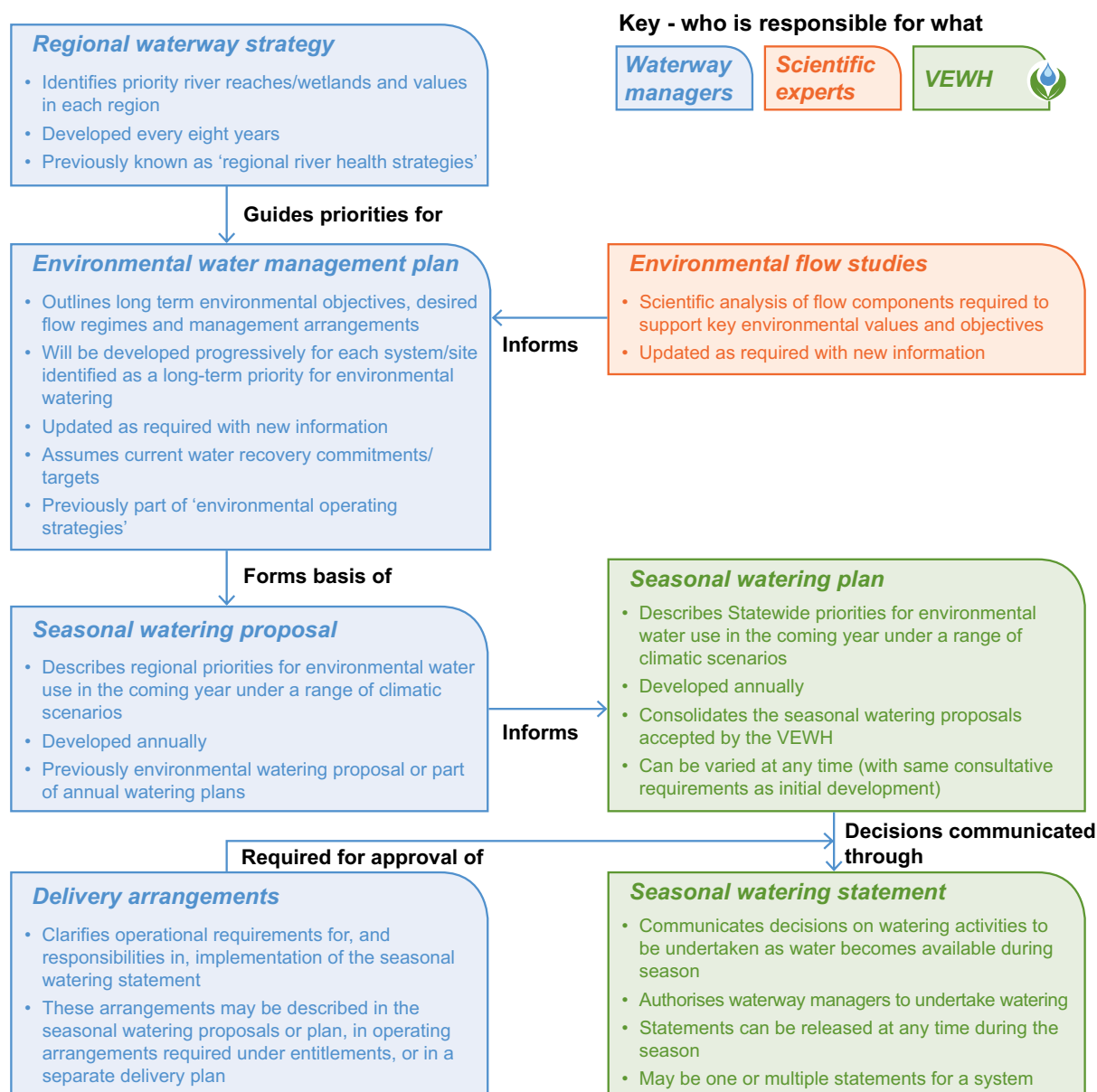
Seasonal watering proposals submitted by waterway managers have been considered by the VEWH and incorporated in this plan.

Seasonal watering statements will be issued to communicate decisions on environmental watering actions, including as water becomes available during the season. The statements authorise waterway managers to undertake priority watering actions. A number of seasonal watering statements issued in 2011-12 extend into the 2012-13 watering year. These statements and the watering actions they authorise are in line with watering priorities in both 2011-12 and 2012-13.

Before any actions are carried out, the VEWH must ensure that appropriate delivery arrangements are in place (see section 6).

Some elements of the planning framework, particularly regional waterway strategies and environmental water management plans, will be developed or refined over the next few years.

Figure 5.1 Planning for use of Water Holdings



5.2 Prioritising watering actions

It is necessary to prioritise watering actions for many reasons including: to address the variability in environmental needs from year to year; because some priority watering actions may be met naturally; or because there is not always enough supply to meet watering demands. To address this, a flexible framework called the seasonally adaptive approach is used to plan for short-term climate variability and guide decision making. This robust planning framework involves developing scenarios that help identify and scope potential watering actions and determine the priority environmental objectives for all likely conditions. In dry conditions, priority watering actions are focused on protecting drought refuges and preventing critical or irreversible loss. In wetter conditions, the aim is to improve resilience and restore floodplain linkages.

As a result of natural connectivity and man-made channels, it is often possible to deliver water from a particular reservoir to a number of river or wetland systems. Northern Victoria is particularly connected. This interconnectivity provides the opportunity to prioritise environmental water use across systems and waterway management regions. It is the role of the VEWB to do this prioritisation. Determining priorities is most important when resources are constrained; for example, during drought periods or when there are limited funds for delivery charges. In considering seasonal watering proposals, developing the seasonal watering plan and prioritising the use of the Water Holdings, the criteria used include the:

- extent and significance of the environmental benefit expected from the watering
 - for example, the area watered, the size of the breeding event to be triggered, the conservation status of the species that will benefit
- certainty of achieving the environmental benefit and ability to manage other threats
 - for example, a flow has been provided in the past with demonstrated benefits and relevant complementary measures are being undertaken at the site
- ability to provide ongoing benefits at the site
 - for example, where the management arrangements provide for watering in the long term

- water requirements of the site at which the watering is to take place, taking into account watering history at the site and the implications of not watering the site
 - for example, the potential for critical or irreversible loss of important environmental values
- risks associated with the watering
 - for example, risks to human safety, private property and perverse environmental outcomes including declines in water quality
- feasibility of the watering action
 - for example, flexibility of timing of delivery, operational requirements and constraints, and infrastructure capacity
- overall cost effectiveness of the watering action
 - for example, considering the likely benefit to be achieved against the costs of the watering action (including the volume of water to be used and any costs associated with delivery and risk management).

It is recognised that environmental watering can provide a range of benefits, including social and economic. In the interests of providing multiple outcomes wherever possible, opportunities to provide social and economic benefits will also be considered when prioritising watering actions, where there is no detriment to the potential environmental benefits.

5.3 Risk management

A State-wide risk management framework has been adopted for the development of each seasonal watering proposal. This framework assesses and rates risks relating to the implementation of priority watering actions. Section 9 outlines the risks that have been identified by waterway managers and rated medium or high for each system, and lists the intended mitigating strategies for each.

Watering actions will not be implemented where there are unacceptable associated risks.

The risks of personal injury and flooding of private land and/or public infrastructure are of particular note and have been assessed, and mitigating strategies identified where they were rated as medium or high, in all seasonal watering proposals. The VEWH and waterway managers will not flood private land without the prior consent of affected land owners. Risk management strategies will be implemented as necessary to address the risk of accidental or exacerbated flooding. In some systems, these risks have been rated low, and these are not included in the risk summaries.

Before watering actions are undertaken, waterway managers, storage operators and water holders work together to assess risks and implement mitigating strategies as necessary. Watering actions will not be undertaken where the residual risk (ie. following the implementation of mitigating strategies) is considered unacceptable.

5.4 Planning for the unknown

There are many unknown factors that can influence the planning and implementation of environmental water delivery. A number of these factors are outlined below.

Given Victoria's place in the Murray-Darling Basin, the VEWH plays a key role in planning for the delivery of Commonwealth environmental water and water from the Living Murray program. This plan specifically outlines the priority watering actions for the use of all water holders' water for environmental outcomes in Victorian river systems. However, the VEWH also acts as the intermediary for the delivery of other water holder's environmental water held in Victoria for downstream demands; for example, for the Lower Lakes in South Australia. As it is not currently possible to anticipate the specifics of these demands, it is not possible to include this detail in this plan. However, the VEWH will authorise the use of other water holder's water for environmental outcomes elsewhere, provided there are no adverse impacts on Victoria's waterways.

The VEWH may also receive water donations from individuals, community groups and other organisations, which can contribute to the priority watering actions identified in this plan. This may include: using the allocation in the system it is donated; selling the allocation to buy at a later time or in a different system; or carrying it over for a priority watering action in a future year. Some donors may wish their water to be used for a specific purpose not listed in this plan, such as a local priority watering action of importance to the donor. The benefits and cost of this would need to be weighed up by the VEWH; these types of actions may be authorised if considered beneficial.

Research proposals requiring a small volume of environmental water may be received by the VEWH throughout the year. Water may be allocated from the Water Holdings for research and development purposes where it enhances knowledge, ultimately leading to better management of the Water Holdings. Research proposals will be considered on a case-by-case basis, and authorised where it is considered they maximise environmental outcomes in the long term.

In some cases, environmental water may be needed for an emergency management situation or to mitigate the impacts of a natural event, including reducing the impact of natural blackwater events, preventing fish deaths or mitigating the effects of blue-green algae. It could also include smoothing the transition to or from a high natural flow event; for example, providing a more gradual rate of 'rise and fall' to minimise the threat of river bank slumping. It is not possible to specifically plan for these events at the start of the year, and it is often necessary to take swift action when they occur. The VEWH may decide, while considering current water availability and priority watering actions, to use a portion of the Water Holdings to mitigate adverse environmental impacts during these emergency situations.

Due to the changing nature of each system, including evolving demands on systems and new water saving projects coming online, delivery constraints in a particular system may change during the water year. Likewise, it may be necessary for waterway managers or storage operators to undertake construction, scoping, maintenance or other works during the year. These will be taken into account as the season unfolds and delivery of environmental water adjusted as appropriate.

5.5 Variations to the seasonal watering plan

In line with the *Water Act 1989*, the VEWH can only authorise a priority watering action where it is consistent with a seasonal watering plan. The VEWH is able to vary any section of the seasonal watering plan at any point during the water year. Variations may be required throughout the year to include new or amended entitlements, or to address any circumstances that could not have been identified at the start of the water year. Section 5.4 highlights circumstances where it will not be necessary to vary the plan in order to authorise a priority watering action, (though a seasonal watering statement will still need to be issued).

All variations will be made publicly available as separate attachments to the original plan. These will be available on the VEWH website and printed copies will be available on request from the VEWH office.

While this plan outlines the priority watering actions for 2012-13, environmental water planning is carried out over a rolling 18-24 month period. As a result, a number of priority watering actions in this plan begin before, or continue beyond 2012-13.



Dowd Morass, Victorian Environmental Water Holder

The effective and efficient management of the Water Holdings involves a number of processes and management tools. This section discusses the arrangements that must be in place before a priority watering action can be implemented, and how trade and carryover can be used to make the most effective use of the Water Holdings.

6.1 Delivering priority watering actions

The physical storage and delivery of environmental water to sites in Victoria is guided by, and subject to a number of conditions, rules, and in some cases fees and charges. A seasonal watering statement must be issued by the VEWB before water delivery can commence. Before issuing a seasonal watering statement to authorise a waterway manager to engage with storage operators to order and deliver water, the VEWB must be sure delivery arrangements are in place and that any costs to be met by VEWB are acceptable.

Delivery details include water source, delivery route, strategies to overcome delivery constraints, local site governance, mechanism, timing and triggers for watering, water ordering process, costs and funding sources, and reporting and monitoring requirements.

Depending on the particular system and the entitlement being used, delivery arrangements might be outlined in any of the following:

- the seasonal watering plan
- seasonal watering proposals
- operating arrangements required to be developed under some entitlements
- a separate delivery plan.

Once delivery arrangements have been confirmed, environmental watering can begin. This may be via a release from an upstream storage or by diverting directly from a river or channel.

6.2 Carryover and trade

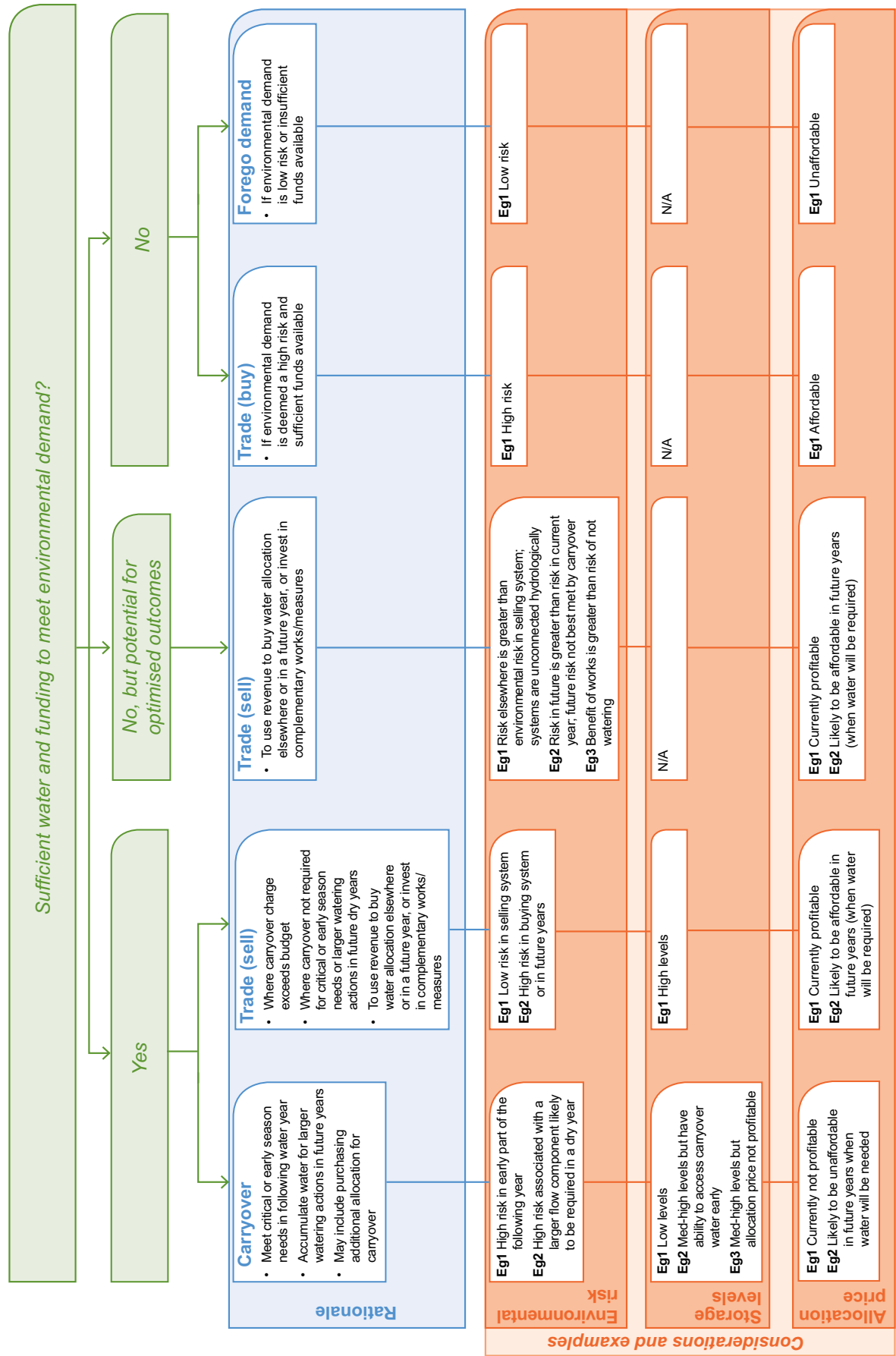
In certain circumstances, the VEWB can carry over allocation into the following water year and trade its water entitlements or allocations, consistent with the VEWB objectives – that is, the trade or carryover needs to benefit the environment. The mix of management tools including water use, carryover and trade will be used to optimise environmental benefits.

Carryover provides opportunities for more flexibility and efficiency in environmental water planning and delivery by allowing water holders to use environmental water when it is of greatest value to the environment.

Water trading also provides some opportunities to maximise environmental outcomes. For example, revenue raised through allocation trade may be used to purchase allocation at a different time or in a different system, fund delivery costs, or even fund small priority structural works to improve water use efficiency. While the VEWB also has the power to trade its water entitlements (ie. permanent trade), subject to approval by the Minister for Environment, it is not anticipated that this type of trade will be required very often.

The VEWB has developed a simple decision tree (see Figure 6.1) to outline some of the key considerations to guide carryover and allocation trading decisions. This involves assessing the amount of water available to meet environmental demand and then considering factors such as environmental risk, storage levels and allocation price.

Figure 6.1 Key considerations in allocation, trade and carryover decisions



6 Managing the Water Holdings

All carryover and trade must be:

- in line with the general rules put in place by the Minister for Water (that apply to all entitlement holders)
- in line with any specific conditions in the entitlements, and any rules put in place by the Minister for Environment
- undertaken only to maximise environmental outcomes.

The VEWH is also developing a business rule to guide the internal decision making and processes for allocation trading. This includes assessing potential third party impacts and mitigating these where possible.

In some instances, it may be appropriate for the VEWH to carry over allocation into 2013-14 or to sell some water allocation, rather than using it in the current water year. Likewise, it may be necessary to buy additional water allocation in order to complete a priority watering action in a particular system. Trade and carryover opportunities will be assessed throughout the season and undertaken only where they maximise environmental outcomes.

The VEWH must report annually on the management and use of the Water Holdings, including trade and carryover, to ensure transparency and accountability. All trading and carryover activity conducted by the VEWH will be recorded on the Victorian Water Register (www.waterregister.vic.gov.au) and published in the VEWH annual report. The VEWH trade business rule will be available on the VEWH website.



Yarra River, Yarra River Keepers

It is important to demonstrate that environmental water has been delivered, and that this water is resulting in environmental outcomes. This section outlines the monitoring, water accounting and reporting undertaken by the VEWH.

The VEWH is required to report on when, where, how and why environmental water is used. The environmental objectives of environmental watering are summarised in section 9.

7.1 Water accounting

Environmental water accounting provides information on the volume of water released, delivered and used at each of the environmental watering sites.

As priority watering actions are implemented, the VEWH maintains internal water accounting records to keep track of water use and the volumes remaining in the Water Holdings.

In addition, allocation bank accounts are held for most of the entitlements held by the VEWH. As water is allocated to, or delivered from each entitlement, these amounts are recorded in the Victorian Water Register (www.waterregister.vic.gov.au).

7.2 Monitoring

Scientific environmental flow studies demonstrate the links between particular flow components (such as freshes or overbank flows) and specific environmental outcomes (such as breeding of a priority fish species). In addition to these flow studies, the Victorian Government has developed and is undertaking the Victorian Environmental Flow Monitoring and Assessment Program (VEFMAP). This program will provide a sound scientific basis for the link between particular flow components and the ecological response.

The VEWH and waterway managers focus their monitoring efforts on actual water delivery, but may also conduct targeted ecological monitoring to improve future management decisions.

7.3 Reporting

The VEWH will report the management of the Water Holdings at the end of each water year in its annual report. The VEWH also contributes environmental water information to the Victorian Water Register, which is a public register of all water-related entitlements in Victoria.

In reporting on the priority watering actions that are implemented, the VEWH largely relies on information provided by waterway managers. This information is collated and made available in the bi-monthly watering update reporting on all environmental watering actions using the Water Holdings across Victoria. The environmental outcomes recorded from priority watering actions will be provided in the annual watering booklet. The VEWH will also report on environmental watering outcomes through its website, media releases and other publications as required.

Information about the use of the broader EWR is available through the Monthly Water Report, (produced by the Department of Sustainability and Environment). The Monthly Water Report provides a summary of the status of Victoria's water resources and water supplies at the end of the reporting month (<http://www.water.vic.gov.au/monitoring/monthly>).

A major focus of the VEWH is to take a leading role in improving the field of environmental water management. This section describes what the VEWH and its partners are doing to learn more about environmental water management to achieve greater environmental outcomes for Victoria's rivers, wetlands and floodplains.

8.1 Addressing knowledge gaps and constraints

Environmental water management is a relatively new endeavour. As such, there are many areas where additional information is required to enable better decision making and ultimately, better environmental outcomes.

The VEWH will work with waterway managers and other partners to address these areas as best as possible. In some cases, this may require technical work to address limitations in existing environmental flow studies. In others, it may only need the development of an environmental water management plan to pull together existing information and 'operationalise' scientific recommendations (ie. using science to develop management actions).

In addition, the VEWH will continue to work with the Department of Sustainability and Environment and other policy bodies to improve environmental water policy. An example includes improving environmental water accounting policies to allow greater reuse of return flows.

There are also opportunities for waterway managers to continue to work with storage operators to adjust system operations to provide environmental outcomes, as long as there are no associated adverse third party impacts. This could include changing the pattern in which consumptive water is delivered to provide short peaks in flow, rather than constant low flows, to trigger fish breeding events. It could also include adjusting the way in which 'pre-releases' are made (ie. releases made from storage to mitigate flooding impacts), in order to minimise the environmental impacts, such as bank slumping.

8.2 Adaptive management

As knowledge gaps are addressed, constraints are overcome, and as environmental water managers learn from their experiences, lessons will be incorporated in future planning.

The VEWH is in a unique position, as a State-wide body, to facilitate shared learning between all waterway managers. In this way, environmental water management will continue to improve, ultimately leading to healthier rivers, wetlands and floodplains.

FACT #4

What are return flows?

Priority watering actions use certain amounts of water to meet target flows. In many cases, when this amount has been delivered to meet its objective, some of this water is returned to the bulk supply system. This amount may be recorded by the storage operator and made available for reuse for environmental benefits downstream.

For example, when using structural works, it takes 165 GL of water to flood Gunbower Forest for one month, but only about 16 GL of this is retained on-site with the remaining 149 GL of water returning to the system. Reuse of return flows, where manageable, allows this water to be used for other environmental watering downstream; for example, pumping into Hattah Lakes.

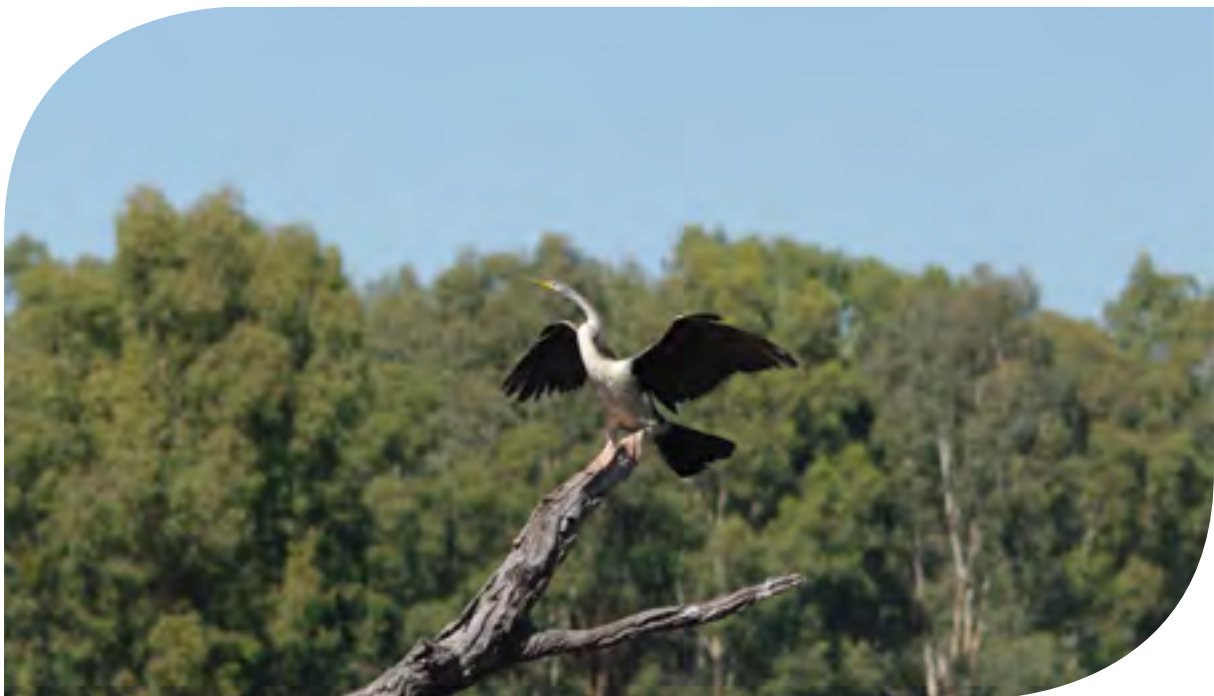
The following section outlines the scope of planned priority watering actions during 2012-13. They are described first for southern Victoria, starting in the east and moving across to western Victoria, and then for northern Victoria moving east to west.

The planned priority watering actions detailed in this section describe:

- priority flow components for rivers
- wetting and drying phases for wetlands
- possible carryover for the following years.

When planning for the implementation of watering actions, the highest priorities will be considered first, irrespective of where they fall within the year. This ensures sufficient water is available for the highest priority watering actions, before providing for the lower priority watering actions

The priority watering actions in this plan refer to the types of flows (flow components) which may be required to meet specific environmental objectives. Like the natural flow of a river or phases of a wetland, different combinations of priority watering actions provide a range of different benefits for each ecosystem. These are described in fact boxes 5 and 6.



Darter in the Barmah-Millewa Forest, Keith Ward, Goulburn Broken Catchment Management Authority

FACT #5

Common flow components

Flow components describe the different parts of a flow regime relevant to an ecosystem. They are characterised by their size, frequency, timing and duration. Common flow components and the associated benefits are:

- A **cease to flow** event is a period of no discernible flow, and is a natural characteristic in some Victorian rivers. Benefits of a cease to flow include habitat protection and diversity. A cease to flow assists in maintaining the density of native aquatic plant species and reducing the extent of invasive plant species on the stream bed. This protects habitat for many aquatic species including platypus, fish and macroinvertebrates. A cease to flow can also reduce numbers of exotic invasive species, such as European carp.
- **Low flows** generally provide a continuous baseflow through the channel. This may either maintain the flow above a cease to flow, or provide habitat as a change from high flows. Low flows can provide watering for in-stream vegetation and maintain habitat for a wide diversity of fish and macroinvertebrate species.
- **Freshes** are short duration peak flow events. They are flows that rise above the baseflow, lasting for at least several days. Freshes provide short pulses in flow and are an important part of the variability of flow regimes in a system. These types of flow events mimic what would happen as a result of an intense, localised rainfall event in an unregulated system. Freshes provide benefits including improving water quality, allowing the input of freshwater, mixing pools, triggering fish spawning and migration, encouraging bird breeding, and flushing organic matter and sediment that may have built up in a river system.
- **High flows** are persistent increases in the seasonal baseflows that remain within the channel. High flows do not fill the channel to bankfull. High flows effectively wet and connect most habitats within the main channel and are important for fish migration through the system. High flows can also act as a trigger or requirement for breeding in some fish species.
- **Bankfull flows** provide enough water to reach the top of the river bank with little flow spilling onto the floodplain. Bankfull flows provide an important trigger for fish breeding. They also help with sediment movement and bank maintenance.
- **Overbank flows** are a greater magnitude than bankfull, resulting in inundation of the adjacent floodplain habitats. Overbank flows are critical for a range of ecological factors, including floodplain productivity. To prevent damage to people and property, environmental water is not released to provide overbank flows on private land without landholder consent. Overbank flows maintain floodplain and wetland connectivity and can stimulate fish and bird breeding.

Wetland management phases

Wetlands have wetting and drying cycles, reflecting the requirements of important ecological communities. For example, the optimum flow regime in some wetlands is one year of full inundation, followed by two years with no active water management allowing the wetland to dry. Other wetlands may require three years of inundation, with only one drying year between. Maintaining the balance between wetting and drying is important in maintaining the diversity and health of the wetland system.

- **Wetting** - As water arrives in a wetland, soils become waterlogged and release nutrients. These nutrients promote a range of biological processes including the stimulation of macroinvertebrate production. Aquatic plants respond to the arrival of water by growing from seedbanks and new shoots. Animal species such as frogs, turtles and fish respond to the water by spawning and laying eggs in and around the wetland. This phase also provides breeding habitat for waterbird species such as egrets, ibis and cormorants and can sustain the health of river red gum forests.
- **Wetland inundation** - When holding water, wetlands provide habitat for a range of plant and animal species. The wetland will be used by a range of waterbirds which feed on the new vegetation growth, macroinvertebrates, fish and frogs. Vegetation species tolerant of inundation will go through their life-cycle within the wetland, while less tolerant vegetation will be pushed to the edge of the wetland where there is less water. The wetland is considered highly productive during this phase, providing a food and habitat source for a range of wetland animal species.
- **Drying** - When a wetland dries, the water-dependent animal species will start to leave the site. Waterbirds will fledge, and reptiles such as turtles will move to alternative sites. Aquatic plants complete their life cycle in preparation for future flooding events, dying off as the wetland dries. The nutrients from these plants are captured in the wetland bed and sediments. Macroinvertebrates also lay eggs in the sediment of the wetland. This phase of a wetland is critical to allow plant species such as river red gums to germinate on the exposed mud flats as water recedes. Drying phases help to maintain an appropriate balance of aquatic and terrestrial plants, and ensure the wetting phase does not exceed the requirements of the relevant ecological community.



Tarago River, Melbourne Water

Southern Victoria

Within southern Victoria, there are nine systems which can receive water from the Water Holdings (see sub-sections 9.1-9.9). These include the Snowy system in the far-east; the Latrobe, Thomson and Macalister systems in Gippsland; the Yarra, Tarago and Werribee systems around Greater Melbourne; and the Barwon and Moorabool systems around Greater Geelong and Greater Ballarat.

The Snowy River originates in New South Wales and is connected to the River Murray in northern Victoria via a series of tunnels, pipelines and aqueducts. Water Holdings held in the Goulburn, Loddon and Murray systems are used to increase environmental flows in the Snowy River via substitution.

Northern Victoria is also connected to southern Victoria by the Goldfields Superpipe (supplying Central Highlands Water's urban customers from the Goulburn system) and the Sugarloaf Interconnector (providing a physical connection between the Goulburn system and Greater Melbourne's supply system). There is also a system of aqueducts and small weirs on the Silver and Wallaby Creeks in the Goulburn system, from which water has been harvested for Greater Melbourne since 1883.

Within southern Victoria, the systems are connected as a result of interconnections completed or being built to ensure urban water supply for Greater Melbourne and Greater Geelong. There is or soon will be the physical ability to move water between the Thomson and the Yarra, between the Yarra and the Barwon, and between the Barwon and Moorabool systems.

While these connections currently or soon will exist, providing the physical ability to move water between systems, the environmental water entitlements place some restrictions on such movement. The need for and ability to undertake these transfers needs to be explored.

For the systems in which there are Water Holdings, the main storage operators in southern Victoria are Southern Rural Water, Melbourne Water and Central Highlands Water. In addition to being the storage operator, Melbourne Water is also the waterway manager for the systems around Greater Melbourne.

Western Victoria

The Wimmera-Glenelg is a single, highly-connected, regulated source system and the only system within western Victoria in which there are Water Holdings. This source system supplies both the Glenelg and the Wimmera regulated river systems (see sub-sections 9.10 and 9.11), as well as wetlands connected to the Wimmera-Mallee pipeline (see sub-section 9.12).

The Wimmera-Glenelg environmental water entitlement was originally created in 2004 as part of the process of converting loosely-defined rights to water into secure entitlements, including the water savings from the Northern Mallee Pipeline Project.

It has been progressively updated as further water savings have been realised. In 2010, the entitlement was reissued to reflect the water recovery undertaken as part of the Wimmera-Mallee Pipeline Project.

The Wimmera-Glenelg supply system is complex, with many rivers, streams and pipelines, multiple storages, channels connecting storages, and numerous passing flow requirements. The system is operated by Grampians-Wimmera-Mallee Water.

Due to this complexity, planning for use of the Water Holdings in western Victoria is undertaken collaboratively by the Wimmera and Glenelg catchment management authorities. Sub-sections 9.10 and 9.11, which address the two systems separately, are complementary to each other.

Northern Victoria

Northern Victoria includes the tributaries that flow north into the River Murray. These systems include the Goulburn, Broken, Campaspe and Loddon (see sub-sections 9.13-9.16). The northern wetlands and floodplains are also supplied by these systems as well as the Murray system (see sub-sections 9.17 and 9.18). The Living Murray icon sites, which form part of the northern wetlands and floodplains system, are addressed separately in section 9.18. There are no Water Holdings for the Kiewa and Ovens systems.

Northern Victoria is part of the Murray-Darling Basin, in which water sharing is governed by the *Murray-Darling Basin Agreement*. This agreement guides how much water is allocated to each state (Victoria, New South Wales and South Australia). Each State then has its own entitlement framework for allocating its share of water to water users.

Northern Victoria is renowned for its irrigated agricultural production and has been significantly developed over the past 100 years. The water systems in northern Victoria are highly connected, allowing water to move between systems.

The storage operator in northern Victoria is Goulburn-Murray Water, and for the storages subject to interstate sharing arrangements, the Murray-Darling Basin Authority.

Over the last 10 years, there has been significant investment to return water to the environment. In addition to Victorian projects, water recovery has been undertaken by partners of the Living Murray program and separately by the Commonwealth Government. The VEWH will liaise with these other water holders to coordinate delivery of their water with the Victorian Water Holdings and optimise the benefits for Victorian systems



Lake Wallawalla, Mallee Catchment Management Authority

9.1 Snowy system



Snowy River, East Gippsland Catchment Management Authority

Waterway manager – East Gippsland Catchment Management Authority

The heritage-listed Snowy River originates on the slopes of Mount Kosciuszko, draining 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. Much of the Snowy valley and its remnant vegetation and wetlands continue to be important resting, feeding and breeding areas for migratory species from tropical rainforests in south-east Asia and wetland birds from Russia, China and Japan. The construction of the Snowy Mountains Hydro-electric Scheme between 1949 and 1974 resulted in the diversion of 99 percent of the Snowy River's natural flow at Jindabyne Dam. While meeting critical demand for electricity generation and playing a vital irrigation role for farms in the west, flow diversion and other human activities have impacted on the river's health. The Victorian Government is working with the New South Wales and Commonwealth governments to restore health to this iconic river.

Environmental water use in 2012-13

The VEWH holds water entitlements in trust for the Snowy program, and manages the administrative requirements of these entitlements to ensure Victoria meets its commitments to provide water to the Snowy River.

Decisions about the preferred environmental water releases for the Snowy are made by the New South Wales Ministerial Corporation, on recommendation of the Snowy Scientific Committee. While the VEWH does not have a direct role in planning for delivery of this water, it will seek to work with the Snowy Scientific Committee and East Gippsland Catchment Management Authority to provide flow regimes which will benefit the lower Snowy River, estuary and wetlands.

Table 9.1.1 Water Holdings available for use in the Snowy system

Entitlement	Description
Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004	<ul style="list-style-type: none"> • 16,812 ML high-reliability entitlement
Bulk Entitlement (River Murray – Snowy Environmental Reserve) Order 2004	<ul style="list-style-type: none"> • 29,794 ML high-reliability entitlement
Water shares	<ul style="list-style-type: none"> • 6,401 ML Goulburn high-reliability water share • 17,852 ML Goulburn low-reliability water share • 11,460 ML Murray high-reliability water share • 6,415 ML Murray low-reliability water share • 470 ML Loddon high-reliability water share

System overview

The Snowy Mountain Hydro-electric Scheme is a water harvesting and hydro-electric power facility located in Kosciusko National Park in New South Wales. The Snowy Scheme can store up to 5,300,000 ML which is released to generate hydro-electricity. Under its licence, Snowy Hydro Limited has an obligation to release nominal annual volumes of 1,062,000 ML to the River Murray and 1,026,000 ML to the Murrumbidgee systems.

Since 2000, the New South Wales, Victorian and Commonwealth governments have committed \$425 million to recover 212,000 ML for the Snowy (21 percent of average natural flows downstream of the Jindabyne Dam), plus 70,000 ML for the River Murray. In 2003, Water for Rivers was established as a joint government enterprise to undertake the water recovery. The water has been primarily recovered through irrigation modernisation projects, but also included some entitlement purchases.

A substitution arrangement is in place for Water Holdings in the Murray, Loddon and Goulburn systems to increase environmental flows in the Snowy system. Water savings in the Murray and Goulburn systems provide additional water that can be supplied for consumptive use in northern Victoria. Similar arrangements apply on the New South Wales Murray and Murrumbidgee systems. This reduces the volume of water that must be supplied from the Snowy system (ie. reduces the 1,062,000 ML per year) to the River Murray and Murrumbidgee River, thereby freeing up water for environmental flows in the Snowy.

The majority of the water recovery has now been undertaken and the subsequent environmental water entitlements created. As the water recovery is completed, the remaining Victorian component will be rolled into these entitlements. The entitlements are held by the VEWB in trust for the Snowy program. The VEWB manages the administrative requirements of these entitlements to ensure Victoria meets its commitments to provide water to the Snowy system but currently has no management role in the delivery of water to the Snowy. The VEWB oversees the substitution arrangements in the Victorian rivers, which are then reported to the New South Wales Ministerial Corporation that requests this volume of environmental water to be released by Snowy Hydro down the Snowy River. The Snowy Scientific Committee, which includes two Victorian representatives, makes recommendations on the appropriate release pattern to maximise environmental benefits.

The Snowy system is shown in Figure 9.1.1.

9.1 Snowy system

Figure 9.1.1 The Snowy system



Current situation

In addition to the natural flooding flows that occurred during winter and spring 2011, the Snowy River received 84,000 ML of regulated releases over 19 days in October to mimic the spring surge that used to occur annually under natural conditions. The health of the Snowy River improved, in particular by the removal of silt and algae from the river bed.

Environmental objectives

The main environmental objective for the Snowy River for 2012-13 will focus on removing silt and algae from the river bed which has built up due to the loss of high flow events due to regulation. Secondary environmental objectives include inundating the old river bed and stimulating local-scale fish movement.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering action for the Snowy River is to provide a flushing flow (10,000 ML per day for ten days between September and November).

Adaptive management considerations

The scheduling of the flushing flow will be highly dependent on inflows during spring. Snowy Hydro is working closely with the New South Wales Office of Water around the scheduling of these flows.

Monitoring undertaken on behalf of the Victorian Department of Sustainability and Environment, East Gippsland Catchment Management Authority and New South Wales Office of Water in 2010 and 2011 established that active releases to the Snowy River can have a measurable effect as far downstream as the river's estuary. Results from any monitoring undertaken to establish the effects of environmental flow releases in Victoria will be communicated to the Snowy Scientific Committee to inform opportunities to maximise outcomes from future releases for the Victorian river reaches and estuary.

Implementation arrangements

As the VEWH does not have a direct role in planning for delivery of this water, there is no need to issue a seasonal watering statement to authorise priority watering actions in the Snowy system.

Consultation

Managed environmental water releases in the Snowy River are undertaken on the advice of the Snowy Scientific Committee. Its members are appointed by the New South Wales and Victorian governments, and the Chairperson is Dr Jane Roberts, an independent scientist with expertise in aquatic environments. The committee provides advice each year on environmental releases under the Snowy Water Licence independent from the associated governments.

The New South Wales Office of Water will be managing the community notification process around this flushing flow release.

The VEWH will liaise with the East Gippsland Catchment Management Authority and the Department of Sustainability and Environment on issues relevant to the Snowy Scientific Committee to ensure the lower Snowy River, estuary and wetlands are considered in environmental water releases into the future.

Further information

More detailed information on the Snowy system can be sought from the East Gippsland Catchment Management Authority (see section 10). Further information can be accessed from the New South Wales Office of Water at information@water.nsw.gov.au, the Snowy Scientific Committee at www.snowyssc.org or Snowy Hydro Limited at www.snowyhydro.com.au.

9.2 Latrobe system



Sale Common, West Gippsland Catchment Management Authority

Waterway manager – West Gippsland Catchment Management Authority

The lower Latrobe wetlands form part of the Gippsland Lakes system which is listed as a wetland of international importance under the Ramsar Convention. The lower Latrobe wetlands that can be actively managed with environmental water are Sale Common, Heart Morass and Dowd Morass. Sale Common is the largest remaining naturally freshwater wetland in public ownership in the Gippsland Lakes system, and is highly valued for its environmental and recreational values by the community of Sale and surrounding areas. Heart Morass is a large brackish wetland comprised of private and Crown land, at which one of the largest private wetland restoration projects in Australia has been undertaken since 2006-07. Dowd Morass is also a large, brackish wetland, which regularly supports a significant waterbird breeding colony of common and threatened species. These wetlands all support a wide variety of plant and animal species as well as diverse macroinvertebrate communities. There are also a diverse range of threatened waterbird species that use the wetlands.

Summary of planned environmental water use in 2012-13

The priority environmental objective in the lower Latrobe wetland system for 2012-13 is to provide feeding, breeding and sheltering habitat for a range of wetland species, especially waterbirds. This will be achieved by promoting the growth and reproduction of aquatic and fringing vegetation, discouraging the extent and density of undesirable vegetation, and minimising risks posed by adverse salinity and pH.

To achieve these objectives, environmental watering will focus on: inundating the wetlands at least once; and allowing them to partially drawdown between managed inundation events (primarily during summer). The number and timing of managed inundation events will be dependent on a range of considerations including physical constraints such as river height, and the ecological condition of wetland plant and animal populations.

Table 9.2.1 Water Holdings available for use in Latrobe system

Entitlement ¹	Description
Latrobe River Environmental Entitlement 2010	<ul style="list-style-type: none"> Access to water from the Latrobe River to inundate lower Latrobe wetlands when flows are above -0.7m AHD² at Swing Bridge gauging station

1. Through the Gippsland Region Sustainable Water Strategy, the Victorian Government committed to creating an additional 10 GL environmental entitlement for the Latrobe system (in Blue Rock Reservoir) by December 2012. Once this entitlement is created, the seasonal watering plan will be varied to plan for its use for the Latrobe River.

2. The Latrobe wetlands watering point is 0.7m below sea level.

System overview

Water available under the Latrobe environmental entitlement does not consist of water held in storage. It allows access to unregulated flows from the Latrobe River, downstream of the Thomson River confluence, which can be diverted into the lower Latrobe wetlands subject to river levels.

The lower Latrobe wetlands are located on the floodplain of the Latrobe River between the confluence with the Thomson River and Lake Wellington, as shown in Figure 9.2.1. The wetlands form part of the Gippsland Lakes system which is listed as a wetland system of international importance under the Ramsar Convention.

The lower Latrobe wetland system consists of a number of wetlands on the Latrobe River floodplain. There are three wetlands which are able to be managed with environmental water: Sale Common; Heart Morass; and Dowd Morass. The wetlands provide habitat for a diverse range of water-dependent species, especially plants such as water milfoil and swamp paperbark, and frogs, including the threatened growling grass frog and green and golden bell frog. The system also supports threatened waterbird species such as egrets, Australasian bitterns, royal spoonbills, glossy ibis, freckled duck, Caspian tern and white-bellied sea eagles. Sale Common provides good habitat for waterbird species, while Heart Morass is known for its ability to provide food resources, and Dowd Morass supports colonial waterbird breeding events.

The lower Latrobe wetlands are influenced by flows in the lower Latrobe River, which are in turn affected by flows in the upper Latrobe, Thomson and Macalister rivers. Regulation of, and water extraction from, these rivers has reduced the frequency of overbank flooding to the wetlands. Under high flow conditions the wetlands receive natural inundation from the river. It is possible to use environmental water to prolong the duration and extent of inundation to maximise environmental outcomes. The wetlands are also influenced by the water level and salinity of Lake Wellington.

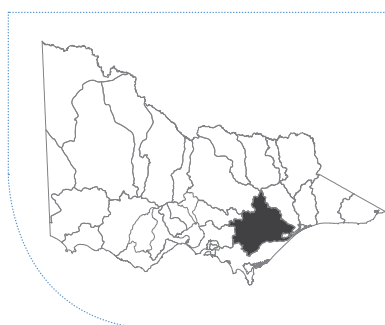
Current situation

Prior to 2010-11, the lower Latrobe wetlands were severely impacted by an extended period of relatively low rainfall and river flow, with the exception of two major floods in 1998 and 2007. These conditions increased salinity levels in Dowd Morass and Heart Morass, due to inundation of these wetlands with saline water from Lake Wellington, and reduced frequencies of riverine flushing. All wetlands were dry for extended periods during this time.

Good rainfall since spring 2010 resulted in the inundation of all lower Latrobe wetlands, including natural riverine flooding, resulting in the dilution of salinity levels. Flooding in the Thomson, Macalister and Latrobe systems occurred in 2011-12. The lower Latrobe wetlands were continuously inundated during 2011-12 and received significant overbank flooding from the Latrobe River. No managed environmental watering was required.

9.2 Latrobe system

Figure 9.2.1 The lower Latrobe wetlands



Symbol	Description
●	Sale Common
●	Heart Morass
●	Dowd Morass
●	Water infrastructure
●	Measurement point
●	Town

There were substantial environmental outcomes resulting from the improved conditions in 2011-12. Wetland plants germinated, expanding in distribution through the wetland beds, and waterbird numbers and diversity have increased to levels not observed in the district during the last 15 years. Nearly 79,000 ducks were counted in the area in November 2011.

Environmental objectives

The priority environmental objective in the lower Latrobe wetland system for 2012-13 is to provide feeding, breeding and sheltering habitat for a range of wetland species, especially waterbirds. It will be important to maintain the diversity of wetland habitats across the system. This will be achieved by promoting the growth and reproduction of aquatic and fringing vegetation, discouraging the extent and density of undesirable vegetation and minimising risks posed by adverse water quality including salinity and pH.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the lower Latrobe wetlands are as follows:

- **Sale Common:** provide wetting flows during July to November; allow partial drawdown of wetland between managed inundation events, primarily during December to March; and provide wetting flows during December to June

- **Heart Morass:** provide wetting flows during July to November; allow partial drawdown of wetland between managed inundation events, primarily during December to March; provide partial wetting flows during March to June; and provide wetting flows as required throughout the year
- **Dowd Morass:** provide wetting flows during July to November; allow partial drawdown of wetland between managed inundation events, primarily during December to March; provide partial wetting flows during March to June; and provide wetting flows as required throughout the year.

Wetting flows are events that fill the wetlands to capacity. Partial wetting flows inundate the wetland, but not to capacity. Flushing flows can only be provided by overbank flooding and are likely to be more effective if significant drawdown has occurred in the wetlands. This is an important flow component to improve water quality and environmental condition of the wetlands. Drawdown of the wetlands occurs when water levels recede and over 75 percent of the wetland surface dries out.

Table 9.2.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios.

9.2 Latrobe system

Table 9.2.2 Priority watering actions under a range of planning scenarios in the Latrobe system

	Planning scenario			
	Drought	Dry	Average	Wet
Sale Common				
Environmental objectives	<p>Encourage the growth and reproduction of aquatic herbland and sedgeland and swamp scrub</p> <p>Maximise recycling of nutrients</p> <p>Maintain ecological functioning of refuge areas</p> <p>Reduce area of parrot's feather and number of European carp</p>	<p>Reduce the extent and density, and discourage the spread, of giant rush</p> <p>Encourage the growth and reproduction of tall spike rush, and aquatic herbland and sedgeland and swamp scrub</p> <p>Maintain waterbird and fauna breeding, recruitment and foraging and sheltering opportunities</p> <p>Import organic matter and nutrients</p> <p>Import seed/propagules</p>	<p>Reduce the extent and density, and discourage the spread, of giant rush</p> <p>Encourage the growth and reproduction of tall spike rush, and aquatic herbland and sedgeland and swamp scrub</p> <p>Maintain waterbird and fauna breeding, recruitment and foraging and sheltering opportunities</p> <p>Import organic matter and nutrients</p> <p>Import seed/propagules</p>	<p>Reduce the extent and density, and discourage the spread, of giant rush</p> <p>Encourage the growth and reproduction of tall spike rush, aquatic herbland and sedgeland and fringing plants such as river red gum</p> <p>Maintain waterbird and fauna breeding recruitment and foraging and sheltering opportunities</p> <p>Maximise importation of organic matter and nutrients and export of salt</p> <p>Maximise dispersal of seed/propagules</p> <p>Facilitate movement of dwarf galaxias from/to Flooding Creek and Cox's Bridge populations</p> <p>Provide breeding habitat for growling grass frog and green and golden bell frog</p>
Priority watering actions	<p>Drawdown (July-June)</p>	<p>Wetting flow (July-November)</p> <p>Partial drawdown (between managed inundation events)</p> <p>Wetting flow (December-June)</p> <p>Emergency wetting flow (anytime)</p>	<p>Wetting flow (July-November)</p> <p>Partial drawdown (between managed inundation events)</p> <p>Wetting flow (December-June)</p>	<p>Wetting flow (July-November)</p> <p>Partial drawdown (between managed inundation events)</p> <p>Wetting flow (December-June)</p>

Table 9.2.2 Priority watering actions under a range of planning scenarios in the Latrobe system (continued)

	Planning scenario			
	Drought	Dry	Average	Wet
Possible volume required from the Water Holdings	0 ML	1,500 ML	900 ML	0 ML
Heart Morass				
Environmental objectives	<p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Maintain/enhance condition and extent of structurally-dominant plants such as swamp paperbark and common reed</p> <p>Provide opportunities for waterbird and fauna breeding, recruitment, foraging and sheltering</p> <p>Maximise recycling of nutrients</p> <p>Maintain ecological functioning of refuge areas</p> <p>Reduce number of European carp</p> <p>Avoid/mitigate risks to aquatic plants and waterbird habitat from adverse salinity/pH</p>	<p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Maintain/enhance condition and extent of structurally-dominant plants such as swamp paperbark and common reed</p> <p>Maintain/enhance waterbird and fauna breeding, recruitment, foraging and sheltering opportunities</p> <p>Import organic matter and nutrients</p> <p>Reduce salinity and maintain/increase pH</p> <p>Import seed/propagules</p> <p>Encourage growth of vegetation and natural regeneration</p>	<p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Maintain/enhance condition and extent of structurally-dominant plants such as swamp paperbark and common reed</p> <p>Maintain/enhance waterbird and fauna breeding, recruitment, foraging and sheltering opportunities</p> <p>Import organic matter and nutrients</p> <p>Reduce salinity and maintain/increase pH</p> <p>Import seed/propagules</p> <p>Encourage growth of vegetation and natural regeneration</p>	<p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Maintain/enhance condition and extent of structurally dominant plants such as swamp paperbark, common reed and river red gums</p> <p>Maximise waterbird and fauna breeding, recruitment, foraging and sheltering opportunities</p> <p>Maximise importation of organic matter and nutrients</p> <p>Export salt and increase pH levels</p> <p>Maximise dispersal of seed/propagules</p> <p>Provide breeding habitat for growling grass frog and green and golden bell frog</p> <p>Encourage growth of vegetation and natural regeneration</p>
Priority watering actions	<p>Drawdown (July-June)</p> <p>Emergency wetting flow (anytime)</p>	<p>Wetting flow (July-November)</p> <p>Partial drawdown (between managed inundation events)</p> <p>Partial wetting flow (March-June)</p> <p>Emergency wetting flow (anytime)</p>	<p>Wetting flow (July-November)</p> <p>Partial drawdown (between managed inundation events)</p> <p>Partial wetting flow (March-June)</p>	<p>Wetting flow (July-November)</p> <p>Partial drawdown (between managed inundation events)</p> <p>Partial wetting flow (March-June)</p>

9.2 Latrobe system

Table 9.2.2 Priority watering actions under a range of planning scenarios in the Latrobe system (continued)

	Planning scenario			
	Drought	Dry	Average	Wet
Possible volume required from the Water Holdings	7,100 ML	5,500 ML	5,200 ML	0 ML
Dowd Morass				
Environmental objectives	<p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Maintain/enhance condition and extent of structurally-dominant plants such as swamp paperbark and common reed</p> <p>Provide opportunities for waterbird and fauna breeding, recruitment, foraging and sheltering</p> <p>Maximise recycling of nutrients</p> <p>Maintain ecological functioning of refuge areas</p> <p>Reduce number of European carp</p> <p>Avoid/mitigate risks to aquatic plants and waterbird habitat from adverse salinity/pH</p>	<p>Maximise colonial waterbird breeding opportunities</p> <p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Promote recolonisation of submerged aquatic plants such as ribbon weed</p> <p>Maintain/enhance condition and extent of structurally dominant plants such as swamp paperbark and common reed</p> <p>Maintain/enhance waterbird and fauna breeding, recruitment, foraging and sheltering opportunities</p> <p>Import organic matter and nutrients</p> <p>Reduce salinity and maintain/increase pH levels</p> <p>Import seed/propagules</p> <p>Avoid/mitigate risks to aquatic plants and waterbird habitat from adverse salinity/pH</p>	<p>Maximise colonial waterbird breeding opportunities</p> <p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Promote recolonisation of submerged aquatic plants such as ribbon weed</p> <p>Maintain/enhance condition and extent of structurally dominant plants such as swamp paperbark and common reed</p> <p>Maintain/enhance waterbird and fauna breeding, recruitment, foraging and sheltering opportunities</p> <p>Import organic matter and nutrients</p> <p>Reduce salinity and maintain/increase pH.</p> <p>Import seed/propagules</p>	<p>Maximise colonial waterbird breeding opportunities</p> <p>Encourage the growth and reproduction of aquatic hermland and brackish hermland</p> <p>Promote recolonisation of submerged aquatic plants such as ribbon weed</p> <p>Maintain/enhance condition and extent of structurally dominant plants such as swamp paperbark, common reed and river red gums</p> <p>Maximise waterbird and fauna breeding, recruitment, foraging and sheltering opportunities</p> <p>Maximise importation of organic matter and nutrients</p> <p>Export salt and increase pH</p> <p>Maximise dispersal of seed/propagules</p> <p>Provide breeding habitat for growling grass frog and green and golden bell frog</p>

Table 9.2.2 Priority watering actions under a range of planning scenarios in the Latrobe system (continued)

	Planning scenario			
	Drought	Dry	Average	Wet
Priority watering actions	Drawdown (July-June) Emergency wetting flow (anytime)	Wetting flow (July-November) Partial drawdown (between managed inundation events) Partial wetting flow (March-June) Emergency wetting flow (anytime)	Wetting flow (July-November) Partial drawdown (between managed inundation events) Partial wetting flow (March-June)	Wetting flow (July-November) Partial drawdown (between managed inundation events) Partial wetting flow (March-June)
Possible volume required from the Water Holdings	5,800 ML	4,400 ML	4,200 ML	0 ML
System total				
Possible volume required from the Water Holdings¹	12,900 ML	11,400 ML	10,300 ML	0 ML
Possible carryover into 2013-14²	N/A	N/A	N/A	N/A

1. Estimated volumes assume some contribution of unregulated flows will be experienced throughout the year.

2. Entitlement consists of access to river flows only and no right to storage capacity, therefore no carryover is available.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the lower Latrobe wetlands. West Gippsland Catchment Management Authority will monitor the flows occurring naturally in the system, and assess the best time to divert water to maximise environmental benefit according to a number of considerations. These include water level and water quality in the wetlands and the Latrobe River, as well as the condition of plant species or the presence of animal species in the wetlands.

Existing wetland water control infrastructure enables delivery of wetting flows, subject to suitable river conditions, and can facilitate drying phases. However, delivery of flushing flows is not possible with existing infrastructure and can only be achieved through natural high flow events.

Allowing water levels in the wetlands to fluctuate in accordance with rainfall and evaporation, avoiding a complete drying of the wetlands (except Sale Common in drought conditions) will build significantly on the environmental benefits seen during high inflow conditions in 2011-12.

Water quality is an important factor influencing environmental watering decisions in the lower Latrobe wetlands, particularly Heart Morass and Dowd Morass, as river water quality can be influenced by saline water from Lake Wellington during extended periods of low flow. Emergency wetting flows to maintain water quality may be necessary, particularly in dry conditions to prevent and mitigate prolonged excessive salinity concentrations and activation of acid sulphate soils. To assess the need for emergency wetting flows, wetland salinity, pH and plant and animal populations will be monitored. Emergency watering may be undertaken if wetland salinity levels exceed 10 grams per litre and/or pH drops below four for prolonged periods.

Under dry conditions, managed watering will not be possible at Sale Common as river baseflows are approximately the same height as the wetland bed. Under wet conditions, it is expected that all priority flow components, including flushing flows, will be delivered naturally without the need to operate water control structures.

Emergency wetting flows may be required to avoid excessive salinity and/or low pH levels that may arise from water level drawdown or inundation with saline water. If required, it is most likely this will occur in autumn or early winter.

Under all but drought conditions, river heights are likely to be sufficient to enable the operation of water control structures to maintain or increase wetland water levels in each system.

Implementation arrangements

Seasonal watering statements will be issued by the VEWL to communicate decisions on the priority watering actions to be undertaken, and to authorise West Gippsland Catchment Management Authority to implement these decisions.

Priority watering actions in the lower Latrobe wetlands will be undertaken by the West Gippsland Catchment Management Authority in accordance with seasonal watering statements, and operating arrangements, expected to be finalised in 2012-13.

The inundation of Sale Common could impact upgrade works on the South Gippsland Highway. Agreement with Vic Roads will be sought by the West Gippsland Catchment Management Authority prior to any managed watering action occurring.

Watering actions identified for Heart Morass will inundate private land. Watering actions for Heart Morass will not be undertaken until agreements with affected landowners are successfully negotiated. The process for negotiating these agreements will be managed by the West Gippsland Catchment Management Authority.

Reporting on the volume of water used under the Latrobe entitlement will be estimates only; it is not possible to precisely measure the volumes as water is not being released from storage or pumped out of channel.

The implementation of priority watering actions will be reported in the VEWL's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWL website at www.vewl.vic.gov.au. Throughout the season, the West Gippsland Catchment Management Authority will also report on watering actions through mechanisms such as media releases and website updates.

Risk assessment and management

In the lower Latrobe wetlands, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.2.3 summarises the medium and high risks, and the mitigating strategies identified by the West Gippsland Catchment Management Authority. The costs of mitigating strategies will be considered in light of funding availability.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

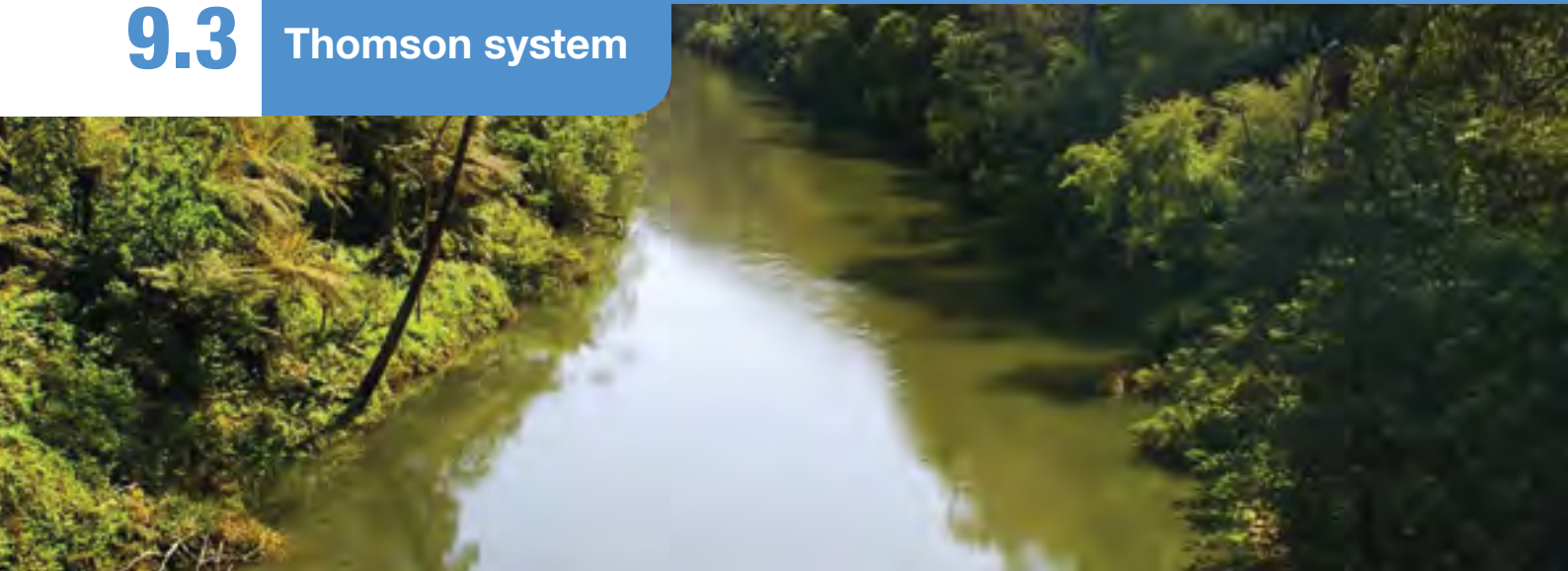
Key stakeholders and community members with an interest in the lower Latrobe wetlands were consulted in the development of the Latrobe seasonal watering proposal, including Parks Victoria, the Lower Latrobe Reference Group, Heart Morass Committee of Management and the Wetlands Environmental Taskforce Trust.

Further information

More detailed information on environmental watering in the Latrobe system can be sought from the West Gippsland Catchment Management Authority (see section 10).

Table 9.2.3 Risk management in the Latrobe system

Risk type	Mitigating strategy
Unable to demonstrate compliance with environmental entitlement	Develop and implement metering/monitoring programs
Unable to provide evidence of meeting environmental objectives	Undertake environmental monitoring and research to assist in reporting on the effects of environmental water management and in refining understanding and management over time
Environmental watering causes unplanned flooding of private land (within Heart Morass)	Identify owners of private land within the Heart Morass whose land might be affected by environmental watering Negotiate agreements with identified landholders
Environmental watering causes flooding of public infrastructure (delaying South Gippsland Highway upgrade due to inundation of work site adjacent to Sale Common)	Do not actively inundate Sale Common until agreement with Vic Roads is reached
Priority watering action causes water quality issues (low pH and high salinity in Dowd Morass and Heart Morass during drawdown)	Catchment Management Authority staff, volunteers and other agency staff will monitor wetland salinity, pH and plant and animal populations to inform need for emergency wetting flows to mitigate adverse water quality conditions
Improved conditions for non-native species (ie. carp)	Investigate practicalities, benefits and costs of using commercial fishing to reduce the amount of European carp
Key stakeholders not supportive of environmental watering	Establish formal landholder agreements prior to proceeding with active inundation of private land Engage key stakeholders in the development of seasonal watering proposals Explain purpose prior to undertaking environmental water actions using appropriate mechanisms (eg. local media, speaking to relevant groups/ individuals)



Thomson River, West Gippsland Catchment Management Authority

Waterway manager – West Gippsland Catchment Management Authority

The Thomson River flows 213 kilometres in a south-easterly direction from the slopes of Mt Whitelaw on the Baw Baw Plateau to join the Latrobe River south of Sale. It is home to some of the most abundant and diverse native fish populations in the Gippsland region, with seven species of migratory fish inhabiting the river, including the threatened Australian grayling. Two sections of the Thomson River (above Cowwarr Weir and the Aberfeldy River within the Baw Baw National Park) are also listed as heritage rivers for their significant environmental, recreational and cultural attributes. In addition, it provides many social opportunities including camping, hiking and rafting. The Thomson Reservoir is the major storage in the system, and is integral to Melbourne's water supply contributing approximately 60 percent of Melbourne's total reservoir storage capacity.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Thomson system for 2012-13 are: maintaining the diversity and condition of aquatic habitat, and delivery of flows to stimulate the migration and spawning of fish.

To achieve these objectives, environmental watering will focus, in priority order, on the primary priorities of: autumn freshes; spring baseflows; autumn/winter baseflows; and autumn/winter/spring freshes. A second-tier priority in the Thomson system is summer/autumn freshes. The priority river reach is reach 3, from Aberfeldy to Cowwarr Weir.

Table 9.3.1 Water Holdings available for use in the Thomson system

Entitlement	Description
Bulk Entitlement (Thomson River – Environment) Order 2005 ¹	10,000 ML per year and share of reservoir storage space Minimum passing flows at various weirs and gauges throughout the Thomson system

¹ The Gippsland Region Sustainable Water Strategy commits to an additional 8,000 ML for the Thomson environmental bulk entitlement (and allowing flexibility to vary passing flow rates) and is scheduled to be finalised in June 2012.

System overview

The priority river reach for environmental watering in the Thomson system is reach 3 from Aberfeldy to Cowwarr Weir due to its largely intact native riparian vegetation communities and significant fish populations, including the threatened Australian grayling. Reach 2 also benefits from flows being passed to reach 3. The measurement point for target flows at reach 3 is Coopers Creek gauge. The environmental flow reaches for the Thomson system are shown in Figure 9.3.1

The environmental entitlement in the Thomson system is held in and released from Thomson Reservoir into reach 2. Further downstream at Cowwarr Weir, the Thomson River splits into two, with water able to be passed down the Old Thomson course (reach 4a), or the New Thomson course (reach 4b). The preference is to pass environmental water down reach 4a to allow for fish migration as Cowwarr Weir is a barrier to fish passage into reach 4b. While reaches 5 and 6 both have important environmental values, it is difficult for managed environmental flow releases to reach them due to the distance and inability to manipulate significant flow volumes at Cowwarr Weir. Water provided through reaches 3 and 4 will still have some benefits to the lower reaches 5 and 6.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Current situation

The prolonged drought from 1997 saw decreased Australian grayling populations in the Thomson system. Environmental water has been used to deliver autumn freshes over the last three years to trigger grayling spawning, and an increase in the population has since been observed. Flows continue to be important to the recovery of grayling populations.

Wet catchment conditions continued throughout 2011-12, with above average rainfall experienced across the catchment, resulting in significant flows down the Thomson River. A number of freshes, bankfull and overbank flows occurred naturally during the year, moving sediment that accumulated in the river channel and restoring important habitat for aquatic species. In addition to these natural flows, spring and autumn baseflows and autumn freshes were delivered to the system using environmental water.

Environmental objectives

The priority environmental objective for the Thomson system is the protection and enhancement of the self-sustaining population of Australian grayling. This includes maintaining the diversity and condition of aquatic habitat, and delivery of flows to stimulate the migration and spawning of fish. Australian grayling are a short-lived species (two to three years) that need to breed on a regular basis to maintain a viable population. Spawning is essential at least twice in any three-year period.

9.3 Thomson system

Figure 9.3.1 The Thomson system



Symbol	Description
	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 the 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

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the primary priority watering actions to be undertaken during 2012-13 in the Thomson system, in priority order, are as follows:

- autumn freshes (one to two freshes of 800 ML per day for four days each during April to May)
- spring baseflows (230 ML per day from October to November)
- autumn/winter baseflows (230 ML per day from May to June)
- autumn/winter/spring freshes (up to four freshes of 800 ML per day for four days each during May to November).

A second-tier priority watering action is:

- summer/autumn freshes (seven freshes of 230 ML per day for three days each during December to April).

The additional flexibility to vary the rate of passing flows in the amendment to the Thomson environmental entitlement (scheduled to be finalised in June 2012) will allow spring and autumn/winter baseflows to be met by passing flows, reducing the need for delivery of environmental water held in storage.

Bankfull flows are also recognised as an important flow component for riparian vegetation maintenance and recruitment, as well as creating disturbance and scour within the river channel. Due to potential flooding risks, infrastructure constraints and the large volume of water required to deliver the flows these flows will not be actively managed, but may occur naturally.

Table 9.3.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.3.2 illustrates the priority watering actions for 2012-13.



Thomson River, West Gippsland Catchment Management Authority

Table 9.3.2 Priority watering actions for the Thomson system under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet to very wet
Expected availability of Water Holdings¹	12,000 ML	14,000 MLw	18,000 ML	>18,000 ML
Environmental objectives	<p>Protect high priority ecological assets by maintaining refuge habitat requirements</p> <p>Avoid catastrophic events caused by water quality issues or high-priority species generational loss</p>	<p>Maintain high priority ecological assets by providing for refuge habitat requirements</p> <p>Maintain river functioning with reduced reproductive capacity</p> <p>Avoid catastrophic events caused by water quality issues or high-priority species generational loss</p>	<p>Improve ecological health and resilience</p> <p>Enhance recruitment opportunities for key plant and animal species</p> <p>Maximise opportunities for natural inflows to meet in-channel environmental objectives (ie. piggy backing)</p>	<p>Maximise recruitment opportunities for key plant and animal species</p> <p>Restore key floodplain and wetland linkages</p> <p>Maximise opportunities for natural inflows to meet in-channel, floodplain and wetland objectives (ie. end of system wetland watering)</p>
Priority watering actions	<p>Spring baseflows</p> <p>Autumn/winter baseflows</p> <p>Summer/autumn freshes²</p>	<p>One autumn fresh</p> <p>Spring baseflows</p> <p>Autumn/winter baseflows</p> <p>Summer/autumn freshes²</p>	<p>One to two autumn freshes</p> <p>Spring baseflows</p> <p>Autumn/winter baseflows</p> <p>One to two autumn/winter/spring freshes</p> <p>Summer/autumn freshes²</p>	<p>Two autumn freshes</p> <p>Spring baseflows</p> <p>Autumn/winter baseflows</p> <p>Two to four autumn/winter/spring freshes</p> <p>Summer/autumn freshes²</p>
Possible volume required from the Water Holdings³	5,000 ML	10,000 ML	18,000 ML	18,000-25,000 ML
Possible carryover into 2013-14⁴	7,000 ML	4,000 ML	0 ML	0 ML

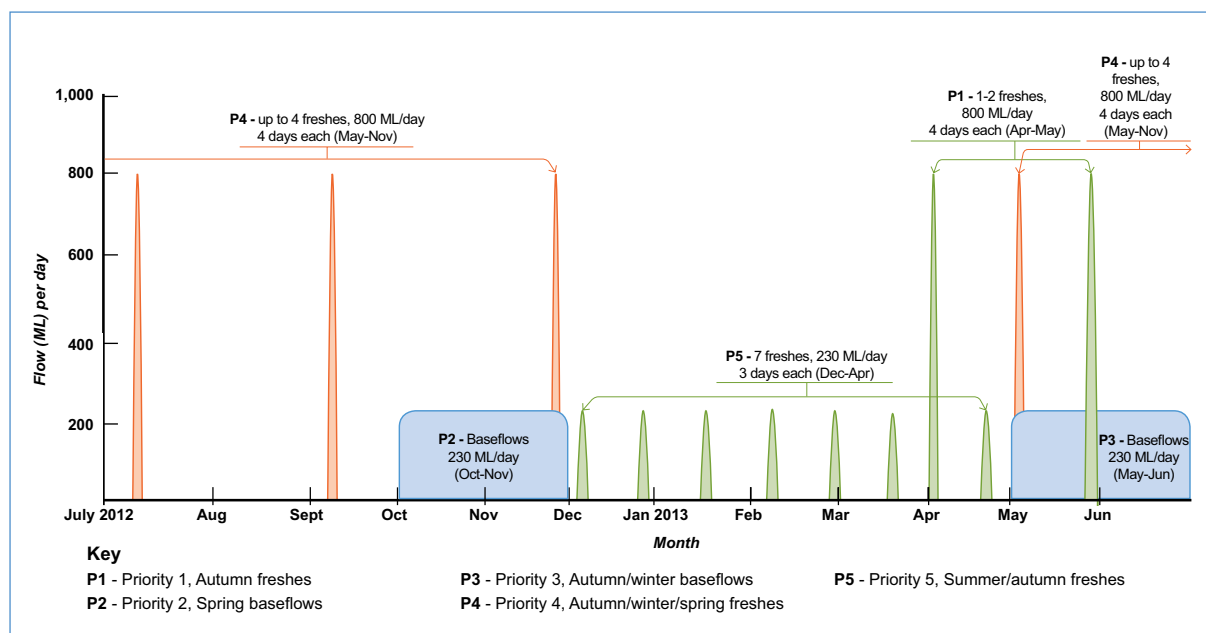
1. These figures include water expected under the environmental entitlement through an amendment due for completion in June 2012.

2. Summer/autumn freshes are a secondary priority in the Thomson system, generally provided for by consumptive water releases. Environmental water may be used to supplement flows only when sufficient water is available to meet higher priorities.

3. Figures assume no unregulated flows occur, and are therefore an upper limit of the volume required from the Water Holdings.

4. The amount of carryover available in 2013-14 can be limited by the available reservoir storage capacity; however this is unlikely to be an issue in 2013-14.

Figure 9.3.2 Priority watering actions in the Thomson system¹



1. This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Thomson system. West Gippsland Catchment Management Authority will monitor catchment conditions, inflows, likely seasonal forecast, and water availability to determine the best time to make releases to provide the priority watering actions efficiently and with maximum environmental benefit.

Autumn freshes are not a priority under drought conditions, as they have been provided every year for the last three years. However, if an autumn fresh is not provided this year, it must be provided in 2013-14 to ensure survival of the Australian grayling population.

The timing of the delivery of autumn fresh events in the Thomson system has been adjusted based on scientific advice and outcomes from research into Australian grayling spawning in the Tarago system. The research has identified the optimum timing for grayling spawning to be in April or May. Monitoring will be undertaken to determine the effectiveness of the revised flow timing in the Thomson system.

The Thomson River environmental bulk entitlement specifies passing flows for the system throughout the year. The passing flows set out in the entitlement are higher than those required for environmental purposes. The planned amendment to the entitlement will allow the passing flow rate to be reduced, subject to system operations, and allow withheld flows to be retained in storage if there is spare capacity in Thomson Reservoir and used to provide priority watering actions. However, it will be the first water to be lost if the storage spills. Once the entitlement amendment is finalised, the West Gippsland Catchment Management Authority will assess the benefits of reducing passing flows during the year to provide high priority components.

Implementation arrangements

Seasonal watering statements will be issued to communicate decisions on the priority watering actions to be undertaken, and authorise West Gippsland Catchment Management Authority to implement these decisions.

9.3 Thomson system

Priority watering actions in the Thomson system will be undertaken by West Gippsland Catchment Management Authority in accordance with seasonal watering statements, and in consultation with Melbourne Water, as storage operator. Implementation will also be guided by the draft Thomson River Operating Arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vevh.vic.gov.au. Throughout the season, watering actions will be communicated by West Gippsland Catchment Management Authority through media releases and stakeholder updates targeting river operators, users, local landholders and the broader community.

Risk assessment and management

In the Thomson system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.3.3 summarises the medium and high risks, and the mitigating strategies identified by West Gippsland Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Table 9.3.3 Risk management in the Thomson system

Risk type	Mitigating strategies
Release volume is insufficient in meeting required flow at target point (potential changes to passing flows in reach 2)	Undertake modelling and risk assessment Use existing passing flow rules until potential impacts are adequately analysed and management actions developed
Storage operator maintenance works affect the ability to deliver water	Engage in regular communications with storage operator (Melbourne Water) to schedule maintenance works
Limited human resources to deliver environmental release	Internal and external information sharing on staff availability and planned releases Sufficient lead times and notifications with storage operator (Melbourne Water) and stakeholders of upcoming flow release orders
Environmental water release causes personal injury to river users	Provide adequate communication of planned flow releases to stakeholders and the broader community

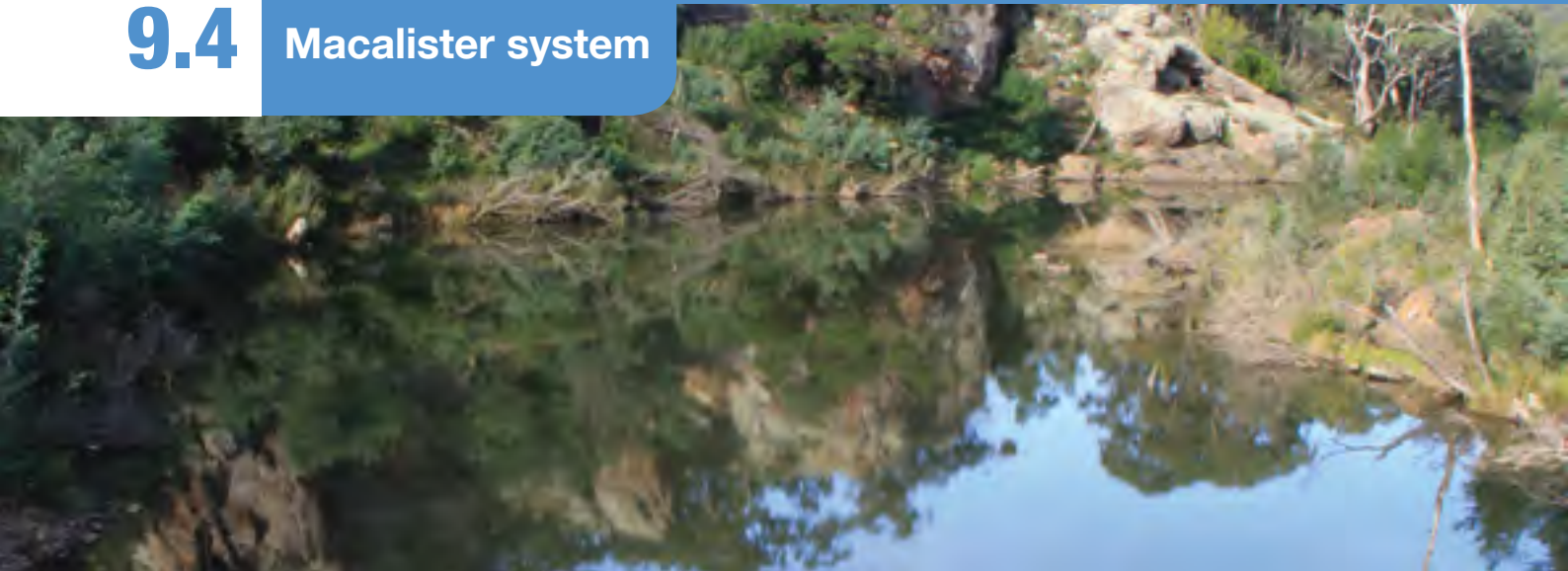
Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders in the Thomson system were consulted in the development of environmental watering priorities for 2012-13. This included Melbourne Water (storage operator) and Southern Rural Water (manager of irrigation entitlements in the Thomson system). Discussions were held with these agencies to assist in the development of planning scenarios for the Thomson system, and facilitate the sharing of information on likely system operations and any issues that may influence the ability to deliver priority watering actions.

Further information

More detailed information can be sought from West Gippsland Catchment Management Authority (see section 10).



Macalister River, West Gippsland Catchment Management Authority

Waterway manager – West Gippsland Catchment Management Authority

The Macalister system is pivotal to the Gippsland region, in part due to its supply of water to the Macalister Irrigation District – the largest irrigation area south of the Great Dividing Range, covering over 50,000 ha. The Macalister River also provides fresh water flows into the lower Latrobe River and to the Gippsland Lakes and surrounding wetlands, and is home to the threatened Australian grayling. The system has high social and recreational values, supporting activities including rafting and fishing.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Macalister system for 2012-13 are: maintaining the diversity and condition of aquatic habitat; maintaining fish passage; and assisting spawning and migration of priority fish species, in particular the Australian grayling.

To achieve these objectives, environmental watering will focus, in priority order, on: autumn/winter baseflows; autumn freshes; and summer/autumn low flows. The priority river reach is reach 2, from Maffra Weir to the Thomson River confluence.

Table 9.3.1 Water Holdings available for use in the Macalister system

Entitlement	Description
Macalister River Environmental Entitlement 2010	12,461 ML high-reliability entitlement 6,320 ML low-reliability entitlement Passing flows

System overview

The priority river reach for environmental watering in the Macalister system is reach 2 from Maffra Weir to the Thomson River confluence, due to its significant fish populations, including the threatened Australian grayling and river blackfish. In particular, flows for fish spawning are targeted at reach 2 because Maffra Weir is a barrier to fish movement. The associated measurement point at Maffra Weir has measurement inaccuracies; therefore, flows are measured in reach 1 (Lake Glenmaggie to Maffra Weir), downstream of Lake Glenmaggie. As the reaches are relatively short and the Macalister River typically gains water from tributary inflow and runoff, releases measured downstream of Lake Glenmaggie will provide the required flows in Reach 2. The environmental flow reaches for the Macalister system are shown in Figure 9.4.1.

Water Holdings in the Macalister system are held in Lake Glenmaggie, which typically fills and spills every year.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Current situation

The prolonged drought from 1997 saw decreased Australian grayling populations in the Macalister system. Environmental water has been used to deliver autumn freshes over the last three years to trigger grayling spawning and an increase in the population has been observed. Flows continue to be important to the recovery of grayling populations.

Wetter than average conditions were experienced in the Macalister system throughout 2011-12, providing significant stream flows, and resulting in several spills from Lake Glenmaggie. Bankfull flows and a number of freshes occurred naturally in the system. Autumn baseflows and a fresh were provided to the system using environmental water.

Environmental objectives

The priority environmental objective for the Macalister system is the protection and enhancement of the self-sustaining population of Australian grayling in the system. This includes maintaining fish passage and the diversity and condition of aquatic habitat, and delivery of flows to stimulate the migration and spawning of the fish. Australian grayling are a short-lived species (two to three years) that need to breed on a regular basis to maintain a viable population. Spawning is essential at least twice in any three-year period.

9.4 Macalister system

Figure 9.4.1 The Macalister system



Symbol	Description
	Reach 1 – Lake Glenmaggie to Maffra Weir
	Reach 2 – Maffra Weir to Thomson River
	Water infrastructure
	Measurement point
	Town

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Macalister system, in priority order, are as follows:

- autumn/winter baseflows (140 ML per day from May to July)
- autumn freshes (up to three freshes of 350 ML per day for seven days each during April to May)
- summer/autumn low flows (35 ML per day from December to May).

Summer/autumn low flows are provided by passing flows under the Macalister bulk entitlement held by Southern Rural Water. These flows are therefore not required to be met through the use of the Water Holdings.

Spring baseflows, summer and winter/spring freshes, and bankfull flows are also important flow components in the Macalister system, contributing to a range of objectives, including riparian vegetation maintenance, as well as creating disturbance and scour within the channel. Consumptive water releases, natural flows and spills from storage contribute to the achievement of some of these flow components. However, due to potential flooding risks, infrastructure constraints and the large volume of water required to deliver these flows, they will not be actively managed, but may occur naturally.

Table 9.4.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.4.2 illustrates the priority watering actions for 2012-13.

Table 9.4.2 Priority watering actions under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet to very wet
Expected availability of Water Holdings	8,000 ML	12,000 ML	14,000 ML	18,500 ML
Environmental objectives	Protect high-priority ecological assets by maintaining refuge habitat requirements Avoid catastrophic events caused by water quality issues or high priority species generational loss	Maintain high-priority ecological assets by providing for refuge habitat requirements Maintain river functioning with reduced reproductive capacity Avoid catastrophic events caused by water quality issues or high priority species generational loss	Improve ecological health and resilience Enhance recruitment opportunities for key flora and fauna species Maximise opportunities for natural inflows to meet in-channel environmental objectives (ie. piggy backing)	Maximise recruitment opportunities for key flora and fauna species Restore key floodplain and wetland linkages Maximise opportunities for natural inflows to meet in-channel, floodplain and wetland objectives (ie. end of system wetland watering)
Priority watering actions	Autumn/winter baseflows Summer/autumn low flows ¹	Two autumn freshes Autumn/winter baseflows Summer/autumn low flows ¹	Two autumn freshes Autumn/winter baseflows Summer/autumn low flows ¹	Three autumn freshes Autumn/winter baseflows Summer/autumn low flows ¹
Possible volume required from the Water Holdings²	8,000 ML	12,000 ML	14,000 ML	18,500 ML
Possible carryover into 2013-14³	0 ML	0 ML	0 ML	0 ML

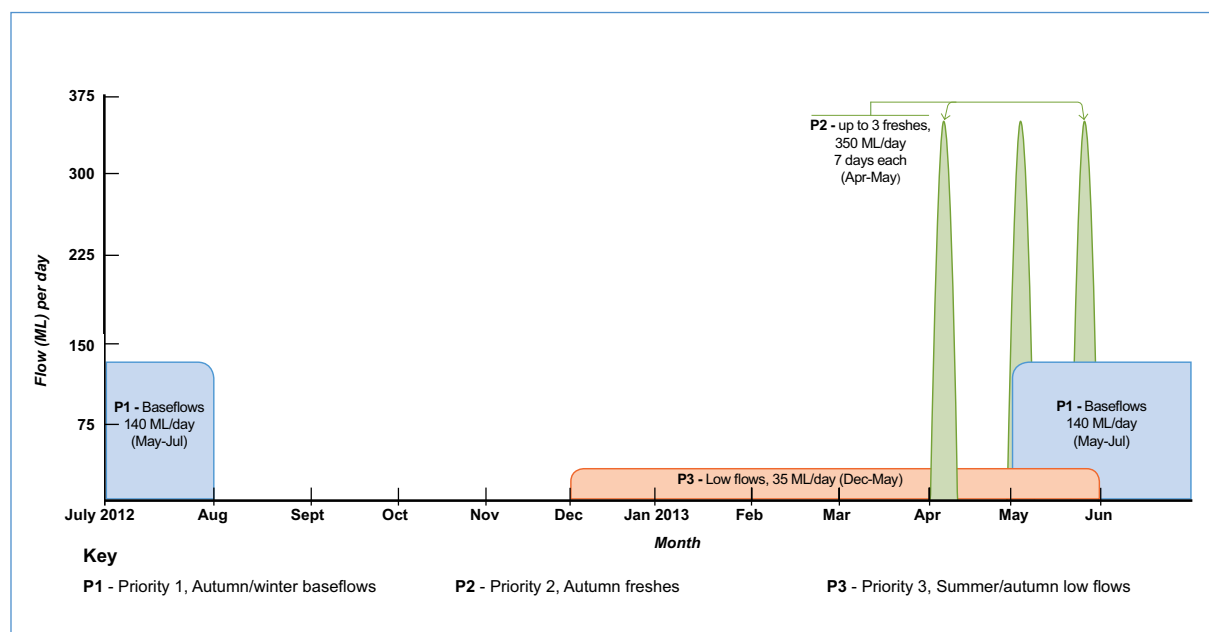
1. These flows will be provided under all scenarios by passing flows required under Southern Rural Water's Macalister bulk entitlement.

2. Figures assume no unregulated flows occur, and are therefore an upper limit of the volume required from the Water Holdings.

3. Lake Glenmaggie is a fill and spill storage, therefore any water carried over is at high risk of spilling. All environmental water allocated is planned to be used to meet priority watering actions in that year.

9.4 Macalister system

Figure 9.4.2 Priority watering actions in the Macalister system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Macalister system. The West Gippsland Catchment Management Authority will monitor the catchment conditions, likely seasonal forecast, water availability and the likelihood of storage spills to determine the best time to make releases to provide priority watering actions efficiently and with maximum environmental benefit.

Autumn freshes are not a priority under drought conditions, as they have been provided every year for the last three years. However, if an autumn fresh is not provided this year, it must be provided in 2013-14 to ensure survival of the Australian grayling population.

The Macalister bulk entitlement held by Southern Rural Water allows for the specified passing flows to be reduced on advice from the West Gippsland Catchment Management Authority, subject to system operations. These flows can be retained in storage if there is spare capacity in Lake Glenmaggie. However, it is the first water to be lost if the storage spills. The passing flows set out in the entitlement are higher than those required over the summer period.

It is therefore desirable to retain these in storage to ensure sufficient water for other priority flow components. This will be dependent on inflows and the available capacity in Lake Glenmaggie. As Lake Glenmaggie spills in the spring of most years, the ability to store water for the priority autumn freshes by reducing passing flows is limited. The West Gippsland Catchment Management Authority will assess the benefits of reducing passing flows during the year to provide high priority components.

Implementation arrangements

Seasonal watering statements will be issued to communicate decisions on the priority watering actions that are actually to be undertaken, and authorise West Gippsland Catchment Management Authority to implement these decisions.

Priority watering actions in the Macalister system will be undertaken by West Gippsland Catchment Management Authority in accordance with seasonal watering statements, and in consultation with Southern Rural Water. Implementation will also be guided by the draft Macalister River Operating Arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by West Gippsland Catchment Management Authority through media releases and stakeholder updates targeting river operators, users, local landholders and the broader community.

Risk assessment and management

In the Macalister system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.4.3 summarises the medium and high risks, and the mitigating strategies identified by West Gippsland Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

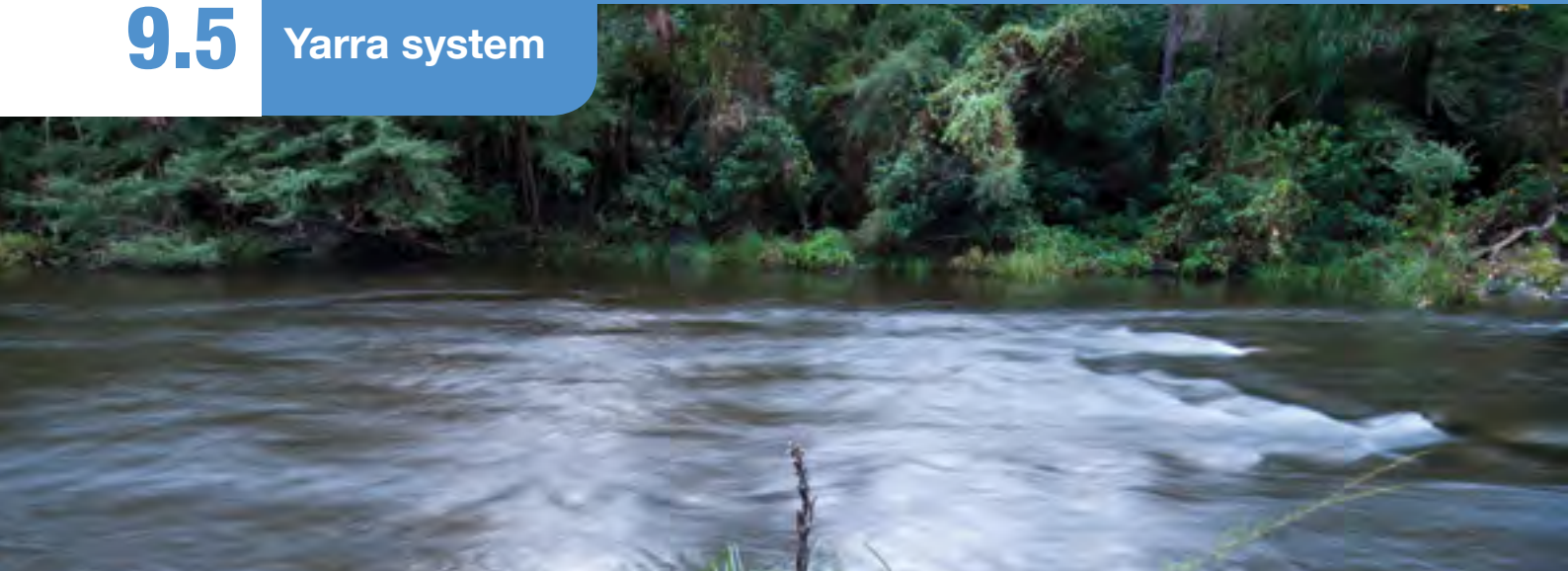
Key stakeholders in the Macalister system were consulted in the development of environmental watering priorities for 2012-13. This included Southern Rural Water, as storage operator in the Macalister system. Discussions were held to assist in the development of planning scenarios for the Macalister system, facilitating the sharing of information on likely system operations and any issues that may influence the ability to deliver priority watering actions.

Further information

More detailed information can be sought from West Gippsland Catchment Management Authority (see section 10).

Table 9.4.3 Risk management in the Macalister system

Risk type	Mitigating strategy
Storage operator cannot deliver required volume or flow rate (due to loss of passing flows savings to spills prior to planned release)	Ongoing dialogue with storage operator (Southern Rural Water) to understand storage conditions and establish sophisticated release rules and planning
Storage operator maintenance works affect the ability to deliver water	Ongoing dialogue with storage operator (Southern Rural Water) to schedule maintenance works
Limited human resources to deliver environmental release	Internal and external information sharing on staff availability and planned releases. Pre-order release if no staff are available prior to release
Current recommendations on environmental flows are inaccurate (autumn fresh flow recommendation)	Initiate a review of environmental flow recommendations to develop a prioritised release schedule based on water availability and achievement of priority objectives, subject to funding availability



Dee Road Bridge at Millgrove, Yarra River, Christian Pearson, Melbourne Water

Waterway manager – Melbourne Water

The Yarra River catchment is the largest within the Port Phillip and Westernport region, being home to over two million people (one third of Victoria's population). It is one of Victoria's most iconic waterways, covering over 4,000 square kilometres, flowing from the tranquil Yarra Valley to the heart of Melbourne's central business district at Southbank. The pristine upper reaches of the river are important water supply catchments, supplying approximately 70 percent of Melbourne's drinking water. The lower reaches provide social and recreational opportunities for more than four million people who live in and travel to Greater Melbourne and its surrounds. The reaches of the Yarra River support many important environmental values, including platypus and a number of nationally-significant fish species such as the Australian grayling and the Macquarie perch.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Yarra system for 2012-13 are: supporting water-dependent plant and animal species including flood-tolerant sedges, river blackfish, galaxias and Australian smelt; supporting breeding events of Macquarie perch and Australian grayling; and maintaining and improving fish diversity. In addition, improvement in vegetation responses through the Yarra system will be sought by providing water to inundate the low banks of the river, increasing the zone of flood-tolerant vegetation

To achieve these objectives environmental watering will focus, in priority order, on: winter/spring freshes; low flows; summer/autumn freshes; autumn high flows; targeted billabong watering; and spring high flows. These flow components will be provided to all the reaches between the Upper Yarra Reservoir and the Yarra River estuary in dry to wet conditions. Reaches 2 and 5 are the highest priorities for environmental water management in drought conditions as they provide a drought refuge for important fish species.

Table 9.5.1 Water Holdings available for use in the Yarra system

Entitlement	Description
Yarra Environmental Entitlement 2006	<p>17,000 ML per year and share of reservoir storage space</p> <p>Minimum passing flows at various weirs and gauges throughout the Yarra system</p> <p>55 ML per year in the Yarra River downstream of the confluence with Olinda Creek</p>

System overview

The Yarra River provides habitat for a range of aquatic species, including the threatened Australian grayling and Macquarie perch. In the upper reaches of the system, vegetation is largely intact with a diverse range of shrubs, grasses, ground ferns and sedges in the riparian zone, and aquatic vegetation through the river channel.

In dry conditions, the priority river reaches for environmental watering are reaches 2 and 5. Reach 2 provides habitat for a range of fish species, including river blackfish, spotted galaxias and common galaxias. Reach 5 contains Australian grayling and Macquarie perch, as well as river blackfish and galaxias. When conditions are suitable, and sufficient water is available, the whole river is a priority for watering, which includes linking these priority drought refuge reaches with the rest of the system. The environmental flow reaches for the Yarra system are shown in Figure 9.5.1.

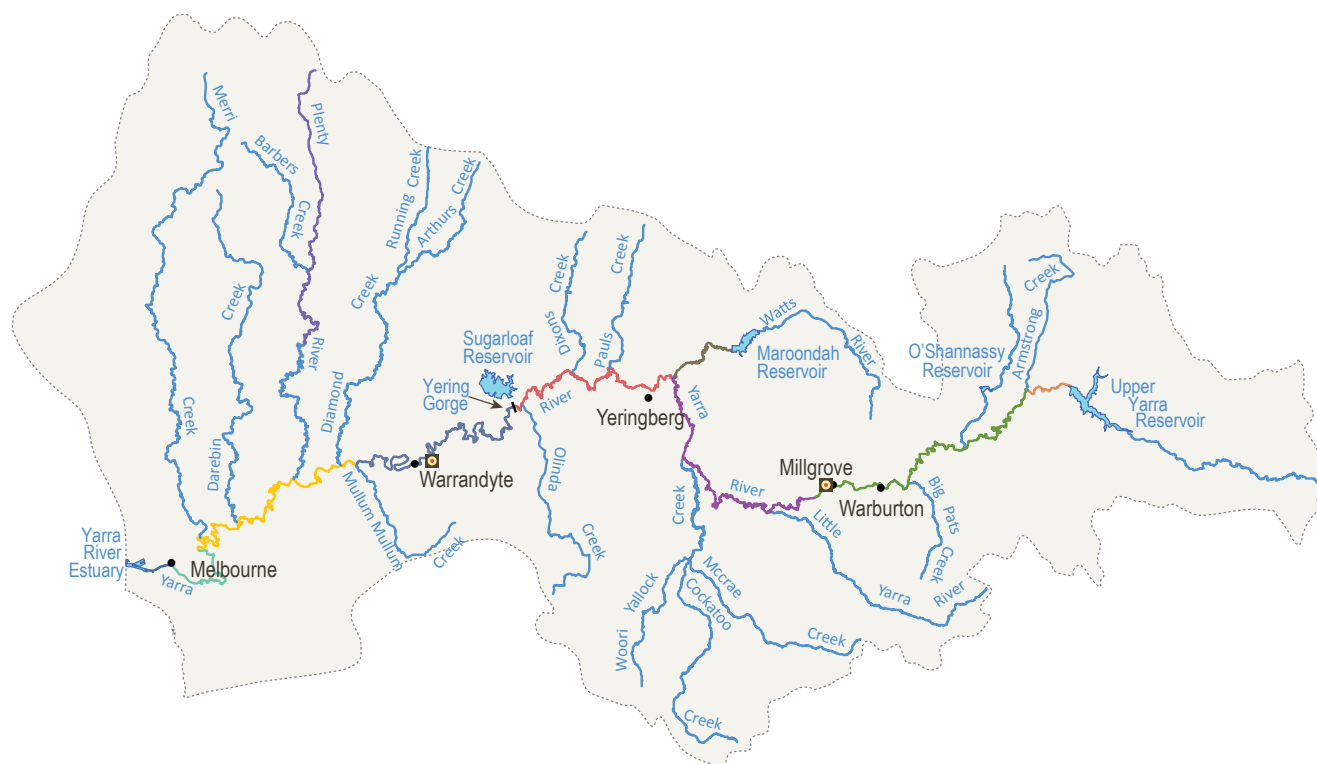
The 17,000 ML of water available under the Yarra environmental entitlement can be released from the Upper Yarra, Maroondah and O'Shannassy Reservoirs. Reach 1 and the upper part of reach 2 can only receive environmental water from the Upper Yarra Reservoir. The lower part of reach 2 and reach 3 can also be supplied from O'Shannassy Reservoir, while water from Maroondah Reservoir flows into the Yarra River via Watts River at reach 4.

Tributaries to the Yarra River significantly impact the flow conditions observed through the system. In the lower reaches, tributaries such as Diamond Creek, Plenty River and Merri Creek provide additional water to the Yarra River. In the upper reaches, the system is influenced by tributaries such as the Woori Yallock Creek, Watts River and Little Yarra River. These tributaries significantly increase the total volume of water passing through the river.

As well as the river itself, there are a number of billabongs in the Yarra system. These are an important feature of the Yarra River floodplain downstream of Millgrove and support a variety of distinct vegetation communities, providing foraging and breeding habitat for waterbirds and frogs. Except in very high flow events, the billabongs are disconnected from the Yarra River. A project is currently underway to investigate the water requirements of these wetlands, and options to actively manage environmental water to these priority sites.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Figure 9.6.1 The Yarra system



Symbol	Description
	Reach 1 – Yarra River: Upper Yarra Reservoir to Armstrong Creek
	Reach 2 – Yarra River: Armstrong Creek to Millgrove
	Reach 3 – Yarra River: Millgrove to Watts River
	Reach 4 – Yarra River: Watts River to top of Yering Gorge
	Reach 5 – Yarra River: Top of Yering Gorge to Mullum Mullum Creek
	Reach 6 – Yarra River: Mullum Mullum Creek to Dights Falls
	Reach 7 – Yarra River estuary
	Reach 8 – Watts River: Maroondah Reservoir to the Yarra River
	Reach 9 – Plenty River: Toorourrong Reservoir to Mernda
	Measurement point
	Town

Current situation

The Yarra River has experienced good streamflows over the past two years. This has resulted in the achievement of a range of priority watering actions, including the recommended summer high flow and winter freshes, which target spawning of Australian grayling and Macquarie perch. These flow components were not always able to be provided during the drought of the previous decade.

During 2011-12, the combination of managed and unregulated flows in the Yarra River maintained water quality at an appropriate level for fish through the season, and resulted in successful recruitment (defined by the presence of juvenile fish) of Australian grayling and Macquarie perch in the system. High flow events also assisted with reducing encroachment of terrestrial vegetation into the river channel. This presents an opportunity for flood-tolerant vegetation to spread further up the river banks.

Environmental objectives

Due to the good flows observed in the river over the past two years, management in 2012-13 aims to build on the positive system responses achieved. The environmental objectives for the Yarra system focus on: supporting water-dependent plant and animal species including flood-tolerant sedges, river blackfish, galaxias and Australian smelt; supporting breeding events of Macquarie perch and Australian grayling; and maintaining and improving fish diversity. In addition, improvement in vegetation responses through the Yarra system will be sought by providing water to inundate the low banks of the river, increasing the zone of flood-tolerant vegetation.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Yarra system are, in priority order, as follows:

- winter/spring freshes in reaches 1-6 (two to three freshes of varying rates between 100 and 2,200 ML per day for seven days each during June to November)
- summer/autumn and winter/spring low flows when not met by the environmental entitlement passing flow provisions in reaches 1-6, likely under dry to average seasonal conditions (10-200 ML per day from December to May and 10-350 ML per day from June to November)
- summer/autumn freshes in reaches 2 and 5 (three freshes of 350 ML per day in reach 2 and 750 ML per day in reach 5 for two days each during December to May)
- summer/autumn freshes in reaches 1, 3, 4 and 6 (three to four freshes of varying rates between 60 and 750 ML per day, depending on the reach, for one to two days each during December to May)
- autumn high flows in reaches 1-6 (one event of varying rates between 560 and 1,500 ML per day for seven days during April to May)
- billabong watering (targeting priority wetlands on the Yarra River floodplain, subject to outcomes of the current investigation into the water requirements of these wetlands)
- spring high flow in reaches 1-6 (one event of varying rates between 300 and 2,200 ML per day, between three and 14 days each, during October to November).

Winter/spring and summer/autumn low flows are a priority flow component and these are provided throughout the year by passing flow provisions under the environmental entitlement. However, under the entitlement, as the storage operator, Melbourne Water is required to only release the lesser of 80 ML per day or the sum of inflows to the Upper Yarra and O'Shannassy Reservoirs. During dry conditions, it may be necessary to supplement these flows using water from the Water Holdings to meet the environmental objectives.

9.5 Yarra system

In addition to priorities outlined above, the delivery of winter high flows in reach 1, a priority flow component from 2011-12, may start at the end of the 2011-12 season. Depending on the occurrence of a natural high flow event to assist mobilising sediment in reach 1, this watering action may extend into the 2012-13 winter period (one event up to 600 ML per day for three days during June or July).

Bankfull and overbank flows are also important to the health of the Yarra River, as identified in the scientific flow study. These flow components assist in maintaining channel form, entrain organic matter and engage high flow channels and the floodplain. As the environmental entitlement specifies that these cannot be met through managed flows, achievement of these flow components relies solely on natural events.

Table 9.5.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.5.2 illustrates the priority watering actions for 2012-13.

Table 9.6.2 Priority watering actions in the Yarra system under a range of planning scenarios

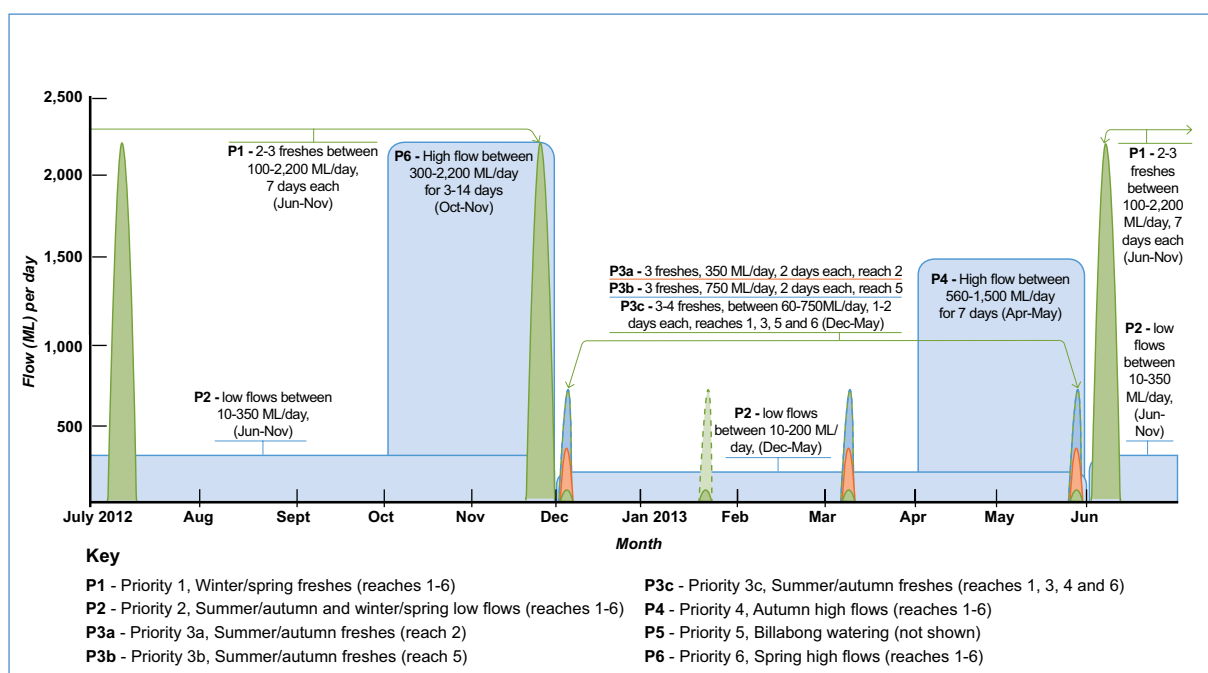
	Planning scenario			
	Drought (protect)	Dry (maintain)	Average (recover)	Wet (enhance)
Expected availability of Water Holdings	25,000 ML carryover 17,000 ML allocation	25,000 ML carryover 17,000 ML allocation	25,000 ML carryover 17,000 ML allocation	25,000 ML carryover 17,000 ML allocation
Environmental objectives	<p>Provide refuge habitat for priority aquatic species to prevent localised extinction of priority fish species such as Australian grayling and Macquarie perch</p> <p>Avoid catastrophic events (eg. fish deaths or large scale algal blooms)</p> <p>Avoid deterioration of water quality to an extent where it impacts on habitat for priority fish species</p>	<p>Provide refuge habitat for priority aquatic species to prevent localised extinction of priority fish species such as Australian grayling and Macquarie perch</p> <p>Scour sediment from pools clean rock surfaces to improve access to suitable habitats for fish and macroinvertebrates</p> <p>Avoid deterioration of water quality to an extent where it impacts on habitat for priority fish species</p>	<p>Scour sediment from pool and benthic surfaces in riffles to improve access to suitable habitats for fish and macroinvertebrates</p> <p>Maintain connectivity through the system for fish passage</p> <p>Avoid declines in water quality</p> <p>Increase the area of flood-tolerant vegetation on banks by restricting terrestrial vegetation encroachment into the channel</p> <p>Assist spawning and migration of priority fish species including Australian grayling and Macquarie perch</p>	<p>Scour sediment from pool and benthic surfaces in riffles to improve access to suitable habitats for fish and macroinvertebrates</p> <p>Maintain connectivity through the system for fish passage</p> <p>Avoid declines in water quality</p> <p>Increase the area of flood-tolerant vegetation on banks by drowning terrestrial vegetation encroaching on banks</p> <p>Assist spawning and migration of priority fish species including Australian grayling and Macquarie perch</p> <p>Maintain channel form throughout all reaches</p>

Planning scenario				
	Drought (protect)	Dry (maintain)	Average (recover)	Wet (enhance)
Priority watering actions	Winter/spring freshes	Winter/spring freshes	Winter/spring freshes	Winter/spring freshes
	Summer/autumn low flows	Summer/autumn and winter/spring low flows	Summer/autumn and winter/spring low flows	Summer/autumn and winter/spring low flows
	Summer/autumn freshes when required	All summer/autumn freshes	All summer/autumn freshes	All summer/autumn freshes
			Autumn high flows	Autumn high flows
			Targeted billabong watering	Targeted billabong watering
				Spring high flows
				Bankfull and overbank may occur naturally but will not be actively managed
Possible volume required from the Water Holdings ¹	14,000-21,000 ML	7,000-14,000 ML	11,500-18,000 ML	8,000 ML
Possible carryover into 2013-14 ²	21,000-28,000 ML	28,000-35,000 ML	24,000-30,500 ML	34,000 ML

1. Estimated volumes assume some contribution of unregulated flows will be experienced throughout the year.

2. The amount of carryover available in 2013-14 may be limited by the available reservoir storage capacity.

Figure 9.6.2 Priority watering actions in the Yarra system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Yarra system. Melbourne Water will monitor the catchment conditions, likely seasonal forecast and water availability to determine the best time to make releases to provide priority watering actions efficiently and with maximum environmental benefit.

Information regarding the flow requirements of Macquarie perch generated from sampling undertaken in 2011-12 suggested that a critical component of successful recruitment relates to the survival rates of eggs in the Yarra system. Preliminary results suggest that providing stable rather than variable flows during December and January are more conducive to achieving successful recruitment of this species. This information will be used to inform management decisions during 2012-13.

The highest priority flow components to be delivered in the Yarra system during 2012-13 are to support breeding events of Macquarie perch and to improve native fish diversity through the system. To achieve this, winter/spring freshes are planned to be provided during June to November to stimulate spawning. Summer/autumn freshes will be managed to avoid disturbance during peak fish spawning periods.

Where possible, autumn high flow events during April and May and some targeted billabong watering will be provided, if not provided through natural flows. If there is sufficient water available, and the system has responded well to the flows throughout the season, a winter high flow event may be provided. This will complement the response observed in vegetation on the riverbank during 2011-12.

It is anticipated that there will be some unregulated flows that occur through the system during the season. In particular, the potential for flows to occur naturally in winter and/or spring is considered to be relatively high. Inflows to the Yarra storages and streamflows in the system will be monitored by Melbourne Water. This will determine which flow priorities are met naturally, and which need to be supplemented or provided entirely by managed environmental water.

Due largely to available carryover, there will be approximately 42,000 ML available for use in the Yarra system during 2012-13. It is anticipated that up to 21,000 ML of environmental water will be required to deliver the priority watering actions during the season, assuming unregulated flows meet some needs. There is therefore a high likelihood there will be water available for use in 2013-14 through carryover provisions to meet the needs of critical species in future years.

Environmental flow requirements may also be met by ceasing harvesting at Yering Pumping Station or through operational transfers within the Melbourne Water headworks system. This is subject to agreement with Melbourne Water storage operators. Where these arrangements occur, any additional losses will be deducted from the Water Holdings.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise Melbourne Water to implement these decisions.

Priority watering actions in the Yarra system will be undertaken by the environmental water team at Melbourne Water in accordance with seasonal watering statements and in consultation with Melbourne Water storage operators. They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

Delivery of environmental water to billabongs on private land will not be undertaken until agreements with affected landholders are successfully negotiated. The process for negotiating these agreements is being managed by Melbourne Water.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vevh.vic.gov.au. Throughout the season, watering actions will be communicated by Melbourne Water through media releases and website updates. Interested individuals and groups can subscribe to an email distribution list managed by Melbourne Water to be informed of environmental water releases.

Risk assessment and management

In the Yarra system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.5.3 summarises the medium and high risks, and the mitigating strategies identified by the Melbourne Water.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Consultation

The successful implementation and management of environmental water in the Yarra system involves effective communication with all relevant stakeholders.

The Yarra River Environmental Flows Advisory Group provides a link to the broader community and is a focal point for environmental flow communication relating to the Yarra system. Membership of this group includes VR Fish, Yarra River Keepers Association, Environment Victoria, various Victorian Government and shire council representatives, Native Fish Australia the Bulk Entitlement Management Committee. This has been the main group consulted in the development of the annual environmental watering priorities for the Yarra River system.

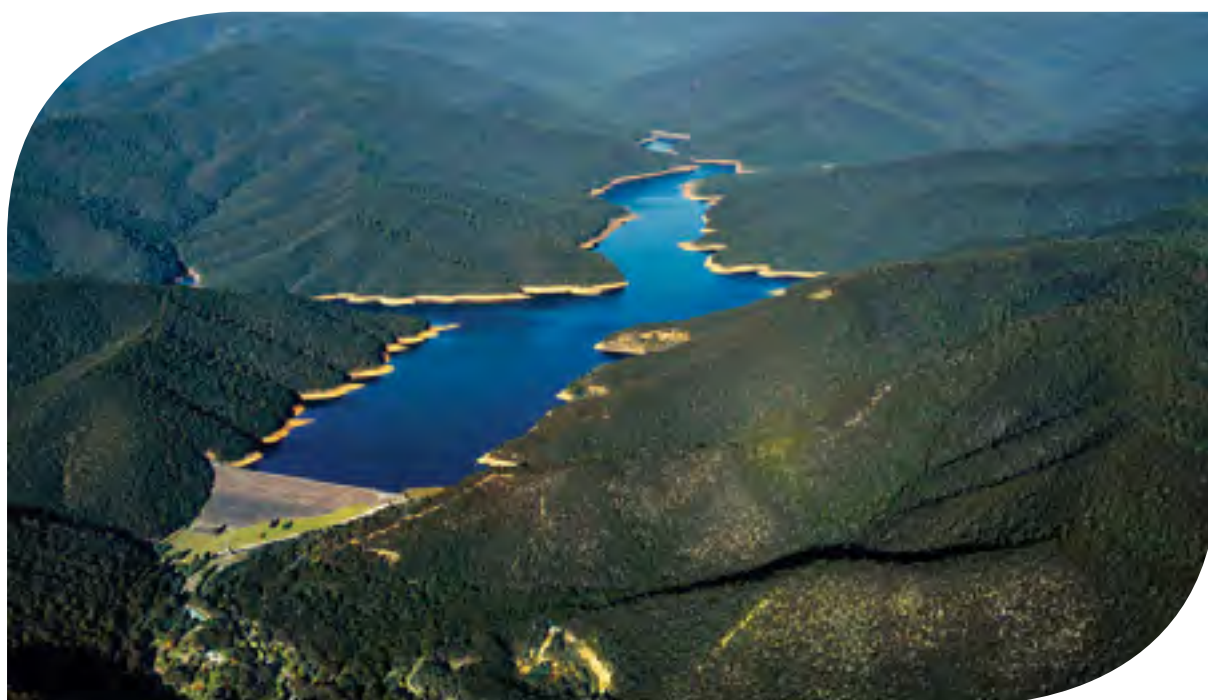
Licensed diverters on the Yarra River will be notified by mail when environmental flows are to be provided in the river.

Further information

More detailed information can be sought from Melbourne Water (see section 10).

Table 9.5.3 Risk management in the Yarra system

Risk type	Mitigating strategy
Current recommendations on environmental flow are inaccurate	Continue to base watering actions on best available science Undertake a monitoring program to identify if an environmental objective is not being achieved
Unable to provide evidence in meeting ecological objective	Undertake monitoring program to identify if an environmental objective is not being achieved



Upper Yarra Reservoir, Melbourne Water



Platypus f

Section 9.6 Tarago system of the VEWL Seasonal Watering Plan 2012-13 has been varied. Please refer to the Tarago system variation available on the VEWL website for the most up-to-date version - www.vewl.vic.gov.au

Waterway manager – Melbourne Water

The Tarago River is a major tributary of the Bunyip River, which rises in the Bunyip State Forest. The Tarago River headwaters are within the Tarago State Forest and flow into the Tarago Reservoir at Neerim. Downstream of the reservoir, the Tarago flows through the towns of Rokeby and Robin Hood before meeting the Bunyip River at Longwarry North, supplying many irrigators in the catchment. The Tarago system is home to many native fish species such as the Australian grayling and river blackfish, along with one of Australia's most iconic marsupials, the platypus. Threatened vegetation species such as long pink-bells, tree geebung, and swamp bush-pea can be found along some river reaches.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Tarago system for 2012-13 include: maintaining and improving habitat for aquatic species; maintaining habitat connectivity; promoting flood-tolerant vegetation; and assisting in the spawning and migration of priority fish species, including the Australian grayling.

To achieve these objectives, environmental watering will focus, in priority order, on: summer/autumn low flows; summer/autumn freshes; autumn and spring high flows; winter/spring freshes; and winter/spring low flows. The priority river reaches are reach 2 (downstream of Tarago reservoir to the confluence of the Bunyip River) and reach 6 (downstream of the Bunyip and Tarago rivers confluence to the estuary).

Table 9.6.1 Water Holdings available for use in the Tarago system

Entitlement	Description
Tarago and Bunyip Rivers Environmental Entitlement 2009	<p>10.3% of inflows, after passing flows have been provided</p> <p>3,000 ML of storage space</p> <p>Passing flows of 12 ML per day or natural flow at Drouin West gauging station</p>

System overview

Water available under the Tarago environmental entitlement is stored in and released from Tarago Reservoir.

The priority reaches for environmental watering are reach 2, the Tarago River from Tarago Reservoir to the Bunyip River confluence, and reach 6, from the confluence of the Bunyip and Tarago rivers to the estuary. These reaches have the priority environmental values and are the reaches most influenced by water released from Tarago Reservoir. Some benefit is also provided to reach 7, as the final reach of the system. The measurement points for target flows are at Drouin West in reach 2 and Iona in reach 6. The environmental flow reaches are shown in Figure 9.6.1.

The Tarago system contains a range of significant native plant and animal species, including populations of threatened native fish species, including the Australian grayling. The upper catchment contains high-quality riparian vegetation and in-stream habitat diversity, supporting a range of native fish including river blackfish and mountain galaxias. While the lower catchment has been highly modified, it contains good patches of remnant vegetation, and healthy populations of Australian grayling and platypus.

Current situation

Wet catchment conditions continued throughout 2011-12, producing above average streamflows in the Tarago system. High unregulated flows combined with passing flow requirements resulted in most priority watering actions being achieved naturally, including spring and autumn high flows and freshes. As a result, no environmental water was required to be released in the Tarago system during 2011-12.

These high flows provided a range of benefits to the system, including discouraging the growth of terrestrial vegetation in the river channel, and restoring scour holes that provide important habitat for aquatic species. Bankfull and overbank flows occurred naturally in the Tarago system during 2011-12.

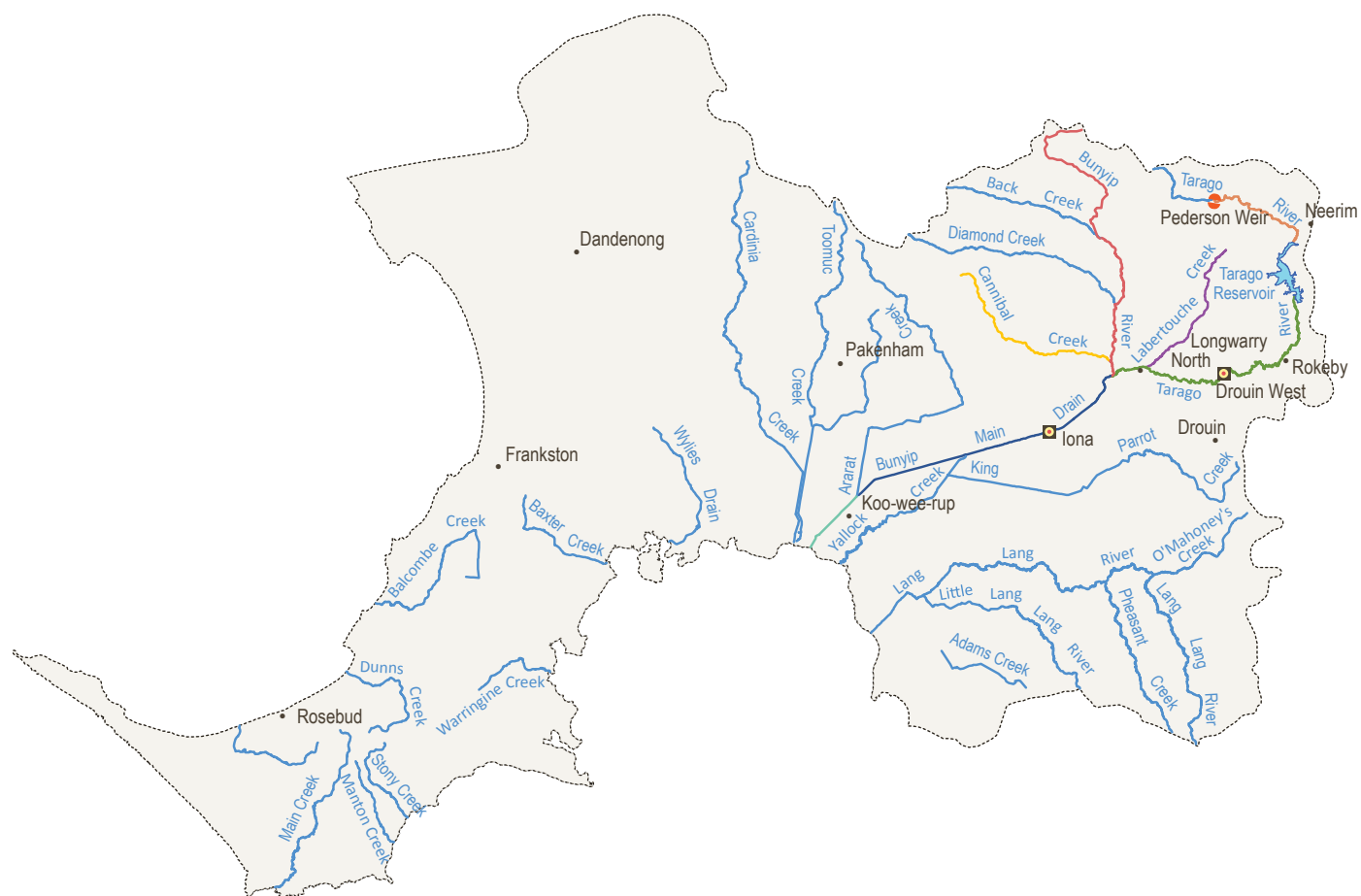
Various age classes of fish have been found in past monitoring studies in the Tarago system, indicating successful breeding events have occurred over the past few years.

Environmental objectives

The environmental objectives for the Tarago system focus on: maintaining and improving habitat for aquatic species; maintaining habitat connectivity; promoting flood-tolerant vegetation; and assisting spawning and migration for native fish species, including the Australian grayling.

9.6 Tarago system

Figure 9.6.1 The Tarago system



Symbol	Description
	Reach 1 – Upper Tarago River: Pederson Weir to Tarago Reservoir
	Reach 2 – Lower Tarago River: Tarago Reservoir to Bunyip River
	Reach 3 – Labertouche Creek
	Reach 4 – Upper Bunyip River: Bunyip State Forest to Tarago River
	Reach 5 – Cannibal Creek
	Reach 6 – Bunyip Main Drain
	Reach 7 – Bunyip estuary
	Measurement point
	Water infrastructure
	Town

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Tarago system, in priority order, are as follows:

- summer/autumn low flows in reach 2 (12 ML per day from December to May)
- summer/autumn low flows in reach 6 (50 ML per day from December to May)
- summer/autumn freshes in reach 2 (five freshes of 100 ML per day for four days each during December to May)
- summer/autumn freshes in reach 6 (three freshes of 120 ML per day for seven days each during December to May)
- autumn high flows in reach 2 (one event of 200 ML per day for one day during April to May)
- spring high flows in reach 2 (one event of 280 ML per day for one day during October to November)
- winter/spring freshes in reach 2 (four freshes of 280 ML per day for three days each during June to November)
- winter/spring freshes in reach 6 (three freshes of 170 ML per day for two days each during June to November, with one required in November).
- winter/spring low flows in reach 2 (100 ML per day from June to November)
- winter/spring low flows in reach 6 (50 ML per day from June to September and 70 ML per day from October to November).

Summer/autumn low flows are a priority flow component, however these are generally provided by passing flows. Where the passing flow requirement is reduced as a result of a reduction in inflows to Tarago Reservoir, environmental water may be used to achieve the desired flow. Melbourne Water, as the storage operator, is required to maintain the passing flows specified in the *Tarago and Bunyip Rivers Environmental Entitlement 2009*.

Bankfull and overbank flows are also important in the Tarago system. These flow components generate and maintain scour holes to create habitat, and are important in facilitating the establishment of riparian vegetation. Due to potential flooding risks, infrastructure constraints and the volume of water required to deliver these flow components, they will not be actively managed but may occur naturally.

When the 3,000 ML share of storage space in Tarago Reservoir is full, the share of inflows which cannot be stored will be released to supplement year-round passing flows and contribute towards the achievement of winter/spring low flows.

Table 9.6.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.6.2 illustrates the priority watering actions for 2012-13.

Table 9.5.2 Priority watering actions for the Tarago system under a range of planning scenarios

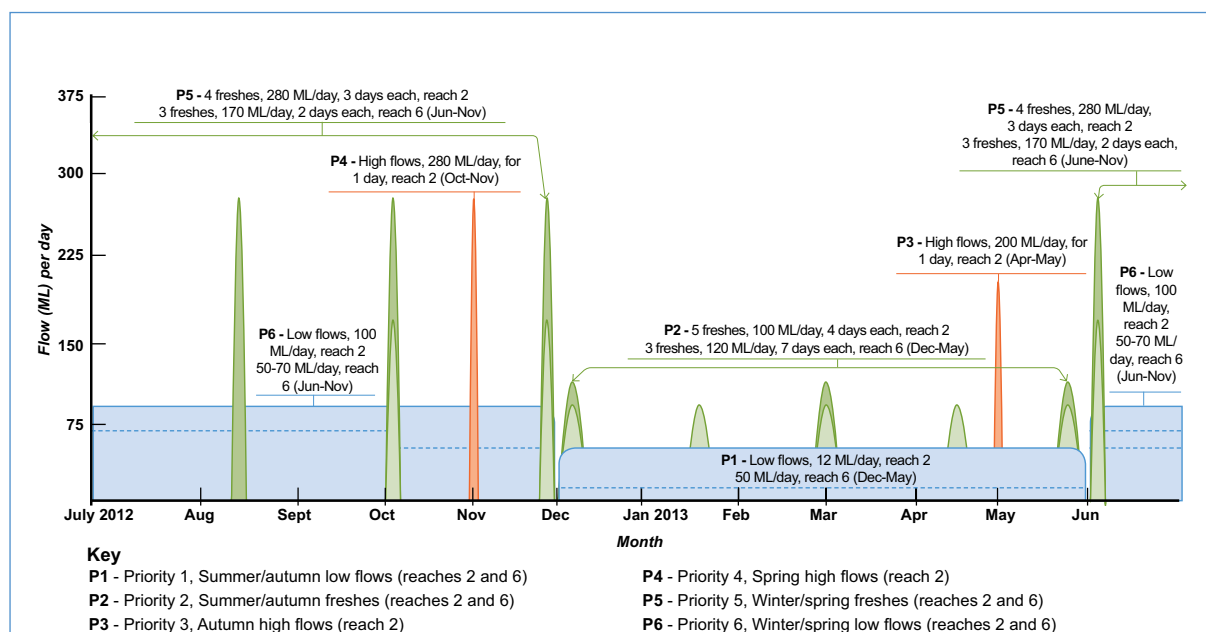
	Planning scenario			
	Drought (protect)	Dry (maintain)	Average (recover)	Wet (enhance)
Expected availability of Water Holdings¹	3,000 ML carryover	3,000 ML carryover	3,000 ML carryover	3,000 ML carryover
	250 ML of inflows	500 ML of inflows	1,500 ML of inflows	1,000 ML of inflows
Environmental objectives	Protect priority species and critical refuge habitat	Protect priority species and critical refuge habitat	Improve access to suitable habitat for priority species	Improve access to suitable habitat for priority species
	Prevent localised extinctions and catastrophic events, such as fish kills	Prevent localised extinctions and catastrophic events, such as fish kills	Maintain habitat connectivity	Maintain habitat connectivity
	Protect water quality to prevent adverse impacts on priority species and habitats	Protect water quality to prevent adverse impacts on priority species and habitats	Increase zone of flood-tolerant vegetation by drowning out encroaching terrestrial species	Increase zone of flood-tolerant vegetation by drowning out encroaching terrestrial species
			Provide flows for spawning and migration of priority fish species	Provide flows for spawning and migration of priority fish species
			Protect against flow-related declines in water quality	Maintain channel geomorphology
Priority watering actions	Summer/autumn low flows	Summer/autumn low flows	Summer/autumn low flows	Summer/autumn low flows
	Summer/autumn fresh if water quality deteriorates	Summer/autumn freshes	Summer/autumn freshes	Summer/autumn freshes
	Winter/spring low flows ²	Autumn high flows	Autumn high flows	Autumn high flows
		Spring high flows	Spring high flows	Spring high flows
		Winter/spring low flows ²	Winter/spring low flows ²	Winter/spring freshes
				Winter/spring low flows ²
Possible volume required from the Water Holdings³	1,500-2,000 ML	2,000-2,500 ML	1,500-3,000 ML	0-3,000 ML
Possible carryover into 2013-14	1,250-1,750 ML	1,000-1,500 ML	1,500-2,000 ML	1,000-3,000 ML

1. The entitlement provides access to 3,000 ML of storage space in Tarago Reservoir. If the storage space is full, additional inflows cannot be stored. As water is used and space becomes available in the entitlements share of storage, 10.3% of inflows will be allocated. The timing of use and inflows to Tarago Reservoir therefore influences the volume of inflows allocated to the account.

2. The share of inflows which cannot be stored (due to the share of storage being full) will be released to supplement year-round passing flows, and may contribute towards the achievement of winter/spring low flows.

3. Possible volumes required from the Water Holdings assume some contribution of unregulated flows will occur throughout the year. The volumes do not include the use of inflows to provide winter/spring low flows whilst the storage share is full.

Figure 9.6.2 Priority watering actions in the Tarago system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Tarago system. Melbourne Water will monitor catchment conditions, inflows, Bureau of Meteorology seasonal forecasts and water availability, assessing the best time to make releases to provide the priority flow components most efficiently and with maximum environmental benefit. Close working relationships with Southern Rural Water will assist in timing environmental releases to build on irrigation releases.

Decisions to release water from the Tarago environmental entitlement will largely be influenced by the amount of unregulated flows experienced in the system throughout the year. With passing flows providing low flow requirements, summer/autumn freshes and autumn and spring high flows are the highest priorities in the Tarago system to provide suitable habitat, connectivity, and migration and spawning cues for fish, particularly the Australian grayling. As inflows and unregulated flows increase, the focus will move to the delivery of winter/spring freshes. Delivery of winter/spring flow components may occur in August 2012 if Melbourne Water determines that there is sufficient water available in the system to achieve priority summer watering actions later in the year.

Under all seasonal conditions, a minimum of 1,000 ML of water is planned to be carried over to provide security in the ability to provide for summer/autumn priorities in the 2013-14 water year.

Environmental water releases will be managed to use the share of inflows that cannot be stored due to the environment's share of storage being full. This is likely to occur leading into 2012-13; therefore releases will be managed to supplement passing flows and contribute to the achievement of winter baseflows, mimicking the pattern of inflows into Tarago Reservoir.

Implementation arrangements

Seasonal watering statements will be issued to communicate decisions on the priority watering actions to be undertaken, and authorise Melbourne Water to implement these decisions.

Priority watering actions in the Tarago system will be undertaken by the environmental water team at Melbourne Water in accordance with seasonal watering statements, and in consultation with Melbourne Water storage operators. Implementation will also be guided by the draft Tarago and Bunyip Operating Arrangements 2011, expected to be finalised in 2012-13.

9.6 Tarago system

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vevh.vic.gov.au. Throughout the season, watering actions will be communicated by Melbourne Water through media releases and stakeholder updates. Interested individuals and groups can subscribe to an email distribution list managed by Melbourne Water to be informed of environmental water releases.

Risk assessment and management

In the Tarago system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.6.3 summarises the medium and high risks, and the mitigating strategies identified by Melbourne Water.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Table 9.6.3 Risk management in the Tarago system

Risk type	Mitigating strategy
Storage operator maintenance works affect the ability to deliver water	Engage in regular communications with Melbourne Water (as storage operator)
Storage operator cannot deliver required volume or flow rate (ie. insufficient storage volume)	Seasonally adaptive management approach allows priority watering actions to be tailored to the volume of water available in the entitlement
Environmental water release causes personal injury to river users	Provide adequate communication of planned flow releases Undertake detailed risk assessment prior to each release event
Unable to provide evidence in meeting ecological objective	Continue to implement long-term ecological monitoring, collecting information on ecological condition to assist demonstrating progress towards achieving the ecological objectives

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders and community members in the Tarago system are engaged through the Tarago and Bunyip Rivers Environmental Flows Advisory Group. This group provides input to the development of environmental watering priorities for the Tarago system and a subsequent annual review. The group include representatives from the local community, landholders, a number of Landcare Networks, local councils, Southern Rural Water and Gippsland Water.

Further information

More detailed information can be sought from Melbourne Water (see section 10).



Drouin West fish passage, Sarah Gaskill, Melbourne Water



Cormorant

Section 9.7 Werribee system of the VEWH Seasonal Watering Plan 2012-13 has been varied. Please refer to the Werribee system variation available on the VEWH website for the most up-to-date version - www.vewh.vic.gov.au

Waterway manager – Melbourne Water

The Werribee system, located 40 kilometres south-west of Melbourne, flows from the Wombat State Forest south east to the undulating plains of basalt soils north of Ballan before flowing into Port Phillip Bay at Werribee. The upper Werribee River contains areas of relatively intact streamside vegetation and is an important habitat for native fish, platypus and macroinvertebrates. The middle reaches of the Werribee River provide good habitat for fish, including short-finned eel, pygmy perch, and tupong, and a significant platypus population. The lower reaches of the river are home to migratory wading birds and numerous fish species, and are lined with highly-valued river red gums. The Werribee River provides water for irrigation districts at Bacchus Marsh and Werribee, as well as private diverters west of Werribee. Water from the Werribee River is also used to supply urban and rural centres including Melton.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Werribee system for 2012-13 focus on: providing suitable habitat to encourage self-sustaining fish populations in the river and estuary; promoting the maintenance of diverse macroinvertebrate populations; providing suitable habitat for water-dependent species such as platypus; and improving the extent and condition of in-stream vegetation

To achieve these objectives, environmental watering will focus, in priority order, on: small high flow freshes; large high flow freshes; low flow freshes and winter/spring baseflows. The priority river reaches for environmental watering are reach 6 (below Lake Merrimu), reach 8 (below Melton Reservoir) and the Werribee River estuary.

Table 9.7.1 Water Holdings available for use in the Werribee system

Entitlement	Description
Werribee River Environmental Entitlement 2011	<p>10% of inflows to Lake Merrimu, after passing flows have been provided</p> <p>Passing flows at Melton Reservoir</p> <p>Some ability to bank passing flows in Melton Reservoir (subject to a number of conditions)</p> <p>Air space storage only, in Lake Merrimu and Melton Reservoir (first to spill)</p>

System overview

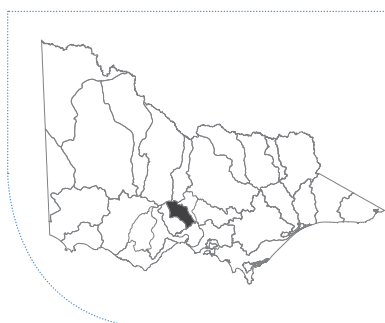
The priority river reaches for the Werribee system are reach 6, downstream of Lake Merrimu, and reach 8, downstream of Melton Reservoir, as environmental water can only be managed in the reaches directly below the reservoirs. These priority river reaches support a number of fish species, including migratory short-finned eels, pygmy perch, black bream, river blackfish, flathead gudgeon, tupong and Australian smelt. A diverse community of macroinvertebrates and a significant platypus population occur in the lower reaches of the system. The Werribee River estuary is also a priority as it is considered a regionally significant ecosystem due to its freshwater-saltwater interface. It is anticipated that reach 9 will also receive some benefit from the environmental flows. The environmental flow reaches are shown in Figure 9.7.1.

The measurement points for target flows are below Lake Merrimu in reach 6 and below Melton Reservoir in reach 8. Flow to the estuary will also be measured so that losses in the lower reaches can be calculated.

Ten percent of flows into Lake Merrimu are reserved for the environment through the Werribee River environmental entitlement, and can be released to the Werribee system from Lake Merrimu and Melton Reservoir. There is no secure access to storage capacity, only opportunistic access to airspace. Lake Merrimu receives a significant amount of inflow from the Lerderderg River via a tunnel system, and operation of this tunnel influences the amount of water available under the environmental entitlement.

Passing flows are provided at numerous locations in the Werribee system. In addition, environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Figure 9.7.1 The Werribee system



Symbol	Description
	Reach 1 – Werribee River: Upstream of Upper Werribee Diversion Weir
	Reach 2 – Pykes Creek: Pykes Creek Reservoir to Werribee River
	Reach 3 – Werribee River: Upper Werribee Diversion Weir to Pykes Creek
	Reach 4 – Werribee River: Pykes Creek to Bacchus Marsh Weir
	Reach 5 – Werribee River: Bacchus Marsh Weir to Lerderderg River
	Reach 6 – Coimada Creek: below Lake Merrimu to Melton Reservoir
	Reach 7 – Djerriwarrh Creek: below Djerriwarrh Weir to Melton Reservoir
	Reach 8 – Werribee River: Melton Reservoir to Lower Werribee Diversion Weir
	Reach 9 – Werribee River: Lower Werribee Diversion Weir to estuary
	Measurement point
	Water infrastructure
	Town

Current situation

The flow regime of the Werribee River has been highly modified, resulting in reversal of the natural flow seasonality of the system. No active management of environmental water has occurred to date; since the environmental entitlement was created in May 2011, there have been significant unregulated flows through the system.

The Werribee River catchment experienced low flow conditions until 2010 when substantial rainfall during spring and winter rainfall filled both Lake Merrimu and Melton Reservoir, with Melton Reservoir spilling for the first time since 2005. During 2011-12, natural flows in the system resulted in achievement, or partial achievement, of all priority watering actions in the lower reaches of the Werribee system, including the estuary.

In particular, it is expected that high flow events in the system during 2010-11 and 2011-12 will have flushed salt water from the estuary during winter and allowed a well-oxygenated salt wedge to migrate upstream during spring. Environmental water management during 2012-13 will maximise environmental benefits from these previous events.

Leakage from Merrimu Reservoir is believed to be the cause of a persistent trickle flow downstream of the Reservoir. This has eliminated the ability to achieve recommended cease to flow events in reach 6 of the Werribee system. Cease to flow events allows the channel to dry out, curtailing the spring growth of reeds such as phragmites and cumbungi which are dominating the stream bed. Encroachment of these species into the river channel is now threatening other values of the reach, such as pool and riffle habitats which are important for fish and macroinvertebrates.



Werribee River, Melbourne Water

Environmental objectives

The environmental objectives for the Werribee system focus on: providing suitable habitat to encourage self-sustaining fish populations in the river and estuary; promoting the maintenance of diverse macroinvertebrate populations; providing suitable habitat for water-dependent species such as platypus; and improving the extent and condition of in-stream vegetation.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Werribee system, in priority order, are as follows:

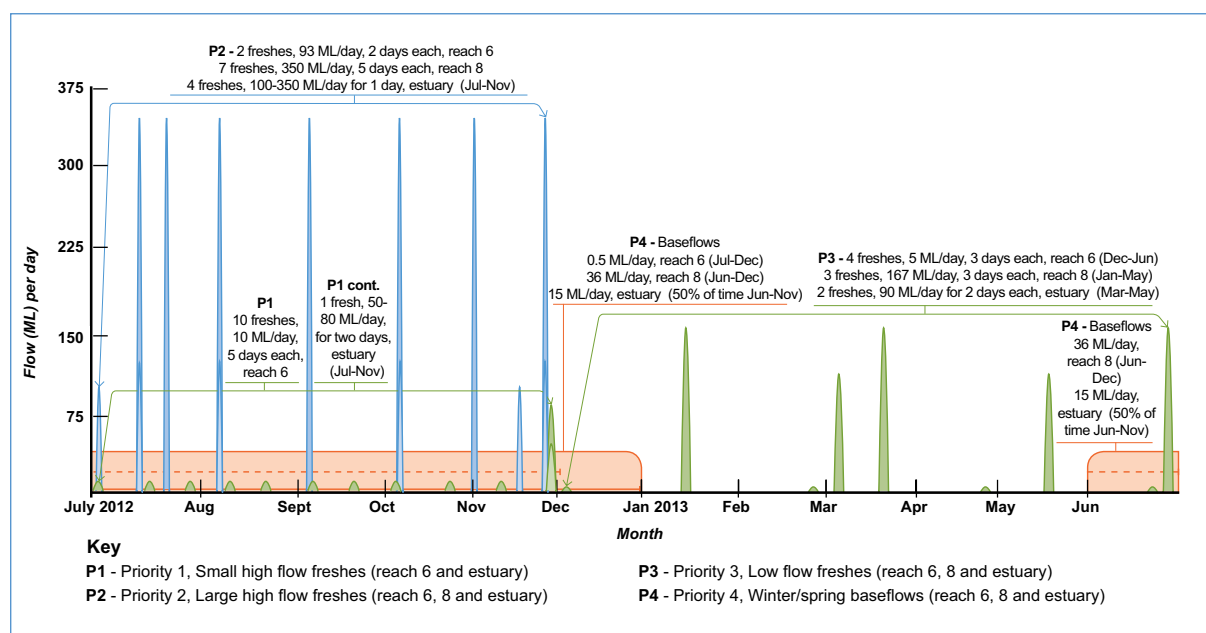
- small high flow freshes (10 freshes of 10 ML per day for five days each during July to November in reach 6; one fresh of 50-80 ML per day for two days in estuary)
- large high flow freshes (two freshes of 93 ML per day for two days each during July to November in reach 6; seven freshes of 350 ML per day for five days each in reach 8; four freshes of 100-350 ML per day for one day each in estuary)

- low flow freshes (four freshes of 5 ML per day for three days each during December to June in reach 6; three freshes of 167 ML per day for three days each during January to May in reach 8; two freshes of 90 ML per day for two days each during March to May in estuary)
- winter/spring baseflows (0.5 ML per day from July to December in reach 6; 36 ML per day from June to December in reach 8; 15 ML per day 50 percent of the time from June to November in estuary).

Bankfull and overbank flows are also important to the health of the Werribee River and estuary, as identified in the scientific flow study. These flow components assist in maintaining channel form, disturbing vegetation in the upper reaches and flushing sediments from seagrass beds in the estuary. Due to the large volume of water required for these two flow components (up to 28,000 ML), it is not practical to deliver these using environmental water. Achievement of these flow components relies solely on natural events.

Table 9.7.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.7.2 illustrates the priority watering actions for 2012-13.

Figure 9.7.2 Priority watering actions in the Werribee system¹



1. This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Table 9.7.2 Priority watering actions in the Werribee system under a range of planning scenarios

	Planning scenario			
	Drought (protect)	Dry (maintain)	Average (recover)	Wet to very wet (enhance)
Expected availability of Water Holdings	3,000 ML carryover	3,000 ML carryover 500 ML allocation	3,000 ML carryover 1,500 ML allocation	3,000 ML carryover >1,500 ML allocation
Environmental objectives	Maintain pool habitat for fish (including pygmy perch) and macroinvertebrates (reach 6) Promote fish recruitment (reach 8 and estuary)	Maintain pool habitat for fish (including pygmy perch) and macroinvertebrates (reach 6) Disturb macrophytes to minimise their growth in existing locations and promote open channel habitat (reach 6). Promote fish recruitment by inundation of salt marsh habitat (reach 8 and estuary)	Maintain pool habitat for fish (including pygmy perch) and macroinvertebrates (reach 6) Disturb macrophytes to minimise their growth in existing locations and promote open channel habitat, and prevent further incursion of stream bed (reach 6) Promote fish recruitment by inundation of salt marsh habitat and flushing of salt water from the estuary (reach 8 and estuary) Maintain platypus feeding habitat and promote fish passage to and from the estuary (reach 8 and estuary)	Maintain pool habitat for fish (including pygmy perch) and macroinvertebrates (reach 6) Disturb macrophytes to minimise their growth in existing locations and promote open channel habitat, and prevent further incursion of stream bed (reach 6) Promote fish recruitment by inundation of salt marsh habitat and flushing of salt water from the estuary (reach 8 and estuary) Maintain platypus habitat and promote fish passage to and from the estuary (reach 8 and estuary)
Priority watering actions	Small high flow freshes Low flow freshes Winter/spring baseflows	Small high flow freshes Large high flow freshes Low flow freshes Winter/spring baseflows	Small high flow freshes Large high flow freshes Low flow freshes Winter/spring baseflows	Small high flow freshes Large high flow freshes Low flow freshes Winter/spring baseflows
Possible volume required from the Water Holdings¹	<500 ML	1,200-1,500 ML	1,200-1,800 ML	>1,800 ML
Possible carryover into 2013-14²	2,500 ML	2,000-2,300 ML	2,700-3,300 ML	2,700 ML

1. Figures assume no unregulated flows occur, and are therefore an upper limit of the volume required from the Water Holdings.

2. The Werribee River Environmental Entitlement 2011 allows water to be stored in storage space not being used by other entitlement holders in Lake Merrimu and Melton Reservoir until the storages spill. Due to current operations of Lake Merrimu, it is unlikely that this storage will fill and spill during 2012-13, providing secure access to available water.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Werribee system. Melbourne Water will monitor catchment conditions, inflows to storages, water availability, water quality and likely seasonal forecast, to determine the best time to make releases to provide the priority flow components most efficiently and with maximum environmental benefit.

As the environmental entitlement does not have secure storage, it will generally not be managed to provide significant carryover from year to year if storages are relatively full. Despite this, it is anticipated that there will be at least 2,000 ML available at the end of 2012-13, irrespective of seasonal conditions, which can be used to deliver priority watering actions in 2013-14. Due to its relatively small catchment area, and the influence of the tunnel system from the Lerderderg River, flows into and out of Lake Merrimu can be closely managed by the storage operator, Southern Rural Water. Currently the storage is managed to actively avoid spilling by reducing inflows from the tunnel system when the reservoir level is high; as such, the environmental water is relatively secure.

Implementation arrangements

Seasonal watering statements will be issued by the VEWB to communicate decisions on the priority watering actions to be undertaken, and to authorise Melbourne Water to implement these decisions.

Priority watering actions in the Werribee system will be undertaken by Melbourne Water in accordance with seasonal watering statements and in consultation with Southern Rural Water. They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWB's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWB website at www.vewb.vic.gov.au. Throughout the season, watering actions will be communicated by Melbourne Water, including through media releases and website updates. Interested individuals and groups can subscribe to an email distribution list managed by Melbourne Water to be informed of environmental water releases.



Werribee River, Melbourne Water

Table 9.7.3 Risk management in the Werribee system

Risk type	Mitigating strategies
Environmental releases cause flooding of private land	<p>Undertake ongoing hydrographic monitoring of river levels during high flow releases and ramp up flow rate gradually</p> <p>Ongoing discussions with Southern Rural Water operations staff prior to and during delivery</p>
Unable to provide evidence in meeting environmental objective	<p>Access to Southern Rural Water's flow gauging data will be negotiated to provide information about achievement of flow targets</p> <p>Additional monitoring including water quality and photopoints will assist in confirming whether environmental objectives are met</p> <p>Local anglers will be engaged to assist in understanding fish presence in the estuary</p>
Releases cause water quality issues (eg. blackwater, low dissolved oxygen, mobilisation of saline pools, acid sulphate soils etc)	<p>Winter high flows that are expected to mobilise large amounts of sediment in Coimada Creek will be gradually ramped down over two-three weeks and water quality will be tested before releases cease</p>
Key stakeholders not supportive of environmental water release	<p>Potential members of a community advisory group have been contacted and a meeting was held in April 2012 to prioritise the flow-dependent environmental values of the river</p> <p>An email list has been formed and interested parties will be kept regularly informed of environmental watering actions throughout the season</p>

Risk assessment and management

In the Werribee system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.7.3 summarises the medium and high risks, and the mitigating strategies identified by Melbourne Water.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders and community members with an interest in the Werribee River were consulted in the development of annual environmental watering priorities, including through a community meeting held in April 2012. Representatives from local council, Landcare groups, Southern Rural Water, Western Water, angling clubs and other groups including the Werribee River Association and Western Region Environment Network were involved in this meeting.

Further information

More detailed information can be sought from Melbourne Water (see section 10).



Lower Barwon River, Tara McIlroy, Corangamite Catchment Management Authority

Waterway manager – Corangamite Catchment Management Authority

The Barwon River rises in the Otway Ranges and flows through Geelong, joining the coast at Barwon Heads. It receives significant inflows from major tributaries, including the Moorabool and Yarrowee/Leigh rivers, which rise in the Victorian Central Highlands region of the Great Dividing Range. The estuarine reach of the Barwon River incorporates a system of wetlands and lakes including Lake Connewarre, Reedy Lake, Hospital and Salt Swamps, and Murnaghurt Lagoon. Of these, environmental water can be actively delivered to Reedy Lake and Hospital Swamps. These wetlands form part of the internationally significant Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site, and are also part of the Lake Connewarre State Game Reserve. These wetlands also have high recreational value to the communities surrounding Geelong and the Bellarine Peninsula.

Summary of planned environmental water use in 2012-13

The overarching priority environmental objective for the Barwon system in 2012-13 focuses on maintaining a high diversity of plant communities to support waterbirds, fish and other animals dependent on the wetlands. This aims to: limit the encroachment of reeds into open water habitat in Reedy Lake; and maintain Hospital Swamps in its current condition and limit future threats.

To achieve these objectives, priority watering actions focus on: providing spring inflows during September to November; manage (Reedy Lake) and allow (Hospital Swamps) a drying phase during December to February; provide filling flows during March to May; and maintain depth during June to August.

As the summer drying of Reedy Lake represents a significant change from past management of the wetland, it is planned to be trialled and assessed over a two-year period. It has also been identified that the summer drying of Reedy Lake will potentially impact on commercial eel fishing operations. The Corangamite Catchment Management Authority and the VEWH are continuing to work to resolve this issue. Reedy Lake will not be actively dried until the issue is resolved.

Table 9.8.1 Water Holdings available for use in the Barwon system

Entitlement	Description
Barwon River Environmental Entitlement 2011	Access to water from the Barwon River to inundate the Lower Barwon wetlands (Reedy Lake and Hospital Swamps) when flows are above 0.7m AHD upstream of the Lower Barrage Gauging Station

System overview

The lower Barwon wetlands are located on the floodplain of the Barwon River, below its confluence with the Moorabool River, as shown in Figure 9.8.1.

Water available under the entitlement does not consist of water held in storage. It allows for access to water from the Barwon River at any time, subject to river levels, for diversion into two of the lower Barwon wetlands, Reedy Lake and Hospital Swamps.

Existing wetland water control infrastructure enables diversion of river flows into the wetlands, subject to river levels, and can also facilitate drying phases. Inlet regulators on Reedy Lake and Hospital Swamps allow for the diversion of flows from the Barwon River into the wetlands. Outflows from the Reedy Lake can be managed through manipulation of the outlet regulator, facilitating drying. There is limited ability to manage outflows from Hospital Swamps.

Reedy Lake and Hospital Swamps support a diverse range of aquatic vegetation communities, providing important feeding and breeding habitat for native fish, including Australian grayling, dwarf galaxias, and Yarra pygmy perch. They also support a number of wetland-dependent bird species, including the threatened Australian painted snipe, Latham's snipe, Caspian tern and whiskered tern.

Current situation

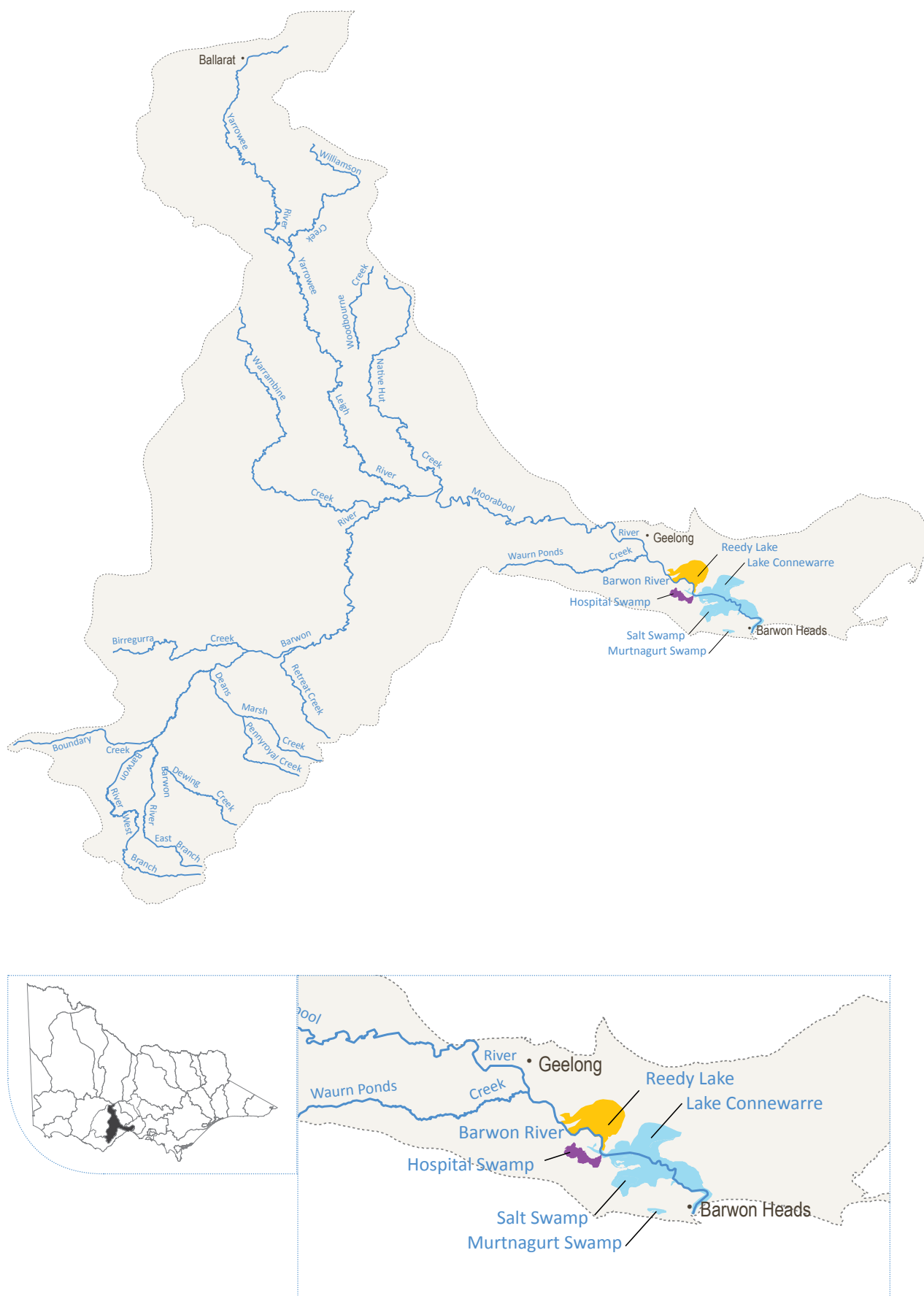
From 1997 to 2009, the lower Barwon wetland system has been characterised by low river inflows and low flow variability. This has negatively impacted on habitat quality and availability for wetland-dependent species in the lower Barwon system, particularly Reedy Lake. The impacts of this include a reduction in plant diversity, water quality and habitat availability for macroinvertebrates, fish, frogs and waterbirds. The lack of high river flows into the system has also reduced the potential for native fish movement and breeding events.

Another major impact of these consistent conditions in Reedy Lake is the continuing spread of phragmites (a type of reed). The density of reeds has reduced habitat variety, and in particular, the area of open water available for waterbird foraging.

At Hospital Swamps, wetland vegetation communities have remained largely unchanged with the environmental values of the wetland in good condition, supporting a diverse range of fish and waterbird populations.

Wet catchment conditions were experienced throughout the 2011-12 water year, with Reedy Lake and Hospital Swamps both receiving inflows from the Barwon River and likely to be full entering the 2012-13 water year.

Figure 9.4.1 The Barwon system



Environmental objectives

The overarching environmental objective for the lower Barwon wetlands is to maintain a high diversity of plant communities to support waterbirds, fish and other animals dependent on the wetlands.

Water management in Reedy Lake aims to limit the encroachment of reeds into open water habitat, to promote native fish and waterbird breeding and increase food resources. A balance between marshland, reed bed and sedgeland plant communities in Reedy Lake is important, providing habitat for various bird and fish species. The current excess growth of reeds threatens the habitat value of the lake as a whole.

The aim of water management in Hospital Swamps is to maintain the wetland in its current condition, and limit future threats to the site. Hospital Swamps contains a diverse range of plant communities, including shrubland, reed bed, and sedgeland vegetation communities as well as open water habitat, which support a wide range of animal species.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions during 2012-13 for Reedy Lake and Hospital Swamps are as follows:

- provide spring inflows until river flows decline from September to November
- manage a summer drying phase from December to February (Reedy Lake)
- allow a summer drying phase from December to February (Hospital Swamps)
- provide filling flows in autumn from March to May
- maintain depth during winter from June to August.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the lower Barwon wetlands.

The ability to achieve the priority watering actions in the lower Barwon wetlands will be dependent on river heights and seasonal conditions in 2012-13. Fluctuations in the height of the Barwon River will influence the commencement of inflows to the wetlands in autumn, and the timing of outflows from Reedy Lake to facilitate drying over summer.

The priority watering action for Reedy Lake is to undertake summer drying to manage the encroachment of reeds into the open water habitat. As this represents a significant change from past management of the wetland, the drying is planned to be trialled over a two-year period. Monitoring will be undertaken throughout this trial period to determine the effectiveness of water management in managing reed encroachment into the wetland. During this period, the Corangamite Catchment Management Authority will also be investigating the feasibility of alternative measures for managing the reeds.

It has also been identified that the summer drying of Reedy Lake will potentially impact upon commercial eel fishing operations. The Corangamite Catchment Management Authority and Victorian Environmental Water Holder are continuing to work to resolve this issue. Reedy Lake will not be actively dried until the issue is resolved.

The effectiveness of drying in Reedy Lake may be influenced by overbank flows from the Barwon River, which could periodically inundate the wetland during drying. If water levels were high and wet conditions were expected over spring/summer, a decision may be made to retain water in the lake, rather than drying. The decision not to dry would aim to prevent shallow summer flooding, which is a favourable condition for the growth and continued expansion of reeds. A number of factors will be assessed to inform the decision to dry Reedy Lake. These factors include ecological requirements and risks, wetland water levels, forecast seasonal conditions and Barwon River levels, in addition to operational constraints such as infrastructure and channel maintenance requirements. Corangamite Catchment Management Authority will continue to monitor conditions and assess risks in Reedy Lake throughout 2012-13 to determine if drying will be undertaken.

Implementation arrangements

Seasonal watering statements will be issued to communicate decisions on the priority watering actions to be undertaken, and authorise Corangamite Catchment Management Authority to implement these decisions.

Watering actions identified for Reedy Lake and Hospital Swamps will inundate small portions of private land. The expected inundation levels are consistent with historical extent. Managed watering actions will not be undertaken until agreements with affected landholders are successfully negotiated. The process for negotiating these agreements will be managed by Corangamite Catchment Management Authority.

Priority watering actions in the Barwon system will be undertaken by Corangamite Catchment Management Authority in accordance with seasonal watering statements. Implementation will also be guided by the operating arrangements, due for completion in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vevh.vic.gov.au. Throughout the season, watering actions will be communicated by Corangamite Catchment Management Authority through media releases and website updates.

Table 9.8.3 Risk management in the Barwon system

Risk type	Mitigating strategies
Inability to achieve management recommendations	<p>Monitor Barwon River flow and levels in wetlands</p> <p>Assess the ability to dry out Reedy Lake and make changes to management if necessary</p> <p>Use results to inform future seasonal watering proposals</p>
Maintenance works affect the ability to deliver water	Schedule structure upgrades to coincide with wetland drying
Limited catchment management authority resources to deliver environmental release	Allocate time for associated delivery activities, including monitoring and gate operation
Cost of infrastructure upgrades exceeds available funding	Take a precautionary approach to infrastructure operation
Environmental water management impacts on other users	A potential impact of summer drying at Reedy Lake on commercial eel fishing operations has been identified. Corangamite Catchment Management Authority is continuing to work with the eel fisherman and the VEWH to resolve this issue, prior to implementation of the priority watering action
Environmental releases causes flooding of private land	Agreements are currently being put in place with all impacted landholders
Operation of the structures causes personal injury to Catchment Management Authority staff	Undertake structure upgrades
Current recommendations on environmental flow inaccurate	<p>Ongoing evaluation of monitoring results and implementation of flow recommendations</p> <p>Use results to inform future seasonal watering proposals</p>
Unable to provide evidence in meeting ecological objectives	Ongoing evaluation of monitoring results and implementation of recommendations
Improved conditions for non-native species (eg. carp)	<p>Carp screens have been installed on the inlet to Reedy Lake</p> <p>Drying wetlands will also help control carp numbers</p>
Blue green algae	No mitigating strategy will be undertaken. If the growth conditions in Reedy Lake or Hospital Swamps are conducive to blue green algae, then it will bloom irrespective of connectivity to the Barwon River. There is no plan to disconnect the wetlands from the Barwon River in the event of an algal bloom
Key stakeholders not supportive of environmental water release	Stakeholder involvement in monitoring activities. Ongoing stakeholder engagement

Risk assessment and management

In the Barwon system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.8.3 summarises the medium and high risks identified, and the mitigating strategies by Corangamite Catchment Management Authority.

The costs of mitigating strategies will be considered in light of funding availability.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

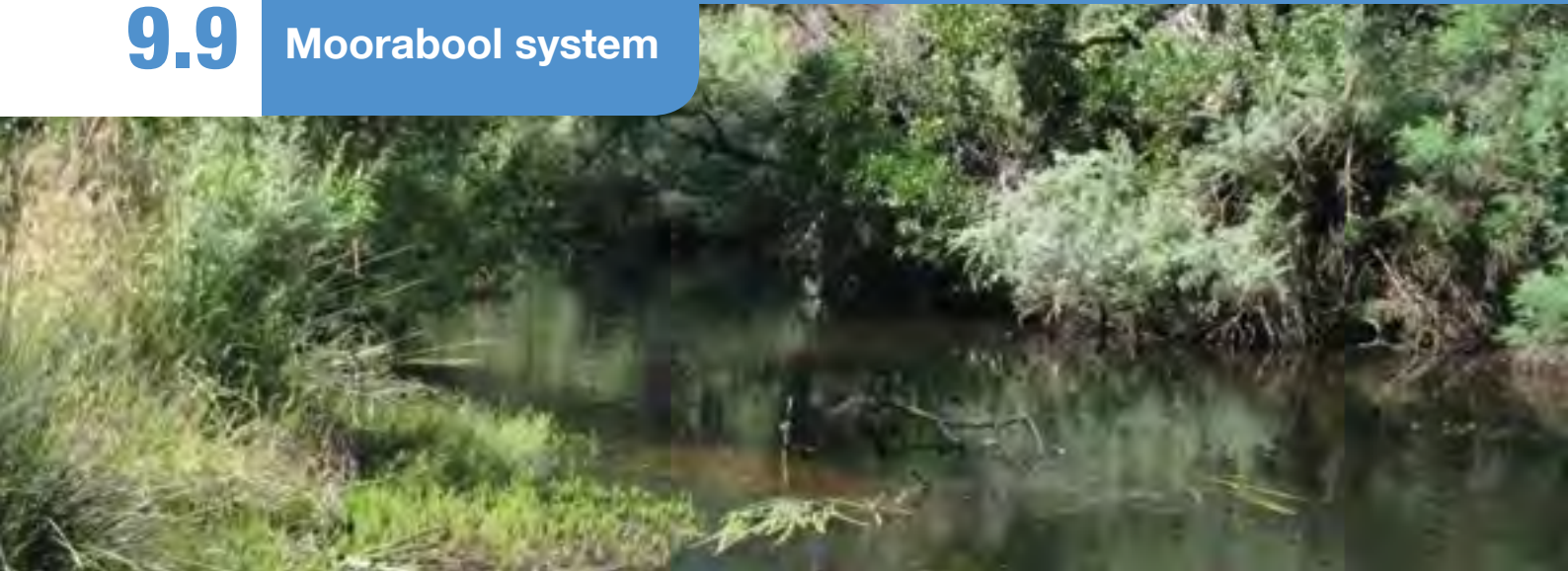
Key stakeholders and community members in the Barwon system have been engaged throughout the development of priority watering actions in the Barwon system, particularly Parks Victoria and Geelong Field and Game, given their historical role in water management at the wetlands. A community seminar was held to discuss the 2012-13 watering priorities, with local landholders, representatives from the local community, and a wide range of environmental and other interest groups. Stakeholders were also invited to provide submissions on the proposed management approaches identified at the community seminar, and again on the draft seasonal watering proposal for the wetlands.

Further information

More detailed information can be sought from Corangamite Catchment Management Authority (see section 10).



Hospital Swamps, Tara Mollroy, Corangamite Catchment Management Authority



Moorabool River, Corangamite Catchment Management Authority

Waterway manager – Corangamite Catchment Management Authority

The Moorabool system is an important catchment for the major urban areas of Geelong and Ballarat. The river also sustains economic values through its contribution to extensive agriculture in the region. Despite years of drought and water extraction, the river still retains significant environmental values, particularly between Lal Lal Reservoir and She Oaks Weir. These values include native fish of high conservation value and areas of significant remnant vegetation. The river maintains populations of native aquatic species such as tupong, river blackfish, southern pygmy perch, Australian smelt and the short-finned eel.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Moorabool system for 2012-13 are to: maintain self-sustaining fish populations; maintain diverse microinvertebrate populations; maintain native in-stream and riparian vegetation; and move sediment through the system.

To achieve these objectives, environmental watering will focus, in priority order, on: summer/autumn freshes; summer/autumn low flows; winter/spring freshes; and winter low flows. The priority river reach of the Moorabool River is reach 3, between Lal Lal Reservoir and She Oaks Weir.

Table 9.9.1 Water Holdings available for use in the Moorabool system

Entitlement	Description
Moorabool River Environmental Entitlement 2010	<p>11.9% (7,086 ML) of storage capacity</p> <p>11.9% of inflows, after passing flows have been set aside</p> <p>Maximum use of 7,500 ML in any consecutive three-year period</p>

System overview

Water available under the Moorabool environmental entitlement is stored and released from Lal Lal Reservoir, the main storage on the Moorabool system.

The priority river reach for environmental water management in the Moorabool system is reach 3, between Lal Lal Reservoir and She Oaks Weir. This reach has significant environmental values including good populations of native fish such as river blackfish, Australian smelt, southern pygmy perch and short-finned eel. Reach 3 also contains a diverse population of macroinvertebrates, platypus and water rats and some of the most valuable in-stream and riparian habitats in the catchment with remnant populations of river red gum, silver wattle and woolly tea tree. It is also the reach most influenced by water released from Lal Lal Reservoir.

Some environmental benefit may be provided to reach 4, the final reach of the Moorabool system which flows into the Barwon River, when water is released to target outcomes further upstream. When catchment conditions are wet enough, environmental water can be used to supplement natural flows to achieve environmental outcomes through reach 3 and into reach 4. The measurement points for flows in the Moorabool system are at Morrisons (middle of reach 3) and She Oaks Weir (downstream end of reach 3). The environmental flow reaches are shown in Figure 9.9.1.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Current situation

Seasonal flow patterns have been reversed from natural conditions in the Moorabool system over the past 10 years. Over this period, small amounts of water were released over summer to maintain water quality in remnant pools and to supply downstream communities with water. There was little winter flow due to harvesting of water in storages and low rainfall conditions.

Over the past two seasons, the Moorabool River has received sustained inflows, providing relief after six years of prolonged drought. Winter 2010 provided significant and sustained flows into water storages, as well as in the river itself. Wetter conditions continued in 2011, resulting in Lal Lal Reservoir spilling for most of the spring period.

Environmental watering during 2011-12 targeted summer flows in the Moorabool system. This maintained water quality and ensured that habitat was available for aquatic species such as fish and platypus. Summer freshes were provided, limiting the encroachment of vegetation into the river channel and freshened pools within the river. Priority winter flows during 2011 were not required to be actively managed as rainfall events resulted in sufficient streamflows occurring naturally in the system.

Figure 9.9.1 The Moorabool system



Symbol	Description
	Reach 1 – Moorabool River East Branch: Bostock Reservoir to West Moorabool River
	Reach 2 – Moorabool River West Branch: Moorabool Reservoir to Lal Lal Reservoir
	Reach 3 – Moorabool River: Lal Lal Reservoir to She Oaks Weir
	Reach 4 – Moorabool River: She Oaks Weir to Barwon River
	Measurement point

Environmental objectives

The environmental objectives for the Moorabool system focus on maintaining self-sustaining fish populations, diverse macroinvertebrate populations and in-stream and riparian vegetation communities. Flows will move organic matter and sediment through the system, maintain physical habitat diversity and complexity, improve water quality and allow greater movement of native aquatic species such as river blackfish through the system.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Moorabool system, in priority order, are as follows:

- summer/autumn freshes (three events of at least 31 ML per day for 10 days each during December to May)
- summer/autumn low flows (average of 20 ML per day from December to May)
- winter/spring freshes (two freshes of at least 146 ML per day for five days each during June to November)
- winter low flows (average of 83 ML per day during June).

These flows will predominantly target ecological responses in reach 3 of the Moorabool River, but will also have benefit when the water passes through to reach 4. When catchment conditions are wet enough, water will be provided to ensure summer and winter freshes continue to pass through reach 3 and into reach 4.

Winter high flows are also an important flow component in the Moorabool system, aiding in deepening pools, removing organic matter, fish breeding and movement, and wetting riparian communities such as tea tree. However, it is not possible to actively provide these flows due to capacity constraints at Lal Lal Reservoir. In addition, there is insufficient water available under the existing entitlement to provide these flows without jeopardising other higher priority watering actions in future years. As such, winter high flows will not be sought using the environmental entitlement, but may occur naturally.

Table 9.9.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.9.2 illustrates the priority watering actions for 2012-13.

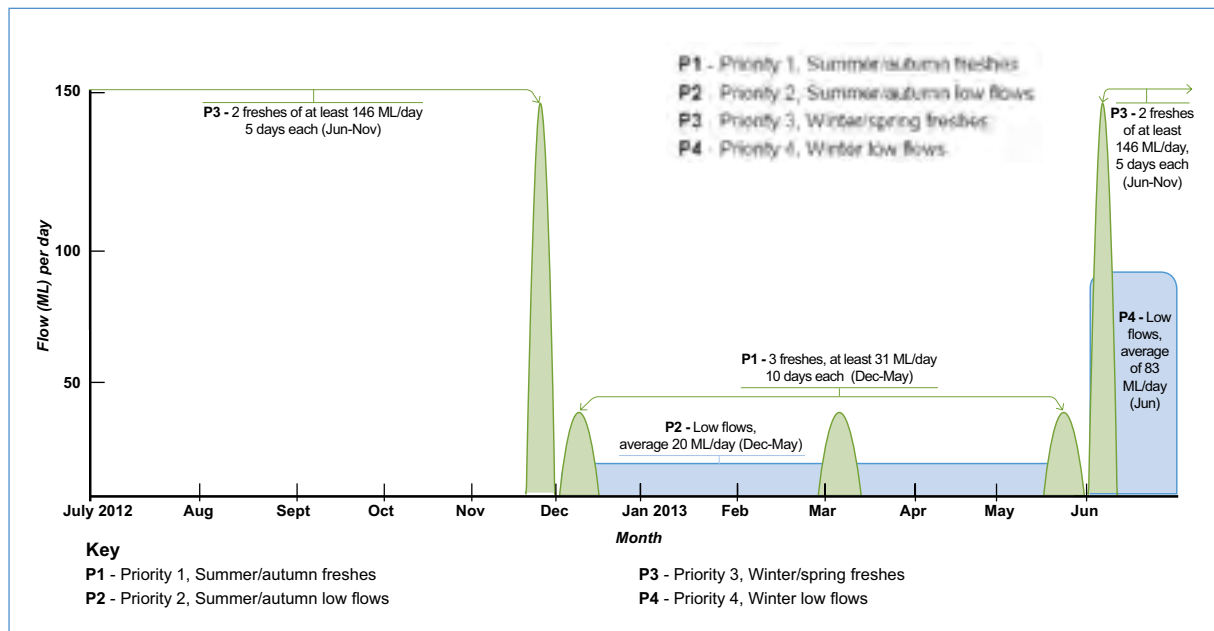
Table 9.9.2 Priority watering actions in the Moorabool system under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet
Expected availability of Water Holdings¹	6,500 ML carryover 0-1,475 ML allocation	6,500 ML carryover 1,500-2,350 ML allocation	6,500 ML carryover 2,375-2,625 ML allocation	6,500 ML carryover >2,650 ML allocation
Environmental objectives	Provide flows to maintain appropriate fish habitat and stimulate recruitment Maintain riffle habitat for macroinvertebrates Maintain water quality for water-dependent animal species	Provide flows to maintain appropriate fish habitat and stimulate recruitment Maintain riffle habitat for macroinvertebrates Maintain water quality for water-dependent animal species Limit encroachment of in-stream vegetation, promoting habitat suitable for fish movement through the system	Provide flows to maintain appropriate fish habitat and stimulate recruitment Maintain riffle habitat for macroinvertebrates Maintain water quality for water-dependent animal species Limit encroachment of in-stream vegetation, promoting habitat suitable for fish movement through the system Maintain in-stream macrophyte species diversity and snag habitat	Provide flows to maintain appropriate fish habitat and stimulate recruitment Maintain riffle habitat for macroinvertebrates Maintain water quality for water-dependent animal species Limit encroachment of in-stream vegetation, promoting habitat suitable for fish movement through the system Maintain in-stream macrophyte species diversity and snag habitat
Priority watering actions	Summer/autumn freshes Summer/autumn low flows	Summer/autumn freshes Summer/autumn low flows Late winter fresh	Summer/autumn freshes (reaches 3 and 4) Summer/autumn low flows Winter/spring freshes (reaches 3 and 4) Winter low flow Cease to flow	Summer/autumn freshes (reaches 3 and 4) Summer/autumn low flows Winter/spring freshes (reaches 3 and 4) Winter low flow
Possible volume required from the Water Holdings²	2,500 ML	2,500 ML	2,500 ML	2,500 ML
Possible carryover into 2013-14	4,000-5,475 ML	5,500-6,350 ML	6,375-6,625 ML	>6,650 ML

1. Storage capacity is limited to 7,086 ML; therefore availability of the Water Holdings may be less than shown here, depending on the timing of inflows and thus allocation, and whether this occurs before delivery of priority watering actions using water currently available.

2. The entitlement allows the use of up to 7,500 ML over a three-year period. The Corangamite Catchment Management Authority intends to use 2,500 ML in each year.

Figure 9.9.2 Priority watering actions in the Moorabool system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Moorabool system. Corangamite Catchment Management Authority will monitor catchment conditions, inflows, likely seasonal forecasts, water availability and water quality, assessing the best time to make releases to deliver the priority watering actions efficiently and with maximum environmental benefit.

For example, while summer/autumn freshes are the highest priority watering action to be delivered in 2012-13 in order to stimulate fish recruitment, this will rely heavily on the provision of the summer/autumn low flows. Summer/autumn low flows aim to maintain water quality in the system while summer/autumn freshes are provided to stimulate fish recruitment. If summer/autumn low flows do not occur and water quality diminishes, it is unlikely that there will be successful recruitment of fish species irrespective of whether there is a summer/autumn fresh delivered. Depending on inflows into Lal Lal Reservoir, a portion of summer/autumn low flows will be provided to the system through passing flows specified under the *Moorabool River Environmental Entitlement 2010* and managed by Central Highlands Water. However, these flows often require topping up with environmental water to reach desired flow rates.

There may be opportunities to build on natural rainfall events when they occur in the Moorabool catchment. Environmental water may be used to increase the variability of flows and increase the flow magnitude and/or duration. This arrangement may be used to supply winter low flows through the system. Natural flows will be supplemented with environmental water to reach the target flow rate of 83 ML per day if there are insufficient natural flows being generated from the catchment.

Other flow components may be partially met by consumptive water releases. As these flows are extracted at She Oaks Weir, they will only provide benefit in reach 3. When possible, consumptive flows may be supplemented with environmental water to provide benefit through to reach 4 as well.

Environmental water available under the entitlement is restricted by a maximum use of 7,500 ML over any three-year consecutive period. Corangamite Catchment Management Authority plans to use 2,500 ML in 2012-13, retaining flexibility for future years through carryover.

Implementation arrangements

Seasonal watering statements will be issued to communicate decisions on the priority watering actions to be undertaken, and authorise Corangamite Catchment Management Authority to implement these decisions.

Priority watering actions in the Moorabool system will be undertaken by the Corangamite Catchment Management Authority in accordance with seasonal watering statements and in consultation with Central Highlands Water and Barwon Water. They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vevh.vic.gov.au. Throughout the season, the Corangamite Catchment Management Authority will also communicate watering actions through media releases and website updates.

Risk assessment and management

In the Moorabool system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.9.3 summarises the medium and high risks, and the mitigating strategies identified by the Corangamite Catchment Management Authority.

The costs of mitigating strategies will be considered in light of funding availability.

If rainfall events are significant enough to create a flood threat (ie. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Consultation

The successful implementation and management of environmental watering involves effective consultation and engagement with all relevant stakeholders.

Key stakeholders and community members with an interest in the Moorabool River were consulted in the development of annual environmental watering priorities for the Moorabool River. An important community group in the Moorabool catchment is People for a Living Moorabool (PALM). Representatives from the Australian Platypus Conservancy and PALM representatives were engaged by the Corangamite Catchment Management Authority during the development of the seasonal watering proposal. In addition, a community session was held in March 2012.

Further information

More detailed information can be sought from the Corangamite Catchment Management Authority (see section 10).

Table 9.9.3 Risk mitigation in the Moorabool system

Risk type	Mitigating strategies
Storage operator maintenance works affect ability to deliver water	Ongoing dialogue with Central Highlands Water to determine best timing for proposed works
Storage operator cannot deliver required volume or flow rate (insufficient storage volume)	Time freshes to coincide with natural rainfall events so less water from the entitlement is used
Releases cause water quality issues	Monitor water quality before during and after releases If water quality issue occurs, discuss options with Barwon Water and Central Highlands Water and develop an action plan
Unable to provide evidence in meeting ecological objective	Ongoing evaluation of monitoring results and implementation of recommendations
Improved conditions for non-native species	Monitor where possible



Release from Lal Lal Reservoir, Corangamite Catchment Management Authority



Glenelg River at Moree, Stephen Ryan, Glenelg Hopkins Catchment Management Authority

Waterway manager – Glenelg Hopkins Catchment Management Authority

The Glenelg River, in south-western Victoria, starts in the Grampian Ranges and runs for over 500 kilometres, making it one of the longest rivers in Victoria. A short stretch of the estuary winds through South Australia before returning to Victoria to enter the sea at Nelson. The Glenelg River is a central feature of the Lower Glenelg National Park and is valued for its high social, economic and environmental attributes. The Glenelg River has a reach listed as a heritage river reach due to the high-value aquatic life it supports, including the endangered Glenelg freshwater mussel and Glenelg spiny crayfish.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Glenelg system for 2012-13 include: maintaining sustainable populations of native and endemic fish species; providing connectivity between reaches to enable fish movement; maintaining appropriate aquatic habitat and food resources for fish; and ensuring water quality is maintained throughout the year.

To achieve these objectives, environmental watering will focus, in priority order, on: summer/autumn baseflows; summer/autumn freshes; winter/spring freshes; and winter/spring baseflows. The priority river reach in the Glenelg system is reach 1, from Rocklands Reservoir to the confluence with the Chetwynd River. Reach 2, from the Chetwynd River to the confluence with the Wannon River is a secondary priority for delivery.

Table 9.10.1 Water Holdings available for use in the Glenelg system

Entitlement	Description
Wimmera and Glenelg Rivers Environmental Entitlement 2010 ¹	<p>40,560 ML of regulated entitlement (to be shared between the Wimmera and Glenelg systems)</p> <p>Fixed passing flows in Wannon River</p> <p>Passing flows with some ability to vary rates in the Glenelg River¹</p>

1. The environmental entitlement provides for passing flows in the Glenelg River to be varied, if agreed with Grampians-Wimmera-Mallee Water; this may be done in order to better provide the priority watering actions.

System overview

Environmental water available in the Glenelg system is provided under the *Wimmera and Glenelg Rivers Environmental Entitlement 2010*. Water available under this entitlement is shared between the Wimmera and Glenelg systems.

The Glenelg system has two main storages which can capture water from the Glenelg River: the Moora Moora and Rocklands reservoirs. Moora Moora Reservoir is a relatively small storage in the headwaters of the Glenelg. Rocklands Reservoir is the largest storage in the Wimmera-Glenelg headwork system and captures all inflows from seven creeks and rivers including the Glenelg River. Environmental water in the Glenelg system is released from Rocklands Reservoir (through carp screens) and can enter reach 1 via the reservoir outlet, and 5 Mile and 12 Mile outlets which provide water to reach 1 progressively downstream.

The priority river reaches in the Glenelg system are reach 1, and then reach 2. Reach 3 and the Glenelg River estuary will also receive some benefit from environmental water releases; however reach 1 and 2 are the only reaches for which environmental water can be adequately released to meet desired flow targets. These reaches are home to a number of important native fish populations, including river blackfish, estuary perch and a number of galaxid and pygmy perch species. They also support good riparian vegetation, including the newly-discovered, endangered Wimmera bottlebrush. The measurement points for target flows are at Harrow for reach 1 and Dergholm for reach 2. The environmental flow reaches are shown in Figure 9.10.1.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Current situation

Wet conditions throughout winter 2011 and isolated rain events in summer 2012 have continued to build on the large-scale flooding that occurred in 2010-11, further contributing to the recovery of the Glenelg system from the drought conditions which dominated the region since 1997.

All planned priority watering actions in 2011-12 occurred naturally or were provided by managed environmental water releases, including summer baseflows and freshes, winter baseflows and spring freshes, particularly in reach 1.

These conditions have provided increased opportunities for fish breeding events, improved water quality and assisted in the establishment of in-stream vegetation, providing critical nursery habitat for juvenile fish. The recovery and improvements to fish populations since the drought is evident through the discovery of estuary perch near Harrow, the only record of the species in the upper reaches of the Glenelg system in several decades.

Environmental objectives

The environmental objectives for the Glenelg system focus on: maintaining sustainable populations of native and endemic fish species; providing connectivity between reaches to enable fish movement; maintaining appropriate aquatic habitat and food resources for fish; and ensuring water quality is maintained throughout the year.

Figure 9.10.1 The Glenelg system



Symbol	Description
	Reach 1 - Rocklands Reservoir to Chetwynd River
	Reach 2 - Chetwynd River to Wannon River
	Reach 3 - Wannon River to tidal extent
	Measurement point
	Water infrastructure
	Town

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Glenelg system, in priority order, are as follows:

- summer/autumn baseflows in reach 1 (11 ML per day from December to May)
- summer/autumn freshes in reach 1 (five freshes of 65 ML per day for six days each during December to May)
- winter/spring freshes in reach 1 (two freshes of 450 ML per day for 10 days each during July to October)
- winter/spring baseflows in reach 1 (up to 150 ML per day from June to November).
- summer/autumn baseflows in reach 2 (16 ML per day from December to May)
- summer/autumn freshes in reach 2 (four freshes of 77 ML per day for 7-15 days each during December to May).

Glenelg Hopkins Catchment Management Authority is also responsible for advising on the management of 'compensation flows' provided for under Grampians-Wimmera-Mallee Water's bulk entitlement. Depending on inflows, up to 3,300 ML of compensation flow may be available. This water will be managed in line with an annual operating plan developed by the Glenelg Hopkins Catchment Management Authority in consultation with Grampians-Wimmera-Mallee Water and the VEW, maximising environmental benefits where possible.

Winter high flows are also important to the health of the Glenelg River, providing longitudinal connectivity and wetting channel margins and low bars in the river. Due to operational constraints and potential flooding risks, achievement of this flow component relies solely on natural events.

Table 9.10.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.10.2 illustrates the priority watering actions for 2012-13.



Bottlebrush on the Glenelg River, Stephen Ryan, Glenelg Hopkins Catchment Management Authority

Table 9.10.2 Priority watering actions in the Glenelg system under a range of planning scenarios

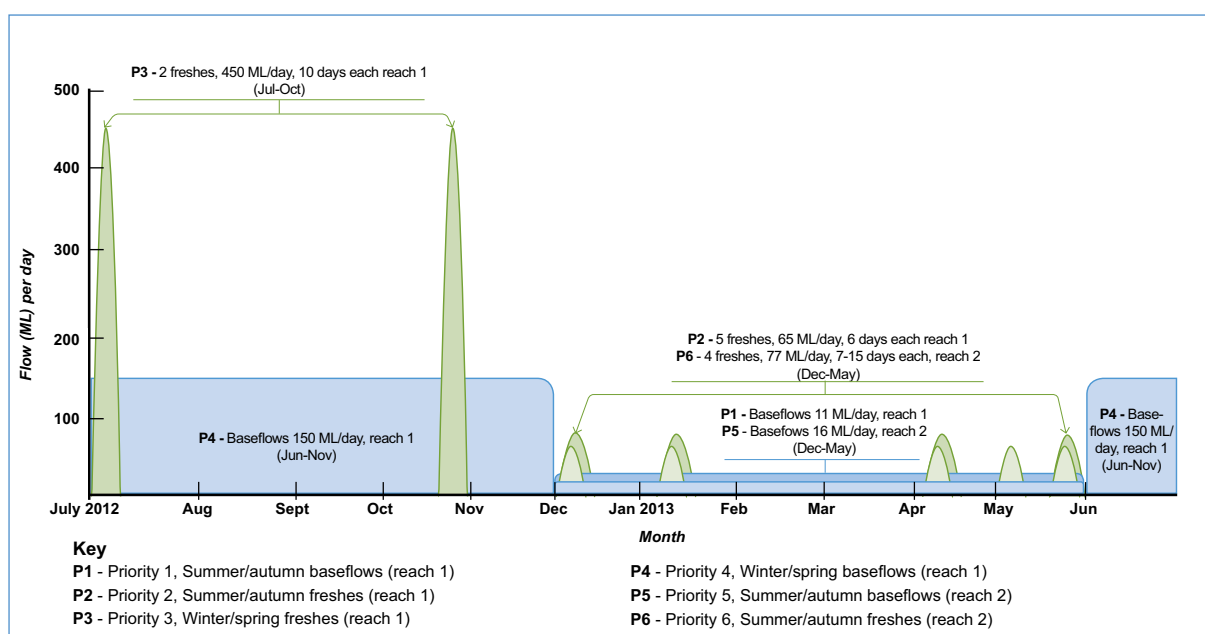
	Planning scenario			
	Drought	Dry	Average	Wet
Expected availability of Water Holdings¹	44,200 ML carryover	44,200 ML carryover	44,200 ML carryover	44,200 ML carryover
	28,932 ML allocation	41,732 ML allocation	46,032 ML allocation	46,032 ML allocation
Glenelg system				
Environmental objectives	Reduce risks associated with poor water quality for native fish and Glenelg spiny crayfish	Maintain desirable water quality for native fish and Glenelg spiny crayfish	Maintain desirable water quality for native fish and Glenelg spiny crayfish	Maintain desirable water quality for native fish and Glenelg spiny crayfish
	Maintain available habitat with a high degree of connectivity	Maintain available habitat with a high degree of connectivity	Maintain available habitat with a high degree of connectivity	Maintain available habitat with a high degree of connectivity
	Increase flow disturbance for macroinvertebrates	Increase flow disturbance for macroinvertebrates	Increase flow disturbance for macroinvertebrates	Increase flow disturbance for macroinvertebrates
	Manage rates of rise and fall associated with releases to avoid adverse ecological impacts	Manage rates of rise and fall associated with releases to avoid adverse ecological impacts	Manage rates of rise and fall associated with releases to avoid adverse ecological impacts	Manage rates of rise and fall associated with releases to avoid adverse ecological impacts
	Inundate benches for carbon/nutrient cycling and vegetation growth	Inundate benches for carbon/nutrient cycling and vegetation growth	Inundate benches for carbon/nutrient cycling and vegetation growth	Inundate benches for carbon/nutrient cycling and vegetation growth
Priority watering actions	Summer/autumn baseflows (reaches 1 and 2)	Summer/autumn baseflows (reaches 1 and 2)	Summer/autumn baseflows (reaches 1 and 2)	Summer/autumn baseflows (reaches 1 and 2)
	Summer/autumn freshes (reach 1)	Summer/autumn freshes (reaches 1 and 2)	Summer/autumn freshes (reaches 1 and 2)	Summer/autumn freshes (reaches 1 and 2)
	Winter/spring freshes (reach 1)	Winter/spring freshes (reach 1)	Winter/spring freshes (reach 1)	Winter/spring freshes (reach 1)
	Winter/spring baseflows (reach 1)	Winter/spring baseflows (reach 1)	Winter/spring baseflows (reach 1)	Winter/spring baseflows (reach 1)
Possible volume required from the Water Holdings²	29,240 ML	33,100 ML	27,100 ML	27,100 ML

Table 9.10.2 Priority watering actions in the Glenelg system under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet
Wimmera system				
Possible volume required from the Water Holdings ³	43,700 ML	43,700 ML	44,300 ML	41,300 ML
Total				
Possible volume required from the Water Holdings	72,940 ML	76,800	71,400 ML	68,400 ML
Possible carryover into 2013-14 ⁴	192 ML	9,132 ML	18,832 ML	0 ML (200 ML shortfall – prioritisation required)

1. Holdings are shared across the Glenelg and Wimmera systems and indicate the total amount for both systems. Includes the once-off amount of 5,532 ML due to target reservoir volumes being achieved in 2012-13 in the Wimmera and Glenelg system, as specified in the environmental entitlement. Includes a 22,000 ML loss to spill under the wet scenario.
2. Figures assume some unregulated flows occur in the Glenelg system. Under all scenarios, passing flow rates are assumed to be reduced by up to 50 percent. Under average and wet conditions the passing flow rate will increase as restrictions are eased in response to improved inflows, meeting winter/spring baseflow requirements.
3. Figures assume some unregulated flows occur in the Wimmera system under wetter scenarios, meeting some of the priority watering actions naturally.
4. Figures take account of the possible volume required in both the Glenelg and Wimmera systems. The amount of carryover into 2013-14 will be determined not only by the volume of unused water but the possibility that the storage spills and carryover is forfeited.

Figure 9.10.2 Priority watering actions in the Glenelg system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Glenelg system. Glenelg Hopkins Catchment Management Authority will monitor catchment conditions, inflows, likely seasonal forecast, water availability and water quality to determine the best time to make releases to deliver priority watering actions efficiently and with maximum environmental benefit.

The Wimmera-Glenelg headwork system is highly regulated with many storages. A number of factors influence the management of environmental releases in the Glenelg system, including reservoir capacity constraints, storage levels, and other water resource management activities. Glenelg Hopkins Catchment Management Authority will work closely with Grampians-Wimmera-Mallee Water to maximise benefits from the use of environmental water in the system.

Passing flows are provided to the Glenelg system under the environmental entitlement, contributing to baseflow requirements throughout winter and spring. When inflows into the Wimmera-Glenelg headworks system are reduced, passing flow rates are also reduced. Environmental water will be used during these times to supplement passing flows to deliver winter/spring baseflows requirements in reach 1.

Channel capacity constraints downstream of Rocklands Reservoir at Frasers Swamp are currently impacting on the ability to deliver flows through the upper section of reach 1 of the Glenelg River. As a result, flow rates released from the reservoir outlet have been limited to 30 ML per day. The release of higher flow rates to deliver priority watering actions will be delivered using 5 Mile and 12 Mile outlets. Investigations into management of these channel constraints will be undertaken throughout 2012-13.

The Glenelg Hopkins Catchment Management Authority and Wimmera Catchment Management Authority will work together to deliver the priority watering actions in both the Glenelg and Wimmera systems, considering water availability and system constraints. They will communicate regularly to ensure sufficient water is available in the Water Holdings before ordering. In the unlikely event there is insufficient water to meet priority watering actions in both the Glenelg and Wimmera systems, prioritisation will occur, based on the effectiveness of flows in maximising environmental outcomes.

Implementation arrangements

Seasonal watering statements will be issued to communicate decisions on the priority watering actions that are to be undertaken, and authorise Glenelg Hopkins Catchment Management Authority to implement these decisions.

Priority watering actions in the Glenelg system will be undertaken by the Glenelg Hopkins Catchment Management Authority in accordance with seasonal watering statements, and in consultation with the Wimmera Catchment Management Authority and Grampians-Wimmera-Mallee Water. Implementation will also be guided by the Wimmera-Glenelg Storage Management Rules finalised in 2011, and operating arrangements due for completion in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by Glenelg Hopkins Catchment Management Authority through media releases, website and social media updates, SMS alerts, and stakeholder updates targeting river operators, local landholders, river users and the broader community.

Risk assessment and management

In the Glenelg system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.10.3 summarises the medium and high risks, and the mitigating strategies identified by Glenelg Hopkins Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flow releases will be reduced or ceased, resuming again if required once the flood risk has passed. Flooding impacts downstream are difficult to manage due to long travel times; however Glenelg Hopkins Catchment Management Authority will assess seasonal forecasts and risks before undertaking a release.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders in the Glenelg system were consulted in the development of environmental watering priorities for 2012-13. In particular, this included the Wimmera Catchment Management Authority and Grampians-Wimmera-Mallee Water. Discussions were held to assist in the development of planning scenarios for the Glenelg system, and to facilitate the sharing of information on likely system operations and any issues that may influence the ability to deliver priority watering actions. The Glenelg Hopkins River and Wetland Health Advisory Group were also engaged in the development of environmental watering priorities. This group includes community representatives, local landholders, and agencies including Southern Rural Water, the Department of Sustainability Environment and Department of Primary Industries.

Further information

More detailed information can be sought from Glenelg Hopkins Catchment Management Authority (see section 10).

Table 9.10.3 Risk management in the Glenelg system

Risk type	Mitigating strategies
Storage operator cannot deliver required volume or flow rate (eg. spring freshes require close to full capacity release rates at Rocklands Reservoir)	Maintain dialogue with Grampians-Wimmera-Mallee Water about potential and emerging issues Undertake operational review to assess the effectiveness of the delivery
Environmental release causes flooding of private land	Work with Grampians-Wimmera-Mallee Water to release large flows using the 5 Mile and 12 Mile outlets until issue of inundation of private land at Fraser's Swamp is resolved



Wimmera River at Dimboola Weir, Wimmera Catchment Management Authority

Waterway manager – Wimmera Catchment Management Authority

The Wimmera River lies in western Victoria, beginning in the Pyrenees, and flowing into Lake Hindmarsh, the largest freshwater lake in Victoria, and Lake Albacutya, which is listed as a wetland of international significance under the Ramsar Convention. The Wimmera River is listed as a heritage river due to its myriad of environmental and social values. These include evidence of long periods of Indigenous settlement in the area through the discovery of middens (sites where Indigenous people left the remains of their meals) and scar trees, and are reflected through recreational activities including fishing, boating and camping. The Wimmera system is also home to over 85 significant plant species including the endangered Wimmera bottlebrush, located along the MacKenzie River, and Victoria's only self-sustaining population of freshwater catfish.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Wimmera system for 2012-13 are: maintaining water quality in the lower reaches of the Wimmera River; providing suitable habitat for high-value fish populations, supporting the health of Wimmera bottlebrush communities and providing suitable habitat for platypus in the MacKenzie River; and maintaining vegetation condition in Burnt Creek.

To achieve the objectives in the Wimmera River, environmental watering will focus, in priority order, on: winter/spring baseflows; summer/autumn baseflows; summer/autumn freshes; and a second-tier priority of winter/spring freshes. Environmental watering in the MacKenzie River will focus, in priority order, on: summer/autumn baseflows; summer/autumn freshes; winter/spring baseflows; and winter/spring freshes. The priority river reaches for environmental watering are the regulated sections of the Wimmera River where releases can be made: reach 4 and then reaches 2 and 3. Priorities in the MacKenzie River are reaches 2 and 3, with reach 1 benefiting from flows passed to the lower reaches. Opportunistic winter baseflows in Burnt Creek will be provided when the priority flows components in the Wimmera and MacKenzie River are likely to be met.

Table 9.11.1 Water Holdings available for use in the Wimmera system

Entitlement	Description
Wimmera and Glenelg Rivers Environmental Entitlement 2010	<p>40,560 ML of regulated entitlement (to be shared between the Wimmera system and Glenelg system)</p> <p>Fixed passing flows in Fyans Creek</p> <p>Passing flows with some ability to vary rates in the Wimmera River and Mount William Creek</p>

System overview

Environmental water available in the Wimmera system is provided for under the *Wimmera and Glenelg Rivers Environmental Entitlement 2010*. Water available under the entitlement is shared between the Wimmera and Glenelg systems.

Water in the Wimmera system is stored in three on-stream reservoirs: Lake Wartook on the MacKenzie River; Lake Lonsdale on Mount William Creek; and Lake Bellfield on Fyans Creek. Off-stream storages can harvest water via channels from the Wimmera River, Mount William Creek (Taylor's Lake) and Fyans Creek (Lake Fyans). The channel system enables water to be shifted between storages and between the Wimmera and Glenelg systems. The preferred reservoir for environmental water releases for the Wimmera River is Taylors Lake. However, low storage levels in Taylors Lake can result in releases being made from Lake Lonsdale.

In the Wimmera system, the priority river reaches are the heritage-listed reach 4 and then the lower section of reach 2 and reach 3 of the Wimmera River. These reaches contain self-sustaining populations of freshwater catfish, and a number of other endemic fish species including river carp gudgeon, flat-headed gudgeon and smelt. These are the only reaches where environmental water can be actively managed, as the upper reaches are mostly unregulated. The priority river reaches in the MacKenzie River are reaches 2 and 3, with reach 1 receiving consumptive water year-round to supply Horsham's water supply. The only populations of platypus and all endemic fish species in the Wimmera are found in the MacKenzie River, in addition to the endangered Wimmera bottlebrush which is confined to small sections of the lower reaches. Water flowing through reach 3 of the MacKenzie will provide benefit to the Wimmera River below Horsham. The environmental flow reaches are shown in Figure 9.11.1.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Current situation

The wet conditions experienced in the upper catchment since mid-2010 have built on improvements in river health that began in spring 2009, further contributing to the recovery of the Wimmera system from the drought conditions which dominated the region since 1997. Consistent streamflow, combined with flood events in September 2010, December 2010, and January 2011, have led to the most sustained streamflows in over 10 years. However conditions since January 2011 have been very dry, highlighting the critical need for environmental water releases given the absence of natural flows.

This has led to substantial improvements in river health with improved water quality and increased diversity and abundance of macroinvertebrates, fish and vegetation communities. River red gum communities fringing the Wimmera River have shown marked improvement in condition, with significantly stressed trees now beginning to show signs of life.

Environmental objectives

The overarching environmental objective for the Wimmera system is to continue its recovery after prolonged drought. This focuses on: maintaining water quality in the lower reaches of the Wimmera River; supporting the health of Wimmera bottlebrush communities; providing suitable habitat for platypus and high-value fish populations in the MacKenzie River; and maintaining vegetation condition in Burnt Creek.

9.11

Wimmera system

Figure 9.11.1 The Wimmera system



Symbol	Description
	Reach 1 – Wimmera River: Glenorchy to Huddlestons Weir
	Reach 2 – Wimmera River: Huddlestons Weir to Mt William Creek
	Reach 3 – Wimmera River: Mt William Creek to MacKenzie River
	Reach 4 – Wimmera River: MacKenzie River to Lake Hindmarsh
	Reach 1 – MacKenzie River: Lake Warook to Dad and Dave Weir
	Reach 2 – MacKenzie River: Dad and Dave Weir to Distribution Heads
	Reach 3 – MacKenzie River: Distribution Heads to Wimmera River
	Measurement point
	Water infrastructure
	Town

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the primary priority watering actions to be undertaken during 2012-13 in the Wimmera system, in priority order, are as follows:

- Wimmera River:
 - winter/spring baseflows (37 ML per day from June to November)
 - summer/autumn baseflows (5 ML per day from December to May, with a cease to flow event of 5-25 days)
 - summer/autumn freshes (four freshes of 20 ML per day for 7-15 days each during December to May)
- MacKenzie River:
 - summer/autumn baseflows (4 ML per day from December to May, with a maximum of five cease to flow events of seven days each)
 - summer/autumn freshes (five freshes of 5 ML per day for seven days each during December to May)
 - winter/spring baseflows (up to 37 ML per day from June to November)

- winter/spring freshes (three freshes up to 100 ML per day for seven days each during June to November).

Second-tier priorities for the system are as follows:

- Wimmera River:
 - winter/spring freshes (up to five freshes of 334 ML per day for at least 14 days each during June to November)
- Burnt Creek:
 - winter/spring baseflows (1 ML per day from June to November).

The priority watering actions in the MacKenzie and Wimmera rivers are based on the baseflows and freshes that can be feasibly released. The magnitude of freshes is constrained by storage and outlet capacity. In addition, bankfull and overbank flows which are important for vegetation recruitment, sediment movement and removal of saline pools in the Wimmera River cannot be delivered due to storage capacity and risks of flooding private land.

Table 9.11.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figures 9.11.2 and 9.11.3 illustrate the priority watering actions for 2012-13.



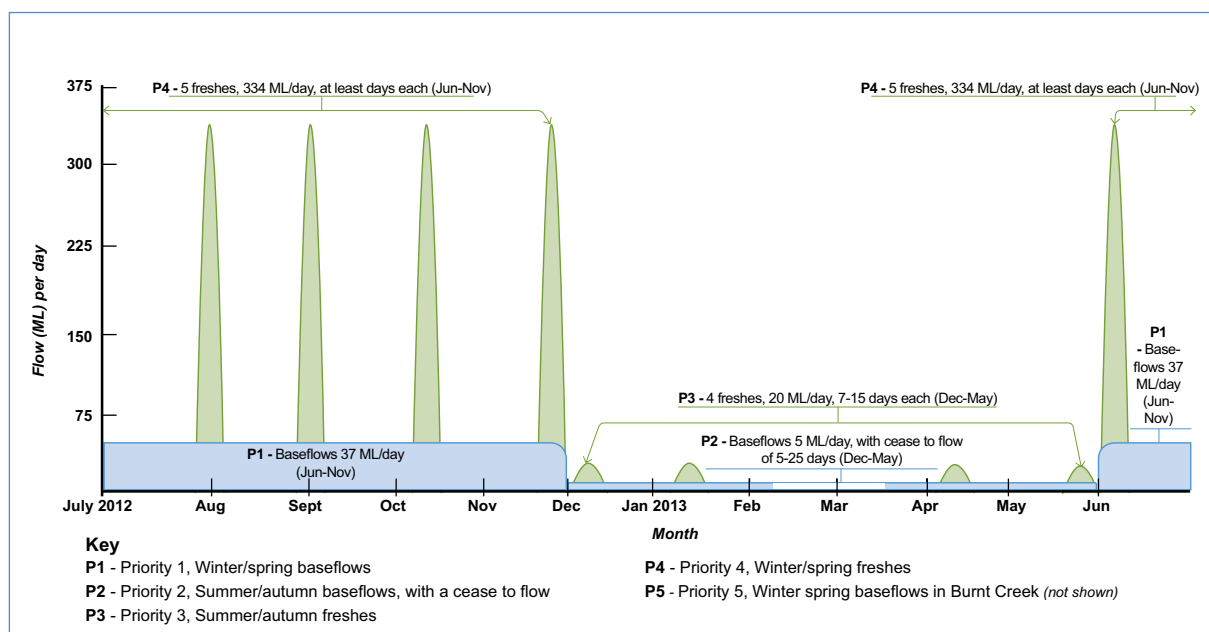
Wimmera River downstream of Ellis Crossing, Wimmera Catchment Management Authority

Table 9.11.2 Priority watering actions under a range of planning scenarios in the Wimmera system

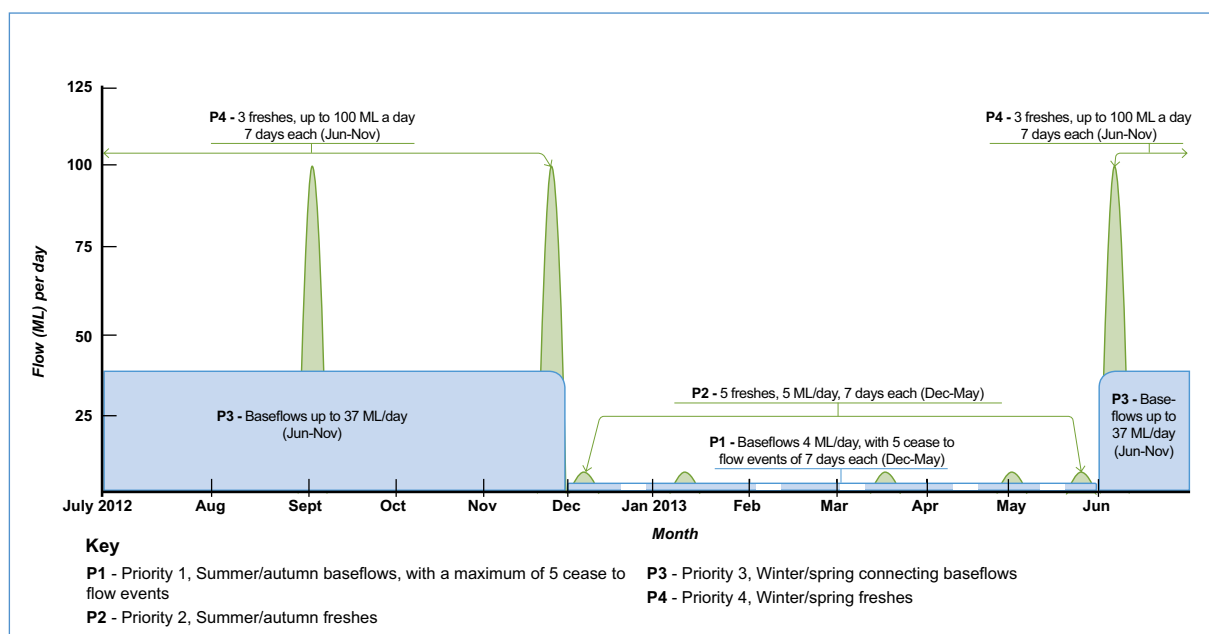
	Planning scenario			
	Drought	Dry	Average	Wet to very wet
Expected availability of Water Holdings¹	44,200 ML carryover	44,200 ML carryover	44,200 ML carryover	44,200 ML carryover
	28,932 ML allocation	41,732 ML allocation	46,032 ML allocation	46,032 ML allocation
Wimmera River (reaches 2-4)				
Environmental objectives	Maintain pool habitat and water quality for fish populations	Maintain pool habitat and water quality for fish populations	Maintain pool habitat and water quality for fish populations	Maintain pool habitat and water quality for fish populations
	Improve fish movement	Improve fish movement	Improve fish movement	Improve fish movement
	Increase macroinvertebrate populations	Increase macroinvertebrate populations	Increase macroinvertebrate populations	Increase macroinvertebrate populations
	Minimise low dissolved oxygen and blue green algae risks	Minimise low dissolved oxygen and blue green algae risks	Minimise low dissolved oxygen and blue green algae risks	Minimise low dissolved oxygen and blue green algae risks
	Limit saline groundwater impacts to improve fish habitat and vegetation condition	Limit saline groundwater impacts to improve fish habitat and vegetation condition	Limit saline groundwater impacts to improve fish habitat and vegetation condition	Limit saline groundwater impacts to improve fish habitat and vegetation condition
Priority watering actions	Winter/spring baseflows	Winter/spring baseflows	Winter/spring baseflows	Winter/spring baseflows
	Summer/autumn baseflows	Summer/autumn baseflows	Summer/autumn baseflows	Summer/autumn baseflows
	Summer/autumn freshes	Summer/autumn freshes	Summer/autumn freshes	Summer/autumn freshes
	Winter/spring freshes	Winter/spring freshes	Winter/spring freshes	Winter/spring freshes
Possible volume required from the Water Holdings²	38,000 ML	38,000 ML	38,000 ML	35,000 ML
MacKenzie River (reaches 2-3)				
Environmental objectives	Habitat for fish (reach 2)	Habitat for fish (reach 2)	Habitat for fish (all reaches)	Habitat for fish (all reaches)
	Maintain health of Wimmera bottlebrush	Maintain health of Wimmera bottlebrush	Maintain health of Wimmera bottlebrush	Maintain health of Wimmera bottlebrush
		Promote chances of Wimmera bottlebrush recruitment	Promote chances of Wimmera bottlebrush recruitment	Promote chances of Wimmera bottlebrush recruitment
			Improve potential for fish/platypus movement	Improve fish/platypus movement potential
				Inundate emergent aquatic vegetation

Planning scenario				
	Drought	Dry	Average	Wet to very wet
Priority watering actions	Summer/autumn baseflows (reach 2)	Summer/autumn baseflows (reach 2)	Summer/autumn baseflows (reach 2)	Summer/autumn baseflows (reach 2)
	Summer/autumn freshes (reach 2)	Summer/autumn freshes (reach 2)	Summer/autumn freshes (reach 2)	Summer/autumn freshes (reach 2)
	Winter/spring baseflows and freshes (reach 3)	Winter/spring baseflows and freshes (reach 3)	Winter/spring baseflows and freshes (reach 3)	Winter/spring baseflows and freshes (reach 3)
	Winter/spring freshes (reach 3)	Winter/spring freshes (reach 3)	Winter/spring freshes (reach 3)	Winter/spring freshes (reach 3)
Possible volume required from the Water Holdings ²	5,700 ML	5,700 ML	5,700 ML	5,700 ML
Burnt Creek				
Environmental objectives	N/A	N/A	Maintain vegetation communities	Maintain vegetation communities
Flow components	N/A	N/A	Winter baseflows	Winter baseflows
Possible volume required from the Water Holdings ²	0 ML	0 ML	600 ML	600 ML
Wimmera system total				
Possible volume required from the Water Holdings ²	43,700 ML	43,700 ML	44,300 ML	41,300 ML
Glenelg system				
Possible volume required from the Water Holdings ³	29,240 ML	33,100 ML	27,100 ML	27,100 ML
TOTAL				
Possible volume required from the Water Holdings	72,940 ML	76,800	71,400 ML	68,400 ML
Possible carryover into 2013-14 ⁴	192 ML	9,132 ML	18,832 ML	0 ML (200 ML shortfall – prioritisation required)

1. Holdings are shared across the Glenelg and Wimmera systems and indicate the total amount for both systems. Includes the once-off amount of 5,532 ML due to target reservoir volumes being achieved in 2012-13 in the Wimmera and Glenelg system, as specified in the environmental entitlement. Includes 22,000 ML loss to spill under a wet scenario.
2. Figures assume some unregulated flows occur in the Wimmera system under wetter scenarios, meeting some of the priority watering actions naturally.
3. Figures assume some unregulated flows occur in the Glenelg system. Under all scenarios, passing flow rates are assumed to be reduced by up to 50 percent. Under average and wet scenarios the passing flow rate will increase as restrictions are eased in response to improved inflows, meeting winter/spring baseflow requirements.
4. Figures take account of the possible volume required in both the Glenelg and Wimmera systems. The amount of carryover into 2013-14 will be determined not only by the volume of unused water but the possibility that the storage spills and carryover is forfeited.

Figure 9.11.2 Priority watering actions in the Wimmera system (Wimmera River)¹

1. This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Figure 9.11.3 Priority watering actions in the Wimmera system (MacKenzie River)¹

1. This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Wimmera system. Wimmera Catchment Management Authority will monitor catchment conditions, inflows, likely seasonal forecast, water availability and water quality to determine the best time to make releases to deliver priority watering actions efficiently and with maximum environmental benefit.

The Wimmera-Glenelg headworks system is highly regulated with many storages. A number of factors influence the management of environmental releases in the Wimmera system, including reservoir capacity constraints, storage levels, and other water resource management activities. Wimmera Catchment Management Authority will work closely with Grampians-Wimmera-Mallee Water to ensure there is maximum benefit from the use of environmental water in the system. Opportunities will be sought where possible to benefit other regulated waterways such as Mount William Creek and Burnt Creek as part of the delivery of water to priority reaches of the Wimmera River.

Flows in the Yarriambiack Creek will vary depending on flows along the Wimmera River. Under some circumstances, it may be necessary to block low flows from entering the creek to ensure priority watering actions in the Wimmera River can occur in the most efficient manner.

The Glenelg Hopkins Catchment Management Authority and Wimmera Catchment Management Authority will work together to provide the priority watering actions in both the Glenelg and Wimmera systems, considering water availability and system constraints. They will communicate regularly to ensure sufficient water in the Water Holdings before ordering. In the unlikely event there is insufficient water to meet priority watering actions in both the Glenelg and Wimmera systems, prioritisation will occur, based on the effectiveness of flows in maximising environmental outcomes.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise Wimmera Catchment Management Authority to implement these decisions.

Priority watering actions in the Wimmera system will be undertaken by the Wimmera Catchment Management Authority in accordance with seasonal watering statements and in consultation with Glenelg Hopkins Catchment Management Authority and Grampians-Wimmera-Mallee Water. They will also be implemented in line with the Wimmera-Glenelg Storage Management Rules finalised in 2011, and operating arrangements due for completion in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by the Wimmera Catchment Management Authority regarding environmental watering through media releases and website updates.

Risk assessment and management

In the Wimmera system, a number of risks have been assessed, and mitigation strategies identified, relating to the implementation of priority watering actions. Table 9.11.3 summarises the medium and high risks, and the mitigating strategies identified by the Wimmera Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed. The costs of mitigating strategies will be considered in light of funding availability.

Table 9.11.3 Risk management in the Wimmera system

Risk type	Mitigating strategies
Release volume is insufficient in meeting required flow at target point	Visual monitoring and automated gauging Increase environmental water releases if possible Implement actions to reduce losses (eg. sandbagging Yarriambiack Creek under low flow conditions)
Storage operator maintenance works affect ability to deliver water	Have ongoing dialogue with Grampians-Wimmera-Mallee Water from planning process through to the active delivery of water, including contingency plans to release water through other points
Storage operator cannot deliver required volume or flow rate (ie. outlet/capacity constraints, insufficient storage volume)	Have ongoing dialogue with Grampians-Wimmera-Mallee Water from planning process through to the active delivery of water, including contingency plans to release water through other points Potential for works to be undertaken to improve delivery rates, subject to funding availability
Environmental releases cause flooding to private land and public infrastructure	Monitor upstream flows and cease releases when high flow are occurring, or significant rainfall events are forecasts
Releases cause water quality issues (eg. blackwater, low dissolved oxygen, mobilisation of saline pools, acid sulphate soils etc)	Saline and dissolved oxygen monitoring, undertake further research into saline pools subject to funding availability
Improved conditions for non-native species (eg. carp)	There is currently no strategy to mitigate this risk. Undertake research into carp and other control methods for exotic species
Current recommendations on environmental flow inaccurate	Improve environmental flow recommendations and conduct monitoring
Unable to provide evidence in meeting environmental objective	Undertake ongoing ecological monitoring of releases to assist the refinement of flow recommendations over time
Key stakeholders not supportive of environmental water release	Ensure planning is rigorous and scientifically based Continue to communicate the importance of environmental water releases

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders in the Wimmera system were consulted in the development of environmental watering priorities for 2012-13. In particular, this included the Glenelg Hopkins Catchment Management Authority and Grampians-Wimmera-Mallee Water. Discussions were held to assist in the development of planning scenarios for the Wimmera system, and to facilitate the sharing of information on likely system operations and any issues that may influence the ability to deliver priority watering actions.

Further information

More detailed information can be sought from the Wimmera Catchment Management Authority (see section 10).



Wimmera River at Quantong Bridge, Wimmera Catchment Management Authority



Wal Wal

Section 9.12 Wimmera-Mallee Wetlands of the VEWL Seasonal Watering Plan 2012-13 has been varied. Please refer to the Wimmera-Mallee Wetlands system variation available on the VEWL website for the most up-to-date version.

Waterway manager – Mallee Catchment Management Authority, Wimmera Catchment Management Authority and North Central Catchment Management Authority

The Wimmera-Mallee wetlands system is made up of over 40 unique wetlands including freshwater meadows, open freshwater lakes and freshwater marshes located on public and private land in western Victoria. The wetlands vary in size, and are home to a huge variety of native waterbird populations, including brolgas, egrets, blue-billed ducks, freckled ducks, Caspian terns and glossy ibis. They also provide a valuable source of water for other native animals such as the threatened growling grass frog. Important vegetation communities are present in wetlands, such as spiny lignum and cane grass, providing diverse habitat for a myriad of animal species. In addition, many of the wetlands provide a wide range of social values important to local communities, such as providing places for recreational activities including canoeing and bird watching.

Summary of planned environmental water use in 2012-13

The priority environmental watering deliveries will occur in the Wimmera-Mallee wetlands system for 2012-13 are to: provide habitat for waterbirds, reptiles and frogs; and maintain the condition of fringing wetland vegetation.

To achieve these objectives, environmental water deliveries will occur in spring and autumn in each of the three catchment management authority areas. The priority wetlands to be watered in 2012-13 will be dependent on when each wetland is connected to the Wimmera-Mallee Pipeline.

Table 9.12.1. Water Holdings available for use in the Wimmera-Mallee wetlands

Entitlement	Description
Wimmera and Glenelg Rivers Environmental Entitlement 2010	Up to 1,000 ML annually to supply to former channel-fed wetlands

System overview

The modernisation of water delivery infrastructure throughout the Wimmera-Mallee region has seen a shift from predominantly open channel systems to a highly-efficient piped water supply system. This change has resulted in significant water savings, which have been redirected to deliver a range of economic, social and environmental benefits in the region. A number of important wetlands in the Wimmera-Mallee region historically received outflows from the open channel system, supporting various environmental values. The environmental significance of these wetlands, and the need for water to support their environmental values, was recognised through the creation of a 1,000 ML entitlement to supply water to former channel-fed wetlands.

A range of water-dependent plant and animal species rely on these varying wetland environments. For example, cane grass and water couch will only tolerate shallow flooding within wetlands, while ribbon weed requires a greater depth of water to grow successfully. Brolgas, a threatened waterbird species, have been recorded in freshwater meadows within the wetland system, while threatened duck species such as the blue-billed and freckled duck are more commonly found in open water habitats.

Forty-nine high-value wetlands have been identified as priorities for connection to the Wimmera-Mallee Pipeline (see Figure 9.12.1). These wetlands were prioritised based on an assessment of the environmental importance of the wetland, its hydrology, land management, and feasibility of connection. These wetlands will progressively be connected to the Wimmera-Mallee Pipeline over coming years.

Environmental water available under the wetland component of the entitlement is supplied from the Wimmera-Mallee Pipeline.

The Wimmera-Mallee wetlands are located in parts of the Mallee, Wimmera, and North Central Catchment Management Authority areas.

Current situation

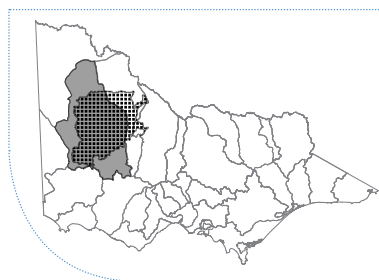
Since the construction of the Wimmera Mallee Pipeline was completed in April 2010, the majority of the wetlands have been isolated and no longer receive water except in high rainfall events where localised runoff may enter the wetlands.

Recent watering history for wetlands within the system differs depending on a number of factors. These factors include: whether the wetland was supplied from the Grampians channel system (generally in the southern part of the system) or Waranga channel system (generally in the northern part of the system); whether the wetland was a priority for filling during the drought; and how much of the wetland was inundated. The majority of the wetlands dried completely during the late 1990s and 2000s.

Due to high rainfall and localised runoff in the area during 2010 and 2011, the majority of wetlands in the system have received water despite not being connected to the pipeline. Since January 2011, catchment conditions have been dry, with water in the wetlands decreasing due to evaporation and seepage.

At 1 July 2012, two wetlands had been connected to the Wimmera-Mallee Pipeline. Roselyn Wetland and Barbers Swamp are both located in the Mallee Catchment Management Authority region and were connected during 2011-12. During 2012-13, it is expected that further wetlands will be connected to the pipeline in the Mallee, Wimmera and North Central Catchment Management Authority regions.

Figure 9.12.1 The Wimmera-Mallee wetlands



Mallee Catchment Management Authority

1. Above North Connolly WL; 2. Barbers Swamp; 3. Broom Tank; 4. Bull Swamp; 5. Chiprlick; 6. Clinton Shire Dam; 7. Cokym Reserve; 8. Consindines; 9. Countons Wetland; 10. Cronomby Tanks; 11. Daniher Lake; 12. Goulds Reserve; 13. Greens Wetland (2); 14. Hill Paddock Wetland; 15. Homelea; 16. J Ferrier Wetland; 17. John Ampt; 18. Kath Smith Dam; 19. Lake Marlbed; 20. Lake Tchum North; 21. Mahoods Corner; 22. Marlbed Lake Swamp; 23. Moreton Plains Reserve; 24. Pam Juergens Dam; 25. Part of Gap Reserve; 26. Poyner; 27. R Ferriers Dam; 28. Rickard Glenya Dam; 29. Roselyn Wetland; 30. Shannons Wayside

Wimmera Catchment Management Authority

31. Carapungna; 32. Challambra Swamp; 33a. Harcoans; 33b. Mutton; 34. Nelson Solcombe Dam; 35. Pinedale; 36. Sawpit Swamp; 37. Wal Wal Swamp; 38. Krong Swamp; 39. Crow Swamp

North Central Catchment Management Authority

40. Ingram Dam; 41. Creswick Swamp; 42. Little Lake Buloke; 43. Cherrip Swamp; 44. Davis; 45. Corack Lake; 46. Cambell; 47. Unnamed wetland no. 837932; 48. Railway Dam

Environmental objectives

The overarching environmental objectives for the Wimmera-Mallee wetlands are to: provide habitat for waterbirds, reptiles and frogs; and maintain the condition of fringing wetland vegetation. Providing a wide range of habitats by improving the condition of aquatic and terrestrial wetland vegetation in turn ensures that animal species have habitat and water resources available for use in a predominantly dry landscape.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, environmental watering will occur throughout 2012-13 in the Wimmera-Mallee wetland system.

Environmental water deliveries will occur in spring and autumn in each of the three catchment management authority areas. In some cases, wetlands will be filled from empty; in other cases, the wetlands will only require a top up with water. In all cases, vegetation responses will be targeted, through wetting of the wetland margins, promoting growth and development of emergent wetland vegetation as water recedes after the watering event.

As delivery of water relies on the channel system being linked to the wetlands, environmental watering will be staggered according to construction schedules.

Table 9.12.2 outlines the priority sites to receive environmental water during 2012-13.

Table 9.12.2 Priority watering actions for the Wimmera-Mallee wetlands

Catchment management authority area	Priority sites to receive environmental water in 2012-13	Maximum volume (ML)
Total expected availability of Water Holdings		1,547 ML carryover 480-1,000 ML allocation ¹
Mallee Catchment Management Authority	1. Above North Connelly WL; 2. Barbers Swamp; 3. Broom Tank; 4. Bull Swamp; 5. Chiprick; 6. Clinton Shire Dam; 7. Cokym Reserve; 8. Considines; 9. Coundons Wetland; 10. Cronomby Tanks; 11. Daniher Lake; 12. Goulds Reserve; 13. Greens Wetland (2); 14. Hill Paddock Wetland; 15. Homelea; 16. J Ferrier Wetland; 17. John Ampt; 18. Kath Smith Dam; 19. Lake Marlbed; 20. Lake Tchum North; 21. Mahoods Corner; 22. Marlbed Lake Swamp; 23. Moreton Plains Reserve; 24. Pam Juergens Dam; 25. Part of Gap Reserve; 26. Poyner; 27. R Ferriers Dam; 28. Rickard Glenya Dam; 29. Roselyn Wetland; 30. Shannons Wayside	577 ML
Wimmera Catchment Management Authority	31. Carapungna; 32. Challambra Swamp; 33a. Harcoans; 33b. Mutton; 34. Nelson Solcombe Dam; 35. Pinedale; 36. Sawpit Swamp; 37. Wal Wal Swamp; 38. Krong Swamp; 39. Crow Swamp	314 ML
North Central Catchment Management Authority	40. Ingram Dam; 41. Creswick Swamp; 42. Little Lake Buloke; 43. Cherrip Swamp; 44. Davis; 45. Corack Lake; 46. Cambell; 47. Unnamed wetland no. 837932; 48. Railway Dam	497 ML
Possible volume required from the Water Holdings		1,388 ML
Possible carryover into 2013-14		639-1,159 ML

1. Based on receiving an allocation of 48-100% of entitlement volume during 2012-13, and this water not spilling from storage.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Wimmera-Mallee wetlands system.

The delivery of environmental water in the Wimmera-Mallee wetlands system relies on infrastructure connections being completed. Catchment management authorities will work closely with Grampians-Wimmera-Mallee Water, land managers such as Parks Victoria and landowners throughout the connections program, ensuring that planning for and delivery of water is undertaken as required throughout the season.

Some wetlands may not need to be actively watered if they receive flood inundation in very wet conditions. Recent and forecast rainfall will be considered prior to the delivery of water to a wetland. However, the wetlands are considered off-stream wetlands, meaning they do not receive water from a recognised watercourse. Unlike connected floodplain wetlands, it is anticipated that environmental water requirements will not be strongly influenced by catchment conditions, unless there is widespread catchment flooding through the region, reducing the need to provide water to the wetlands.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise Mallee, Wimmera or North Central catchment management authorities to implement these decisions.

Priority watering actions in the Wimmera-Mallee wetland system will be undertaken by the Mallee, Wimmera and North Central catchment management authorities in accordance with an endorsed delivery plan for each wetland.

Delivery of environmental water to wetlands on private land will not be undertaken until agreements with affected landholders are successfully negotiated. The process for negotiating these agreements is being managed by each catchment management authority.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, the Mallee, Wimmera and North Central catchment management authorities will communicate watering actions through media releases and website updates.

Risk assessment and management

In the Wimmera-Mallee wetland system, a number of risks have been assessed, and mitigation strategies identified, relating to the implementation of priority watering actions. Table 9.12.3 summarises the medium and high risks identified, and the mitigating strategies by the catchment management authorities. The costs of mitigating strategies will be considered in light of funding availability.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

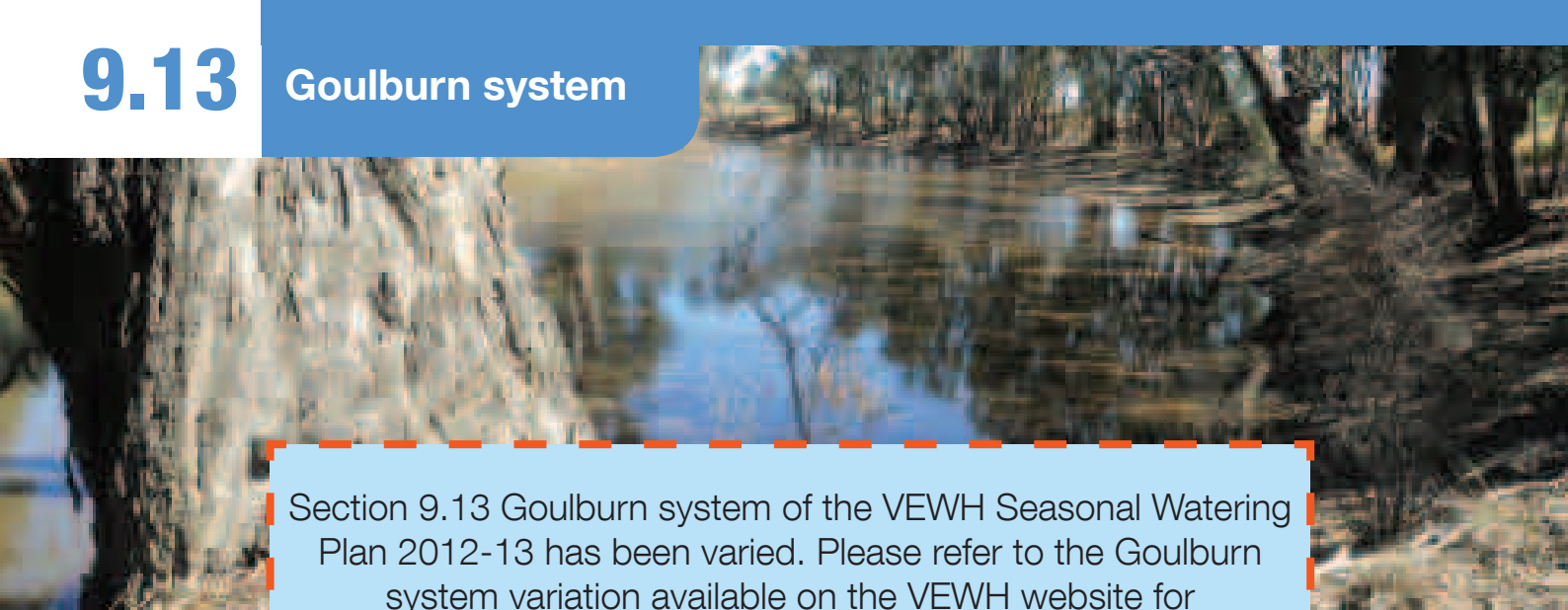
A committee was established to provide advice regarding the connection and supply of the wetland water (the Wetland Evaluation Team). This committee included Mallee Catchment Management Authority (as the nominated representative of Mallee, Wimmera and North Central catchment management authorities), the Department of Sustainability and Environment, Grampians-Wimmera-Mallee Water, and the Birchip Landcare Group as representatives of the local community. This is the main group who have been engaged in the development of annual watering priorities for this system.

Further information

More detailed information can be sought from the Mallee, Wimmera and North Central catchment management authorities (see section 10).

Table 9.12.3 Risk management in the Wimmera-Mallee wetlands

Risk type	Mitigating strategies	CMA
Release volume is insufficient to meet required inundation extent	Ensure design and construction of outfalls to wetlands is sufficient to meet target inundation extent and duration	MCMA, WCMA, NCCMA
Storage operator maintenance works affect ability to deliver water	Engage with Grampians-Wimmera-Mallee Water throughout the watering season and as connections to the wetlands are constructed: this will assist with timing the delivery of releases to connected wetlands when works are completed and channel capacity available	MCMA, WCMA, NCCMA
Storage operator cannot deliver required volume or flow rate (ie. outlet/ capacity constraints, insufficient storage volume)	Engage with Grampians-Wimmera-Mallee Water throughout the watering season to assist with timing of releases when there is sufficient capacity to meet requirements	MCMA, WCMA, NCCMA
Limited catchment management authority resources to deliver environmental release	Ensure that environmental water management within the catchment management authority is adequately resourced to undertake required delivery tasks	MCMA, NCCMA
Environmental releases cause flooding of private land	Landholder agreement negotiated for flooding on private land Delivery plans will be developed and approved by the catchment management authority and endorsed by the VEWH	MCMA, WCMA, NCCMA
Environmental releases cause flooding of Crown land	Agreement obtained from land manager for flooding on Crown land	MCMA, WCMA, NCCMA
Current recommendations on environmental flows are inaccurate	Base decisions on current best available science Develop an environmental water management plan to identify the flow requirements and ecological values of the wetlands. Undertake review of watering actions with relevant stakeholders to ensure watering recommendations are adaptively managed over time	MCMA, WCMA, NCCMA
Unable to provide evidence in meeting ecological objective	Ensure monitoring activities are undertaken (eg. Index of Wetland Condition)	MCMA, WCMA, NCCMA
Releases cause water quality issues (eg. blackwater, low dissolved oxygen, mobilisation of saline pools, acid sulphate soils etc)	Monitor water quality throughout the watering season and manage watering action accordingly (eg. provide additional flows or stop delivery)	MCMA, NCCMA



Section 9.13 Goulburn system of the VEWB Seasonal Watering Plan 2012-13 has been varied. Please refer to the Goulburn system variation available on the VEWB website for the most up-to-date version - www.vewb.vic.gov.au

McCoys E

Waterway manager – Goulburn Broken Catchment Management Authority

The Goulburn river basin is Victoria's largest, covering over 1.6 million hectares or 7.1 percent of the State's total area. The Goulburn River is an iconic heritage river because of its significant environmental, recreational and cultural values. It supports areas of intact river red gum forest, and provides habitat for threatened and endangered species such as the great egret, Murray cod and Macquarie perch. It also contains many important cultural heritage sites, provides water for agriculture and supports recreational activities such as fishing and canoeing.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Goulburn system in 2012-13 are: providing appropriate habitats for fish spawning, recruitment and migration; enhancing the extent and diversity of aquatic vegetation; maintaining the diversity of riparian vegetation; and improving the abundance and diversity of macroinvertebrate communities.

To achieve these objectives, environmental watering will focus, in priority order, on: winter/spring baseflows; a spring fresh; summer baseflows; autumn/winter baseflows and increased winter/spring baseflows. If additional water is available or catchment runoff conditions are average to wet, environmental watering will also focus on: carrying water over for winter/spring baseflows in 2013-14; increased summer baseflows; a summer/autumn fresh; providing and carrying water over to continue to provide increased autumn/winter baseflows in 2013; and carrying water over for a winter fresh in 2013-14. Reducing the rates of rise and fall of natural events will also be considered.

The priority river reaches for environmental watering are reaches 4 and 5, from Goulburn Weir to the River Murray. Reaches 1 to 3, between Lake Eildon and Goulburn Weir, benefit from (or are not adversely impacted by) the flows being passed to the lower reaches.

Table 9.13.1 Water Holdings available for use in the Goulburn system

Entitlement	Description
Victorian Water Holdings	
Bulk Entitlement (River Murray-Flora and Fauna) Conversion Order 1999	27,600 ML high-reliability entitlement
River Murray Environmental Water Savings Supply Deed ¹	One-third of water savings created in the Murray system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Goulburn Environmental Water Savings Supply Deed ¹	One-third of water savings created in the Goulburn system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Shepparton Modernisation Project ²	1,500 high-reliability entitlement (estimate only) 7,600 ML low-reliability entitlement (estimate only)
Silver and Wallaby Creeks Environmental Entitlement 2006 ³	Passing flows
Goulburn System – Living Murray - Environmental Entitlement 2007 ⁴	49,625 ML high-reliability entitlement 156,980 ML low-reliability entitlement
Other Water Holdings	
Commonwealth Environmental Water Holdings ⁵	181,897 ML Goulburn high-reliability water share 10,654 ML Goulburn low-reliability water share

1. Volumes determined and allocated after audit of water savings in September each year. The long-term average audited saving for the environment from 2011 are: Murray 4,533 ML; and Goulburn 24,375 ML.

2. Entitlement does not yet exist, but is expected to be finalised in 2012-13.

3. Entitlement provides passing flows only and not a volume in storage, therefore no management action is necessary.

4. Water allocated to this entitlement must be used for the Living Murray 'icon sites'. However, this water is released down and can provide environmental benefits in the Goulburn River en route to the River Murray.

5. Decisions about the use of Commonwealth Environmental Water Holdings are the responsibility of Commonwealth Environmental Water. The VEW will submit proposals for the use of Commonwealth environmental water for Victoria's priority rivers and wetlands. Current as at 31 May 2012. Does not include Commonwealth Environmental Water Holdings in other systems which can be traded in for use in the Goulburn system, subject to trading rules.

System overview

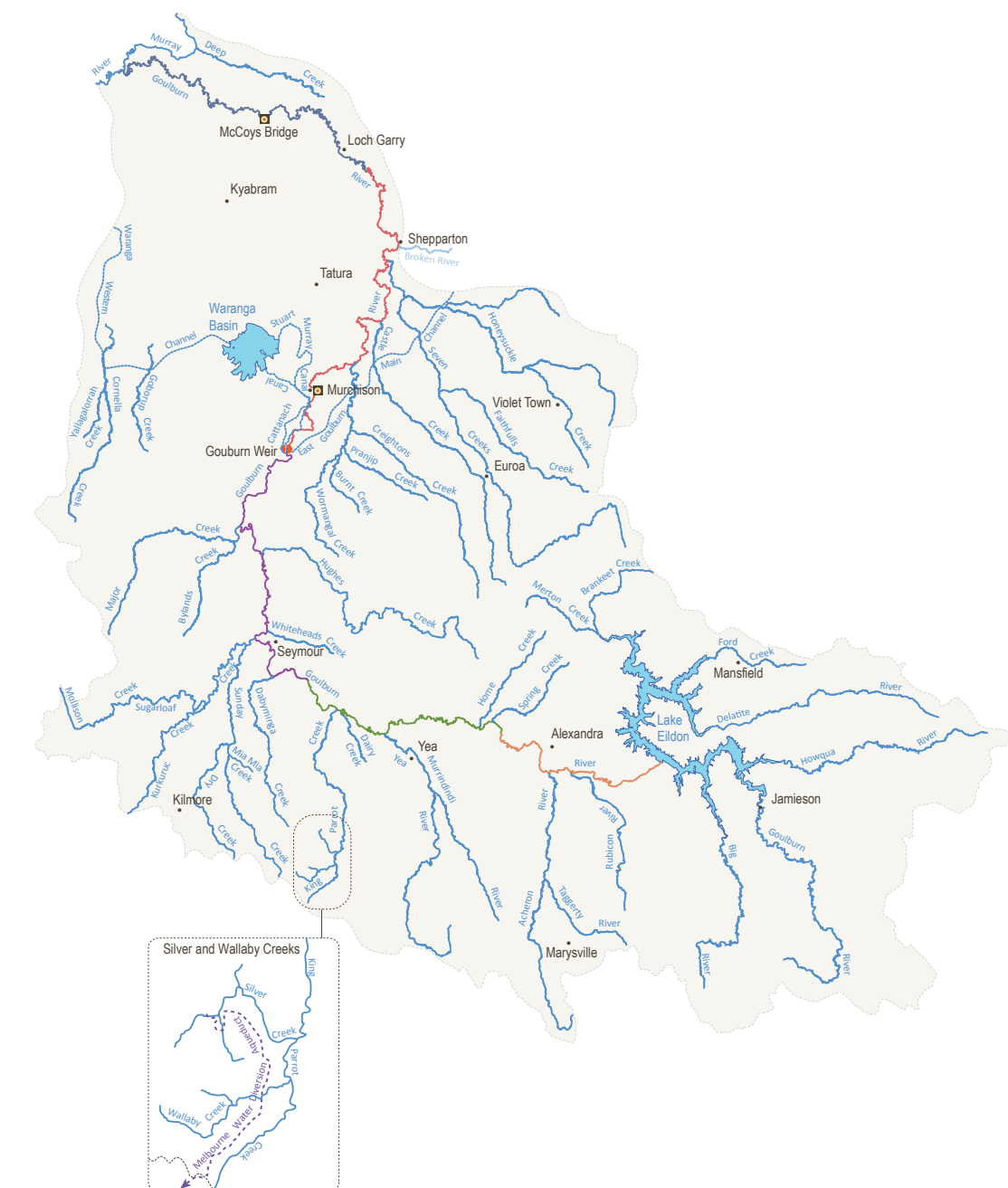
The priority river reaches for environmental watering are reaches 4 and 5, from Goulburn Weir to the River Murray, with reaches 1, 2 and 3, between Lake Eildon and Goulburn Weir, benefiting (or not being adversely impacted) from the flows being passed to the lower reaches. Reach 4 and 5 of the Goulburn River provide important habitat for a range of native fish communities, including small-bodied fish such as carp gudgeon and large-bodied fish such as golden perch, Murray cod and freshwater catfish. The measurement points for target flows are at Murchison for reach 4 and McCoys Bridge for reach 5. The environmental flow reaches are shown in Figure 9.13.1.

Water Holdings in the Goulburn system can be released from Lake Eildon into reach 1 and Goulburn Weir into reach 4. Water can also be traded for use in the Goulburn system from other systems, subject to trading rules.

Passing flows are provided under Goulburn-Murray Water's bulk entitlements and consumptive water is delivered down the Goulburn River en route to the River Murray. These can provide significant environmental benefits if delivered during the right time of year. High flows in summer can have an adverse effect on the system and need to be managed where possible; the larger and longer the flow, the more potential for ecological damage. Goulburn Broken Catchment Management Authority will work with Goulburn-Murray Water to minimise adverse environmental impacts during this time.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Figure 9.13.1 The Goulburn system



Symbol	Description
	Reach 1 - Lake Eildon to Molesworth
	Reach 2 - Molesworth to Seymour
	Reach 3 - Seymour to Nagambie
	Reach 4 - Nagambie to Loch Garry
	Reach 5 - Loch Garry to the River Murray
	Measurement point
	Water infrastructure
	Town

Current situation

Over the last 12 years, the Goulburn River has been characterised by 10 years of drought with very low flows, and the last two years with high flows. Between autumn 2011 and autumn 2012, the Goulburn River experienced a number of natural freshes, bankfull and overbank flows as a result of widespread and heavy rainfalls. Natural flows combined with targeted environmental releases allowed the majority of the 2011-12 priority watering actions to be met and the environmental recovery of the Goulburn River and its floodplain to continue despite the effects of high natural flows. Benefits included providing successive opportunities for feeding and breeding of waterbirds, frogs and native fish. However, these high flows limited the establishment of aquatic and riparian vegetation from the banks in the lower reaches and led to an increase in carp numbers. Environmental flows were provided to meet baseflow requirements and a fresh.

With the prolonged drought causing a decline in river health, the wet 2010-11 and 2011-12 started the environmental recovery of the Goulburn River. It is important to continue this recovery in 2012-13.

Environmental objectives

The environmental objectives for the Goulburn system focus on: providing appropriate habitats within the river for spawning, recruitment and migration of fish species such as golden perch; enhancing the extent and diversity of aquatic vegetation; maintaining the diversity of riparian vegetation; improving the abundance and species diversity of macroinvertebrate communities.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the first-tier priority watering actions to be undertaken during 2012-13 in the Goulburn system, in priority order, are as follows:

- winter/spring baseflows (500 ML per day at Murchison and/or 540 ML per day at McCoys Bridge from July to November)
- a spring fresh (one fresh of 5,600 ML per day at Murchison and/or McCoys for 14 days during September to November)
- summer baseflows (500 ML per day at Murchison and/or 540 ML per day at McCoys Bridge from December to February)

- autumn/winter baseflows (500 ML per day at Murchison and/or 540 ML per day at McCoys Bridge from March to June)
- increased winter/spring baseflows (830 ML per day at Murchison and/or 940 ML per day at McCoys from July to November).

If additional water is available, environmental watering will also focus on these second-tier priorities:

- carryover for winter/spring baseflows in 2013-14 (500 ML per day at Murchison and/or 540 ML per day at McCoys from July to November 2013)
- increased summer baseflows (830 ML per day at Murchison and/or 940 ML per day at McCoys from December to February)
- a summer/autumn fresh (one fresh of 5,600 ML per day at Murchison and/or McCoys for two days during December to May)
- increased autumn/winter baseflows (830 ML per day at Murchison and/or 940 ML per day at McCoys from March to June) and carryover for continued increased winter baseflows in 2013-14 (830 ML per day at Murchison and/or 940 ML per day at McCoys from July to August 2013)
- carryover for a winter fresh in 2013-14 (5,600 ML per day at Murchison and/or McCoys for 14 days during July to August 2013).

Bankfull flows are also identified as an important flow component for maintaining channel shape and preventing in-filling of pools, while overbank flows are important for wetlands and bringing food resources into the river. They are not priority watering actions at this stage due to recent high and overbank flows. In addition, the feasibility of delivering overbank flow recommendations, including how best to deliver or supplement flows while avoiding damage to public and private assets requires further investigation. Therefore overbank flows will only occur naturally.

The VEWB also coordinates the delivery of Living Murray and Commonwealth environmental water, and authorises waterway managers to implement watering actions for downstream sites provided there are no adverse impacts on the Goulburn system. The VEWB will liaise with the Murray-Darling Basin Authority and Commonwealth Environmental Water to maximise the environmental benefits of this water delivery in the Goulburn system.

Table 9.13.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.13.2 illustrates the priority watering actions for 2012-13.

Table 9.13.2 Priority watering actions for the Goulburn system under a range of planning scenarios

	Planning scenario				
	Drought	Very dry	Dry	Average	Wet
Expected availability of Water Holdings	8,600 ML Victorian Water Holdings ¹ 83,100 Living Murray Water Holdings ² 191,898 ML Commonwealth Environmental Water Holdings ³	8,600 ML Victorian Water Holdings ¹ 83,100 ML Living Murray Water Holdings ² 191,898 ML Commonwealth Environmental Water Holdings ³	8,600 ML Victorian Water Holdings ¹ 83,600 ML Living Murray Water Holdings ² 191,898 ML Commonwealth Environmental Water Holdings ³	8,600 ML Victorian Water Holdings ¹ 73,400 ML Living Murray Water Holdings ² 191,898 ML Commonwealth Environmental Water Holdings ³	8,600 ML Victorian Water Holdings ¹ 66,600 ML Living Murray Water Holdings ² 191,898 ML Commonwealth Environmental Water Holdings ³
Environmental objectives	Maintain pool depth and maximise fish habitat Improve and expand macroinvertebrate habitat Bench inundation for carbon/nutrient cycling (providing food source for macroinvertebrates and fish) and vegetation Stimulate golden perch breeding	Maintain pool depth and maximise fish habitat Improve and expand macroinvertebrate habitat Bench inundation for carbon/nutrient cycling (providing food source for macroinvertebrates and fish) and vegetation Stimulate golden perch breeding	Maintain pool depth and maximise fish habitat Improve and expand macroinvertebrate habitat Bench inundation for carbon/nutrient cycling (providing food source for macroinvertebrates and fish.) and vegetation Stimulate golden perch breeding	Maintain pool depth and maximise fish habitat Improve and expand macroinvertebrate habitat Bench inundation for carbon/nutrient cycling (providing food source for macroinvertebrates and fish) and vegetation Stimulate golden perch breeding Reduce bank slumping Mitigate blackwater	Maintain pool depth and maximise fish habitat Improve and expand macroinvertebrate habitat Bench inundation for carbon/nutrient cycling (providing food source for macroinvertebrates and fish) and vegetation Stimulate golden perch breeding Reduce bank slumping Mitigate blackwater

	Planning scenario				
	Drought	Very dry	Dry	Average	Wet
Priority watering actions	First tier:	First tier:	First tier:	First tier:	First tier:
	Winter/spring baseflows	Winter/spring baseflows	Winter/spring baseflows	Winter/spring baseflows	Winter/spring baseflows
	Spring fresh	Spring fresh	Spring fresh	Spring fresh	Spring fresh
		Summer baseflows	Summer baseflows	Summer baseflows	Summer baseflows
		Autumn/winter baseflows	Autumn/winter baseflows	Autumn/winter baseflows	Autumn/winter baseflows
			Increased winter/spring baseflows	Increased winter/spring baseflows	Increased winter/spring baseflows
				Second tier:	Second tier:
				Winter/spring baseflows 2013-14	Winter/spring baseflows 2013-14
				Increased summer baseflows	Increased summer baseflows
				Summer/autumn fresh	Summer/autumn fresh
Possible volume required from the Water Holdings ^{4,5}				Increased autumn/winter baseflows continuing into 2013-14	Increased autumn/winter baseflows continuing into 2013-14
				Winter fresh 2013-14	Winter fresh 2013-14
Possible carryover into 2013-14 ⁶	N/A	N/A	N/A	N/A	N/A

1. Assumes VEW's water holdings are carryover only as additional volumes are allocated only after an audit of water savings which occurs in September each year; as such this volume cannot be estimated.

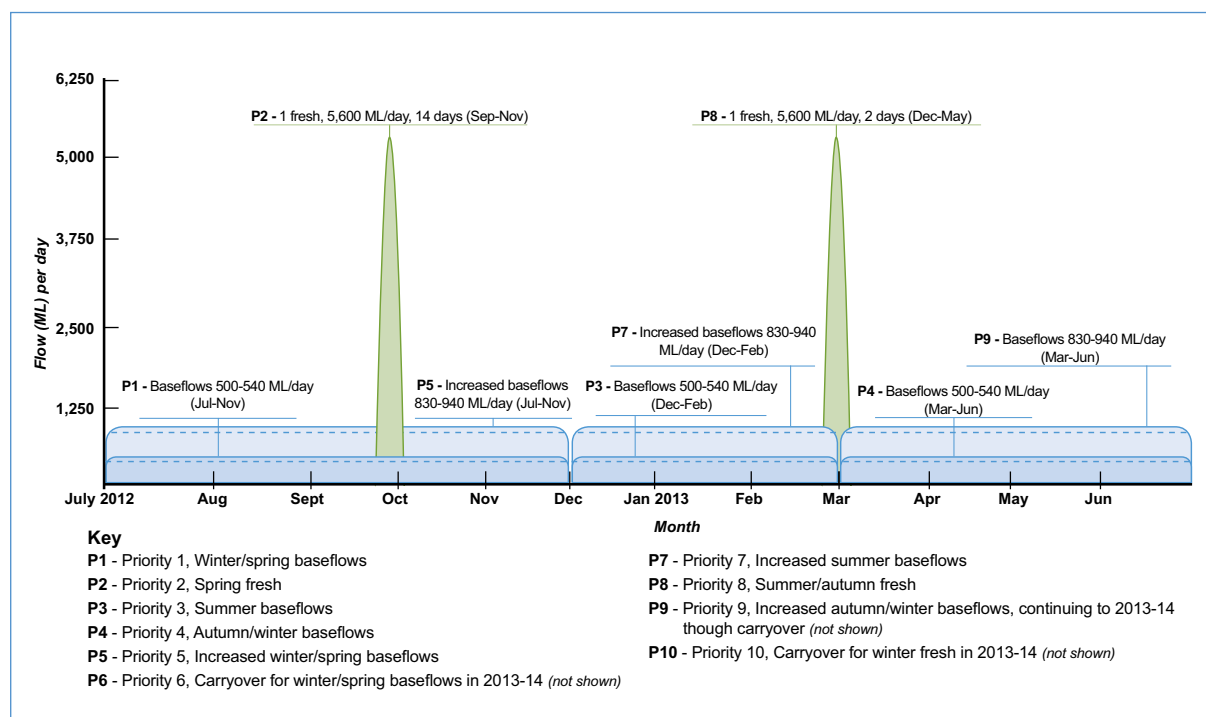
2. Living Murray estimates includes allocation and carryover associated with Goulburn entitlements only, some carryover - spills in the average and wet scenarios.

3. Figures indicate volumes likely to be available from the Commonwealth Environmental Water Holdings.

4. Assumes unregulated flows will occur if the conditions become wetter meeting some of the priority watering actions (drought to dry may use more).

5. Additional priority watering actions could occur under drought to dry conditions if there is water available.

6. Carryover for critical needs in 2013-14 have been considered in the priority watering actions

Figure 9.13.2 Priority watering actions for the Goulburn system¹

¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Goulburn system. Goulburn Broken Catchment Management Authority will monitor catchment conditions, likely seasonal forecasts, water availability, likelihood of storage spills and water quality to determine the best time to make releases to deliver priority watering actions efficiently and with maximum environmental benefit.

Flows will be targeted at McCoys Bridge when there are low tributary flows between Murchison and McCoys, requiring additional flows to be released from Goulburn Weir to meet the targeted flow rates. Flows will be targeted at Murchison when tributary flows may meet some of the requirements at McCoys but not the full targeted flow rates at Murchison.

Environmental water may also be used to soften the rapid increase and decrease in natural flow events by providing a gradual ramp up and down. This will reduce risks associated with bank slumping and macroinvertebrates and fish becoming stranded in small pods on the banks following higher flows.

Over the summer months, unseasonal floods onto the floodplain could cause adverse impacts requiring the use of environmental water to flush out water remaining after any blackwater event.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise Goulburn Broken Catchment Management Authority to implement these decisions.

Priority watering actions in the Goulburn system will be undertaken by the Goulburn Broken Catchment Management Authority in accordance with seasonal watering statements and any agreements with other water holders, and in consultation with Goulburn-Murray Water. They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vevh.vic.gov.au. Throughout the season, watering actions will be communicated by the Goulburn Broken Catchment Management Authority through media releases and website updates.

Risk assessment and management

In the Goulburn system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.13.3 summarises the medium and high risks, and the mitigating strategies identified by the Goulburn Broken Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders with an interest in the Goulburn system were consulted in the development of annual environmental watering priorities including Goulburn-Murray Water and Murray-Darling Basin Authority (River Operations).

To assist with the environmental water management program, the Goulburn Broken Catchment Management Authority is establishing an advisory group to provide advice on environmental water use occurring in the rivers, creeks and wetlands. The membership will include representatives from a range of geographic locations in the system, and from key agencies (such as Department of Primary Industries, Department of Sustainability and the Environment, and Goulburn-Murray Water). Indigenous groups (through the Yorta Yorta as the Registered Aboriginal Party) will also be included.

Further information

More detailed information can be sought from the Goulburn Broken Catchment Management Authority (see section 10).

Table 9.13.3 Risk management in the Goulburn system

Risk type	Mitigating strategies
Environmental releases cause flooding of private land	Consider potential catchment runoff from forecast rainfall in deciding when to commence releases and whether to prematurely cease releases
Current recommendations on environmental flows are inaccurate	Monitor outcomes from flow management and reassess recommendations as necessary
Unable to provide evidence in meeting environmental objectives	Seek involvement contributions and results from monitoring and research programs to improve evidence of meeting environmental objectives
Improved conditions for non-native species (eg. carp)	None available – however environmental benefits outweigh the risk
Key stakeholders not supportive of environmental water releases	Keep key stakeholders aware of release plans and timing



Foot Bridge at Mundoona North, Broken Creek, Goulburn Broken Catchment Management Authority

Waterway manager – Goulburn Broken Catchment Management Authority

The Broken Creek, in northern Victoria, flows north-west from the Broken River into the River Murray, just downstream of Barmah Forest. It supports threatened plant and animal species, including six native fish species of state and national conservation significance, and icon species such as the Murray cod. The Broken Creek also supports riparian vegetation, especially in the lower reaches, which provides important habitat for threatened waterbirds, such as the brolga and bush-stone curlew. It is also an important area for recreational fishing and bushwalking.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Broken system for 2012-13 are to: provide native fish passage; provide suitable water quality conditions for native fish; and improve fish habitat during migration and breeding seasons.

To achieve these objectives, environmental watering will focus, in priority order, on: year-round low flows; winter/spring medium flows; summer/autumn medium flows; summer/autumn high flows; a winter/spring fresh; and spring/summer high flows. The priority river reach for environmental watering is reach 3 (from Nathalia Weir Pool to the River Murray), with flows providing benefits to reaches 1 and 2 on the way.

Table 9.14.1 Water Holdings available for use in the Broken system (lower Broken Creek)

Entitlement	Description
Victorian Water Holdings	
Bulk Entitlement (River Murray Flora & Fauna) Conversion Order 1999	27,600 ML high-reliability entitlement 40,000 ML unregulated entitlement
River Murray Environmental Water Savings Supply Deed ¹	One-third of water savings created in the Murray system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Goulburn Environmental Water Savings Supply Deed ¹	One-third of water savings created in the Goulburn system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Other Water Holdings	
Commonwealth Environmental Water Holdings ²	181,897 ML Goulburn high-reliability water share
	10,654 ML Goulburn low-reliability water share
	206,884 ML Murray high-reliability water share
	11,205 ML Murray low-reliability water share
	47 ML Broken high-reliability water share ³ 4 ML Broken low-reliability water share ³

1. Volumes determined and allocated after audit of water savings in September each year. The long-term average audited savings for the environment from 2011 are: Murray 4,533 ML; and Goulburn 24,375 ML.

2. Decisions about the use of Commonwealth Water Holdings are the responsibility of Commonwealth Environmental Water. The VEW will submit proposals for the use of Commonwealth environmental water for Victoria's priority rivers and wetlands. Current as at 31 May 2012. Does not include Commonwealth Environmental Water Holdings in other systems/States which may be able to be transferred for use in the Broken system, subject to trading rules.

3. Water is held in Lake Nillahcootie on the Broken River. As part of the upper Broken Creek is unregulated, the losses to provide this water would be too great to effectively use these Water Holdings in the lower Broken Creek. The Goulburn Broken Catchment Management Authority and the VEW will work with Commonwealth Environmental Water on delivery of these water shares in the Broken River.

System overview

The Broken Creek flows from the Broken River at Casey's Weir north-west to the River Murray. Water can be released from the Goulburn system through the East Goulburn Main Channel and from the Murray system through the Yarrawonga Main Channel into the lower Broken Creek. Water from these channels cannot be released in the upper reaches of the Broken system.

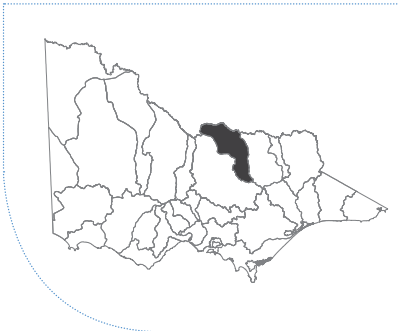
The priority river reach for environmental watering is reach 3 (from Nathalia Weir Pool to the River Murray), with flows also providing benefits to reaches 1 and 2 on the way. The measurement point for target flows for reach 3 is at Rices Weir. The upper Broken Creek from Waggarandall Weir to Katamatite is largely unregulated and ephemeral in nature. The environmental flow reaches in the lower Broken Creek are shown in Figure 9.14.1

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Current situation

Over the last 10 years during the drought the lower Broken Creek was carefully managed to try to prevent a build up of azolla and low dissolved oxygen levels which can lead to fish deaths. The 2011-12 water year resulted in extensive flooding after several years of drought, leading to most of the lower Broken Creek's environmental water needs being met naturally. However, these natural flows resulted in an extensive blackwater event during November 2011 to February 2012, with very low dissolved oxygen levels and some fish deaths. Environmental water was released to improve the water quality and provided habitat for surviving native fish.

Figure 9.14.1 The Broken system



Symbol	Description
	Reach 1 – Broken Creek: Boosey Creek to Nine Mile Creek
	Reach 2 – Nine Mile Creek and Broken Creek to Nathalia Weir
	Reach 3 – Broken Creek: Nathalia Weir to River Murray
	Measurement point
	Water infrastructure
	Town

Environmental objectives

The priority environmental objectives in the Broken system for 2012-13 are to: provide native fish passage; provide suitable water quality conditions for native fish; and improve fish habitat during migration and breeding seasons.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Broken system, in priority order, are as follows:

- year-round low flows (40 ML per day from August to May)
- winter/spring medium flows (120 ML per day from August to November)
- summer/autumn medium flows (150 ML per day from October to May)

- summer/autumn high flows (one event of 250 ML per day for 30-60 days during December to May)
- winter/spring fresh (two freshes of 250 ML per day for 14 days during August to November)
- spring/summer high flows (250 ML per day from September to December).

While the preference is to provide low flows all year round, the channel system closes for maintenance, thus limiting the ability to provide these flows in winter (June to mid-August).

The above priority watering actions meet the recommended water regime under the existing environmental flow study, which does not currently include other flows components such as bankfull flows.

Table 9.14.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.14.2 illustrates the priority watering actions for 2012-13.



Broken Creek, Sarah Gillespie, Goulburn Broken Catchment Management Authority

Table 9.14.2 Priority watering actions for the Broken system under a range of planning scenarios

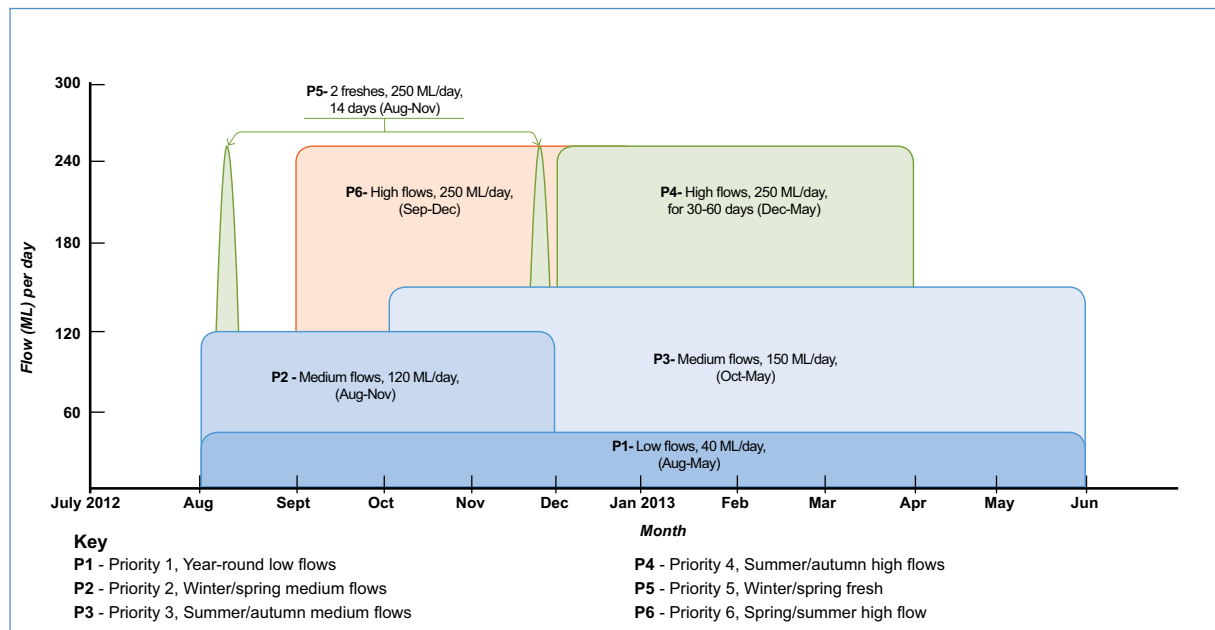
	Planning scenario		
	Very dry	Average	Wet
Expected availability of Water Holdings¹	Water can be accessed from Commonwealth Environmental Water Holdings, VEWH Holdings and consumptive water en route	Water can be accessed from Commonwealth Environmental Water Holdings, VEWH Holdings and consumptive water en route	Water can be accessed from Commonwealth Environmental Water Holdings, VEWH Holdings and consumptive water en route
Environmental objectives	Provide native fish passage Provide suitable water quality conditions for native fish Provide fish habitat during migration and breeding seasons	Provide native fish passage Provide suitable water quality conditions for native fish Provide fish habitat during migration and breeding seasons	Provide native fish passage Provide suitable water quality conditions for native fish Provide fish habitat during migration and breeding seasons
Priority watering actions	Year-round low flows Winter/spring medium flows Summer/autumn medium flows Summer/autumn high flows Winter/spring fresh Spring/summer high flows	Year-round low flows Winter/spring medium flows Summer/autumn medium flows Summer/autumn high flows Winter/spring fresh Spring/summer high flows	Year-round low flows Winter/spring medium flows Summer/autumn medium flows Summer/autumn high flows Winter/spring fresh Spring/summer high flows
Possible volume required from the Water Holdings²	Up to 46,000 ML	Up to 46,000 ML	Up to 50,000 ML
Possible carryover into 2013-14³	N/A	N/A	N/A

1. During water quality emergencies, up to 30,000 ML is available from Goulburn-Murray Water's bulk entitlement to manage water quality issues. River Murray Unregulated Flows is also available on approval from Murray-Darling Basin Authority (River Operations) and Goulburn-Murray Water. These volumes are not included in the expected availability of the Water Holdings.

2. Assumes some unregulated flows and consumptive water en route are contributing to priority watering actions. The volume required may be less depending on the ability and requirement to access consumptive water en route from the Goulburn and Murray systems.

3. There is no ability to carry over water in the Broken system. Decisions to carry over in the Goulburn and Murray systems will be driven by the environmental water demands outside of the Broken system.

Figure 9.14.2 Priority watering actions for the Broken system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the lower Broken Creek. Goulburn Broken Catchment Management Authority will monitor catchment conditions, likely seasonal forecasts, water availability, demands on channel capacity, consumptive use, likelihood of unregulated flows in the River Murray and water quality to determine the best time to make releases to provide priority watering actions efficiently and with maximum environmental benefit.

Being a highly regulated system, the ability to provide priority watering actions is influenced primarily by the delivery of consumptive water en route, and the availability of spare capacity in the irrigation channel system. Seasonal conditions usually have little influence on flows in the lower Broken Creek. The ability to get the required flows through the irrigation channel system to the creek is a major limitation. This limitation creates a high risk of fish deaths in the lower Broken Creek. This means that water from both the Goulburn and Murray systems, which are delivered via different channels, may be required simultaneously. When irrigation demand increases significantly in spring, it is more difficult to access the channel system to deliver water to the creek. Before this occurs, a fresh should be provided to reduce azolla build up in the creek.

Environmental water or consumptive water can be supplied through either the Murray Valley (Murray system) or the Shepparton (Goulburn system) channel systems to deliver flows in the lower Broken Creek.

The ability to use consumptive water en route will determine the amount of environmental water required to deliver priority watering actions. There will be more opportunity to use consumptive water en route in drier years, as local irrigation water demand reduces under wetter conditions. However, in wetter conditions, there is a higher likelihood that River Murray unregulated flows will be available which can be diverted through the Broken Creek. Goulburn-Murray Water's bulk entitlement also includes a 30,000 ML water quality reserve that can be released if required to mitigate water quality issues.

The availability of the various water sources will be dependent on seasonal conditions as well as decisions by Goulburn-Murray Water and Commonwealth Environmental Water.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise Goulburn Broken Catchment Management Authority to implement these decisions.

Priority watering actions in the Broken system will be undertaken by the Goulburn Broken Catchment Management Authority in accordance with seasonal watering statements, any agreements with Commonwealth Environmental Water, and in consultation with Goulburn-Murray Water and Murray-Darling Basin Authority (River Operations). They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by the Goulburn Broken Catchment Management Authority through media releases and website updates.

Risk assessment and management

In the Broken system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.14.3 summarises the medium and high risks, and the mitigating strategies identified by the Goulburn Broken Catchment Management Authority. Monitoring and research projects will be considered in light of funding availability.

If rainfall events are significant enough to create a flood threat (ie. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Table 9.14.3 Risk management in the Broken system

Risk type	Mitigating strategy
Storage operator cannot deliver required volumes or flow rate	Maintain dialogue with Goulburn-Murray Water to deliver water through the Goulburn and Murray irrigation systems where possible
Limited catchment management authority resource to deliver environmental release	Ensure there are multiple staff who can manage releases
Current recommendations on environmental flows are inaccurate	Monitor affects of releases to improve accuracy which will lower risk over time
Unable to provide evidence in meeting environmental objectives	Continued monitoring and research
Improved conditions for non-native species (eg. carp)	While there is no direct mitigation, larger native fish may provide some competition for juvenile carp

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders with an interest in the lower Broken Creek were consulted in the development of annual environmental watering priorities including Goulburn-Murray Water and Murray-Darling Basin Authority (River Operations).

To assist with the environmental water management program, the Goulburn Broken Catchment Management Authority is establishing an advisory group to provide advice on environmental water use occurring in the rivers, creeks and wetlands. The membership will include representatives from a range of geographic locations in the system, and from key agencies such as Department of Primary Industries, Department of Sustainability and Environment, and Goulburn-Murray Water. Indigenous groups (through the Yorta Yorta as the Registered Aboriginal Party) will also be included.

Further information

More detailed information can be sought from the Goulburn Broken Catchment Management Authority (see section 10).



Broken Creek, Goulburn Broken Catchment Management Authority



Campaspe River at Cox Reserve, North Central Catchment Management Authority

Waterway manager – North Central Catchment Management Authority

The Campaspe River, which flows to its confluence with the River Murray at Echuca, lies in north-central Victoria. The Campaspe system provides irrigation water to an agriculturally diverse catchment, including dryland, dairy and intensive horticultural farming. The Campaspe River has high environmental values because of its connection to the River Murray, its banks of river red gums and its healthy native fish populations, including Murray cod, golden and silver perch. It also supports a diverse range of significant bird species, such as the threatened brown tree creeper.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Campaspe system for 2012-13 are: maintaining pool habitat and water quality for fish populations; improving the potential for fish movement; maintaining macroinvertebrate populations; reducing encroachment of terrestrial vegetation in-stream; and enhancing river red gum recruitment.

To achieve these objectives, environmental watering will focus, in priority order, on: a spring fresh in reach 2; summer/autumn low flows and freshes in reach 4; winter/spring low flows and remaining freshes in reach 2; and winter/spring low flows and freshes in reach 4.

The priority river reaches for environmental watering are reaches 2 and 4. Reach 3 will also benefit from environmental water releases if these are made from Lake Eppalock rather than the Campaspe Siphon.

Table 9.15.1 Water Holdings available for use in the Campaspe system

Entitlement	Description
Victorian Water Holdings	
River Murray Environmental Water Savings Supply Deed ¹	One-third of water savings created in the Murray system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Goulburn Environmental Water Savings Supply Deed ¹	One-third of water savings created in the Goulburn system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Bulk Entitlement (River Murray Flora and Fauna) Conversion Order 1999 ²	27,600 ML high-reliability entitlement
Environment Entitlement (Campaspe River – Living Murray Initiative) 2007 ³	126 ML high-reliability entitlement
	5,048 ML low-reliability entitlement
Other Water Holdings	
Commonwealth Environmental Water Holdings ⁴	6,409 ML Campaspe high-reliability water share
	395 ML Campaspe low-reliability water share
	30 ML Coliban high-reliability water share
Bulk Entitlement (Campaspe System – Goulburn-Murray Water)	The bulk entitlement provides for passing flows in the Campaspe River to be varied, if agreed with Goulburn Murray Water; this may be done in order to better provide the priority watering actions.

1. Sourced from the Goulburn and Murray systems but can be transferred for use in the Campaspe system, subject to trading rules. Volumes determined and allocated after audit of water savings in September each year. The long-term average audited saving for the environment from 2011 are: Murray 4,533 ML; and Goulburn 24,375 ML.

2. Sourced from the Murray system but can be transferred for use in the Campaspe system, subject to trading rules.

3. Water allocated to this entitlement must be used for Living Murray 'icon sites'. However, this water must be released from the Campaspe system, providing environmental benefits to the Campaspe River en route.

4. Commonwealth Environmental Water are responsible for decisions about the use of their Water Holdings. The VEWI will submit proposals for the use of Commonwealth environmental water for Victoria's priority rivers and wetlands. Water in the Coliban can only be used in the Coliban system. Current as at 31 May 2012. Does not include Commonwealth Environmental Water Holdings in other systems/States which may be able to be transferred for use in the Campaspe system, subject to trading rules.

System overview

The priority river reaches for environmental watering are reach 2 (Lake Eppalock to the Campaspe Weir) and reach 4 (Campaspe Siphon to the River Murray confluence), as these are the most influenced by water releases. Reaches 2 to 4 have important Murray cod populations, in-stream habitat for fish, and a highly-connected, intact river red gum canopy along its banks. The measurement points for target flows are at Barnadown in reach 2 and Echuca in reach 4. Reach 3 will also benefit from environmental water releases if these are made from Lake Eppalock rather than the Campaspe Siphon. The environmental flow reaches are shown in Figure 9.15.1.

Water Holdings held in the Campaspe system can be delivered from two locations: Lake Eppalock and the Campaspe Siphon. In addition, water can be transferred from the Goulburn system through the Waranga Western Channel to the Campaspe Siphon, or traded into the Campaspe from other systems.

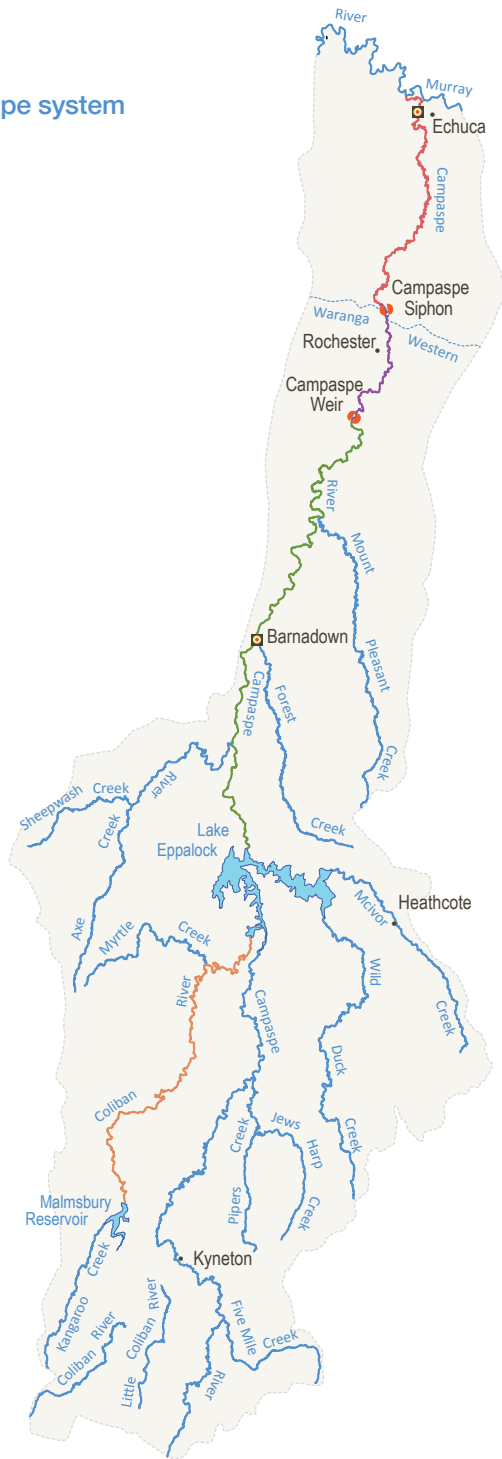
In addition to the Water Holdings, passing flows are provided under Goulburn-Murray Water's bulk entitlement and consumptive water is delivered down the Campaspe to meet consumptive users' needs (reaches 1 to 4). There are also opportunities to provide environmental benefit from consumptive water from the Goulburn through the lower Campaspe (reach 4) en route to meeting irrigation needs in the River Murray. This requires agreement with Goulburn-Murray Water and the Murray-Darling Basin Authority. Water can also be traded from other systems into the Campaspe, subject to trading rules.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

9.15

Campaspe system (including Coliban River)

Figure 9.15.1 The Campaspe system



Symbol	Description
	Reach 1 - Coliban River: Malmesbury Reservoir to Lake Eppalock
	Reach 2 - Campaspe River: Lake Eppalock to Campaspe Weir
	Reach 3 - Campaspe River: Campaspe Weir to Campaspe Siphon
	Reach 4 - Campaspe River: Campaspe Siphon to River Murray
	Measurement point
	Water infrastructure
	Town

Current situation

Following an extended drought, the Campaspe system received above-average rainfall in 2010-11 and 2011-12. This has resulted in the majority of in-stream flow requirements being met for the last two years. Summer baseflows have exceeded the recommendations for the last few years and cease to flows have not occurred due to releases for irrigation purposes and unregulated flows. Sustained higher flows during summer have the potential to negatively impact on bank stability and in-stream vegetation, and can wash juvenile fish out of their preferred slackwater habitat.

The floods reset the river system, scouring the river channel and removing the extensive reed beds (cumbungi and phragmites) that had proliferated during the drought. The system is starting to recover with improved water quality, though long-term environmental benefits will take a few years to be observed.

Environmental objectives

The focus for the Campaspe system for 2012-13 is to build the environmental resilience in the system. The priority environmental objectives in the Campaspe system for 2012-13 are: maintaining pool habitat and water quality for fish populations; improving the potential for fish movement; maintaining macroinvertebrate populations; reducing encroachment of terrestrial vegetation in-stream; and enhancing river red gum recruitment.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 in the Campaspe system, in priority order, are as follows:

- spring fresh in reach 2 (1,000-1,200 ML per day for four days during September to November)
- summer/autumn low flows in reach 4 (10-20 ML per day from December to May)
- summer/autumn freshes in reach 4 (three freshes of 100 ML per day for six days each during February to May)
- winter/spring low flows in reach 2 (100-125 ML per day from June to November)
- remaining winter/spring freshes in reach 2 (three events of 1,000-1,200 ML per day for four days each during June to November)

- winter/spring low flows in reach 4 (200 ML per day from June to November)
- winter/spring freshes in reach 4 (two events of 1,500 ML for four days each during June to November).

Winter/spring bankfull flows are also an important flow component in the Campaspe system, aiding in deepening pools, changing channel form, removing organic matter and watering remnant riparian vegetation. However, it is not possible to actively provide these flows due to capacity constraints at Lake Eppalock. In addition there would not be sufficient water to meet the other priority watering actions. As such, winter/spring bankfull flows will not be sought using the environmental entitlement, but may occur naturally.

Table 9.15.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.15.2 illustrates the priority watering actions for 2012-13.

The VEWB also coordinates the delivery of Living Murray and Commonwealth environmental water and authorises waterway managers to implement watering actions for downstream sites, provided there are no adverse impacts on the Campaspe system. The VEWB will liaise with the Murray-Darling Basin Authority and Commonwealth Environmental Water to maximise the environmental benefits of this water delivery in the Campaspe system.

Winter/spring bankfull flows are also an important flow component in the Campaspe system, aiding in deepening pools, changing channel form, removing organic matter and watering remnant riparian vegetation. However, it is not possible to actively provide these flows due to capacity constraints at Lake Eppalock. In addition there would not be sufficient water to meet the other priority watering actions. As such, winter/spring bankfull flows will not be sought using the environmental entitlement, but may occur naturally.

Table 9.15.2 outlines the environmental objectives and priority watering actions under a range of planning scenarios. Figure 9.15.2 illustrates the priority watering actions for 2012-13.

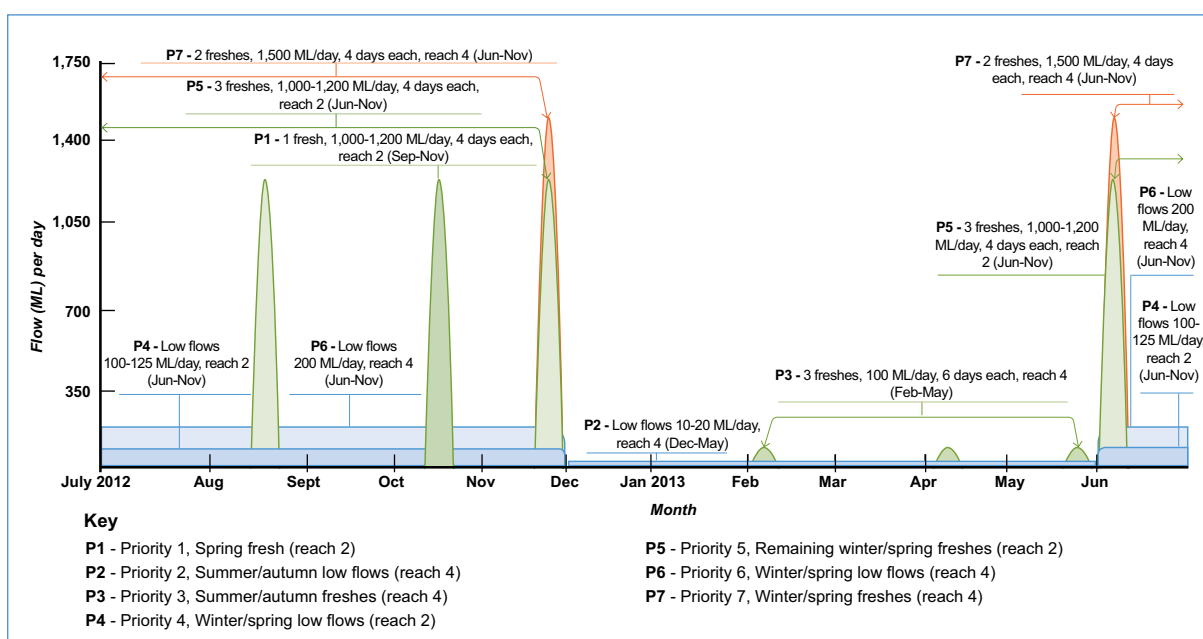
Table 9.15.2 Priority watering actions in the Campaspe system under a range of planning scenarios in the Campaspe system

	Planning scenario		
	Drought	Dry	Average/wet
Expected availability of Water Holdings¹	126 ML Living Murray Water Holdings 6,366 ML Commonwealth Water Holdings	5,211 ML Living Murray Water Holdings 6,761 ML Commonwealth Water Holdings	5,211 ML Living Murray Water Holdings 6,761 ML Commonwealth Water Holdings
Environmental objectives	Reduce encroachment of exotic and terrestrial vegetation Enhance river red gum recruitment Stimulate fish movement and allow movement downstream Mix and flush pools for water quality and macroinvertebrate diversity Respond to blackwater events as required Flush organic material from the system to reduce risk of blackwater events in summer	Reduce encroachment of exotic and terrestrial vegetation Enhance river red gum recruitment Stimulate fish movement and allow movement downstream Mix and flush pools for water quality and macroinvertebrate diversity Respond to blackwater events as required Flush organic material from the system to reduce risk of blackwater events in summer Provide suitable riffle habitat for macroinvertebrates	Reduce encroachment of exotic and terrestrial vegetation Enhance river red gum recruitment Stimulate fish movement and allow movement downstream Mix and flush pools for water quality and macroinvertebrate diversity Respond to blackwater events as required Flush organic material from the system to reduce risk of blackwater events in summer Provide suitable riffle habitat for macroinvertebrates
Priority watering actions²	Spring fresh (reach 2) Summer low flows (reach 4) Summer freshes (reach 4)	Spring fresh (reach 2) Summer low flows (reach 4) Summer freshes (reach 4) Winter low flows (reach 2)	Spring fresh (reach 2) Summer low flows (reach 4) Summer freshes (reach 4) Winter/ low flows (reach 2) Winter/spring freshes (reach 2) Winter/spring low flows (reach 4) Winter/spring freshes (reach 4)

Planning scenario			
	Drought	Dry	Average/wet
Possible volume required from the Water Holdings ³	6,300 ML	11,300 ML	11,300 ML
Possible carryover into 2013-14 ³	N/A	N/A	N/A

1. Does not include water available in the Goulburn and Murray systems, which could be traded into the system if required, subject to trading rules.
2. Additional flow components provide a greater certainty to meeting the environmental objectives and/or provide a longer period of time in which the objectives are being met.
3. Assumes consumptive water en route can be accessed under all scenarios to supplement summer baseflows and freshes, reducing the volume required from the Water Holdings by an estimated 3,800 ML. Also assumes unregulated flows will occur if the conditions become wetter, meeting some of the priority watering actions naturally.
4. Decisions to carry over will be driven by the environmental water demands of Commonwealth Environmental Water and the Living Murray icon sites in 2012-13.

Figure 9.15.2 Priority watering actions in the Campaspe system¹



1. This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Campaspe system. North Central Catchment Management Authority will monitor catchment conditions, likely seasonal forecasts, water availability, likelihood of storage spills, and water quality, to determine the best time to make releases to deliver priority watering action efficiently and with maximum environmental benefit. Depending on water availability the preference is always to deliver water from the uppermost release point to provide benefits for reaches 2 through to 4.

Summer flows may be able to be supplied by using consumptive water en route from Lake Eppalock or from the Goulburn system to the Murray system.

Consumptive releases can be made from the Goulburn system through the Western Waranga Channel to the Campaspe Siphon, continuing on to water reach 4. The North Central Catchment Management Authority will work with Goulburn-Murray Water and the Murray-Darling Basin Authority to maximise benefits from these consumptive releases where possible. Where these arrangements occur, any associated losses will be deducted from the environmental water account.

To manage water quality risks, summer freshes will not be delivered unless the winter/spring freshes have occurred to flush organic load (such as dead leaves and grasses from the benches in the river), and there is sufficient water to follow up the summer/autumn freshes with managed low flows to dilute and aerate the water to reduce dissolved oxygen levels.

Summary of planned environmental water use in 2011-12 in the Coliban River

The Coliban River is in the upper catchment of the Campaspe system. The priority river reach is reach 1 between Malmsbury Reservoir and Lake Eppalock. The primary environmental objective in reach 1 is to provide suitable habitat for small native fish, platypus and water rats. The highest risk period to maintain suitable habitat is during summer.

The priority watering actions are:

- Summer/autumn low flows to maintain water quality. While a flow target of up to 5 ML per day from January to April would be preferred, a reduced flow may be provided due to insufficient water. Flows may also be pulsed depending on water availability
- Summer fresh of 100 ML per day for three days during December to February if sufficient water is available.

There are provisions in Coliban Water's bulk entitlement for passing flows to be banked to release at a later time. The amount to be banked up will depend on seasonal conditions; the wetter it is during the winter months, the more can be stored for summer. If the storage spills, the banked passing flows are the first to spill to ensure no other entitlement holders are impacted.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise North Central Catchment Management Authority to implement these decisions.

Priority watering actions in the Campaspe system will be undertaken by the North Central Catchment Management Authority in accordance with seasonal watering statements and any agreements with other water holders, and in consultation with Goulburn-Murray Water. They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by the North Central Catchment Management Authority through media releases and website updates.

Risk assessment and management

In the Campaspe system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.15.3 summarises the medium and high risks, and mitigating strategies identified by the North Central Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (ie. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed. The costs of mitigating strategies will be considered in light of funding availability.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

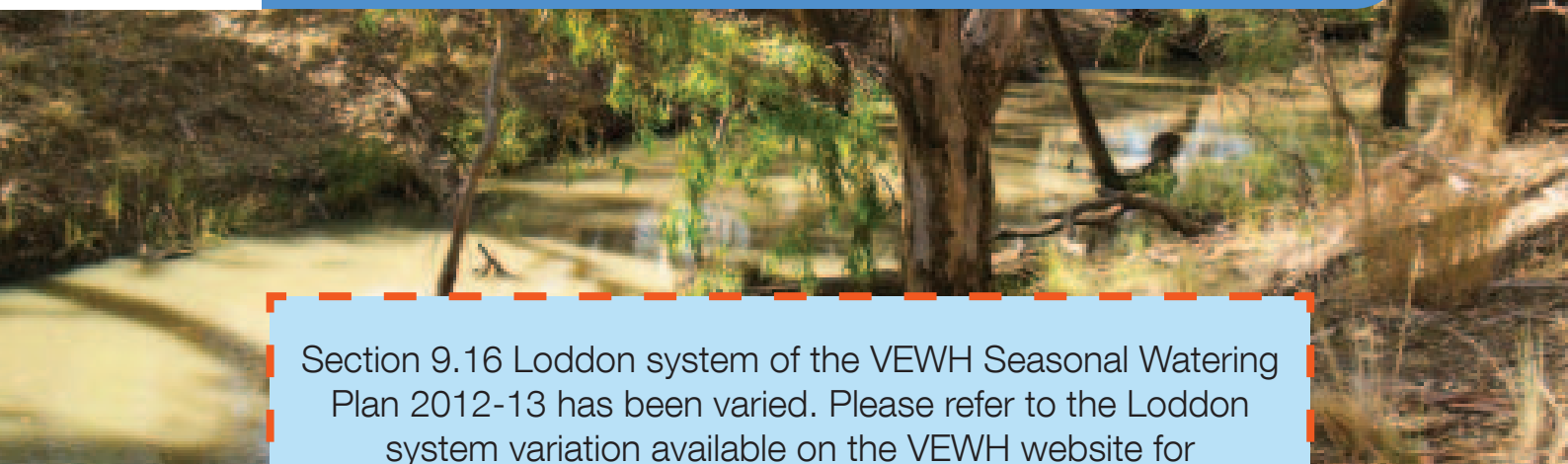
Key stakeholders and community members with an interest in the Campaspe system were consulted in the development of the seasonal watering proposal. In particular, this included the Campaspe Environmental Watering Advisory Group, consisting of landholders, community members, regional representatives of Victorian government departments and Goulburn-Murray Water. The North Central Catchment Management Authority Natural Resource Committee was also engaged to provide a community and local perspective.

Further information

More detailed information can be sought from the North Central Catchment Management Authority (see section 10).

Table 9.15.3 Risk management in the Campaspe system

Risk type	Mitigating strategies
Storage operator maintenance works affect ability to deliver water	Ongoing dialogue with Goulburn-Murray Water regarding maintenance schedule, to assist in timing releases when there is available capacity to meet desired flow rates
Storage operator cannot deliver required volume or flow rate (outlet/capacity constraints, insufficient storage volume)	Ongoing dialogue with Goulburn-Murray Water regarding consumptive demand in the system, to assist in timing releases when there is available capacity to meet desired flow rates
Limited catchment management authority resources to deliver environmental release	Ongoing dialogue between the North Central Catchment Management Authority, VEWH and Department of Sustainability and Environment regarding available resources and work demands
Environmental release cause personal injury to river users	Release no more than the maximum regulated release volume of 1,500 ML a day, which is within normal system operations Engage the community and undertake local media prior to releases
Environmental releases causes flooding of private land	Release no more than the maximum regulated release volume of 1,500 ML a day, which is within normal system operations
Environmental release cause flooding to public infrastructure	Ensure on-ground monitoring of water levels is undertaken for every high flow event
Environmental releases causes flooding of Crown land	Work closely with storage manager and cease regulated release if high catchment runoff flows are predicted Engage the community and undertake local media prior to releases so people are aware of releases
Current recommendations on environmental flow inaccurate	Undertake ongoing ecological monitoring of releases to assist in refining flow recommendations over time Use annual operation monitoring to inform annual priority flow components
Unable to provide evidence in meeting ecological objective	Undertake ongoing ecological monitoring of releases to assist in refining flow recommendations over time Use monitoring data to strengthen the link between flow components and environmental objectives
Releases cause water quality issues (eg. blackwater, low dissolved oxygen, mobilisation of saline pools, acid-sulphate soils etc)	Summer freshes not to be delivered unless high winter flows have been provided to flush organic load from the river Summer freshes not to be delivered unless there is sufficient water available to follow up the fresh and overcome the reduced dissolved oxygen levels through dilution and aeration from flow
Improved conditions for exotic species (eg. carp)	There is currently no strategy to mitigate this risk other than the implementation of the full environmental flow regime to provide a competitive advantage to native species
Key stakeholders not supportive of environmental water release	Engage the community in the development of seasonal watering proposals. Undertake local media prior to releases



Loddon R

Section 9.16 Loddon system of the VEWL Seasonal Watering Plan 2012-13 has been varied. Please refer to the Loddon system variation available on the VEWL website for the most up-to-date version - www.vewl.vic.gov.au

Waterway manager – North Central Catchment Management Authority

The Loddon system is located in north-central Victoria. The Loddon River is home to native fish species such as the river blackfish, Murray cod, golden perch and silver perch, and supports an active tourism industry due to its intact forests and high-value vegetation. Also part of the Loddon system is the smaller Bullarook system (including Birch Creek) which has its own entitlement, and Pyramid Creek. Planned environmental water use for these creeks is discussed on page 149 and 150.

Summary of planned environmental water use in 2012-13

The priority environmental objectives in the Loddon system for 2012-13 are: maintaining channel form; maintaining in-stream and riparian vegetation; reducing encroachment of terrestrial vegetation; and maintaining water quality.

To achieve these objectives, environmental watering will focus, in priority order, on: autumn/winter/spring low flows; a spring fresh; carryover for winter/spring low flows and spring freshes for 2013; and summer freshes. The priority river reach for environmental water management is reach 4 from Loddon Weir to Kerang Weir, as it has the largest water demands. Reaches 1 to 3 and reach 5 benefit from the flows being passed from the upper storages to Loddon Weir, and also from Kerang Weir to the River Murray.

Table 9.16.1 Water Holdings available for use in the Loddon system

Entitlement	Description
Victorian Water Holdings	
Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005	2,024 ML low-reliability entitlement 7,490 ML high-reliability entitlement for use below Loddon Weir Passing flows, including ability to withhold passing flows for release at a later time Access to surplus flows (flows which cannot be captured in storage and pass downstream)
Goulburn River Environmental Entitlement 2010	1,432 ML high-reliability entitlement for use in the Loddon system
Bulk Entitlement (River Murray Flora & Fauna) Conversion Order 1999 ¹	27,600 ML high-reliability entitlement
River Murray Environmental Water Savings Supply Deed ²	One-third of water savings created in the Murray system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Goulburn Environmental Water Savings Supply Deed ²	One-third of water savings created in the Goulburn system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Environmental Entitlement (Birch Creek – Bullarook System) 2009	100 ML entitlement (fully available when allocations for Bullarook high-reliability water shares are at 20%) ³ Passing flows Above cap water (ie. all water not allocated to other entitlement holders)
Other Water Holdings	
Commonwealth Environmental Water Holdings ⁴	2,746 ML Loddon high-reliability water share 527 ML Loddon low-reliability water share

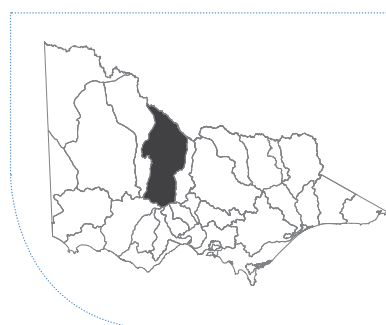
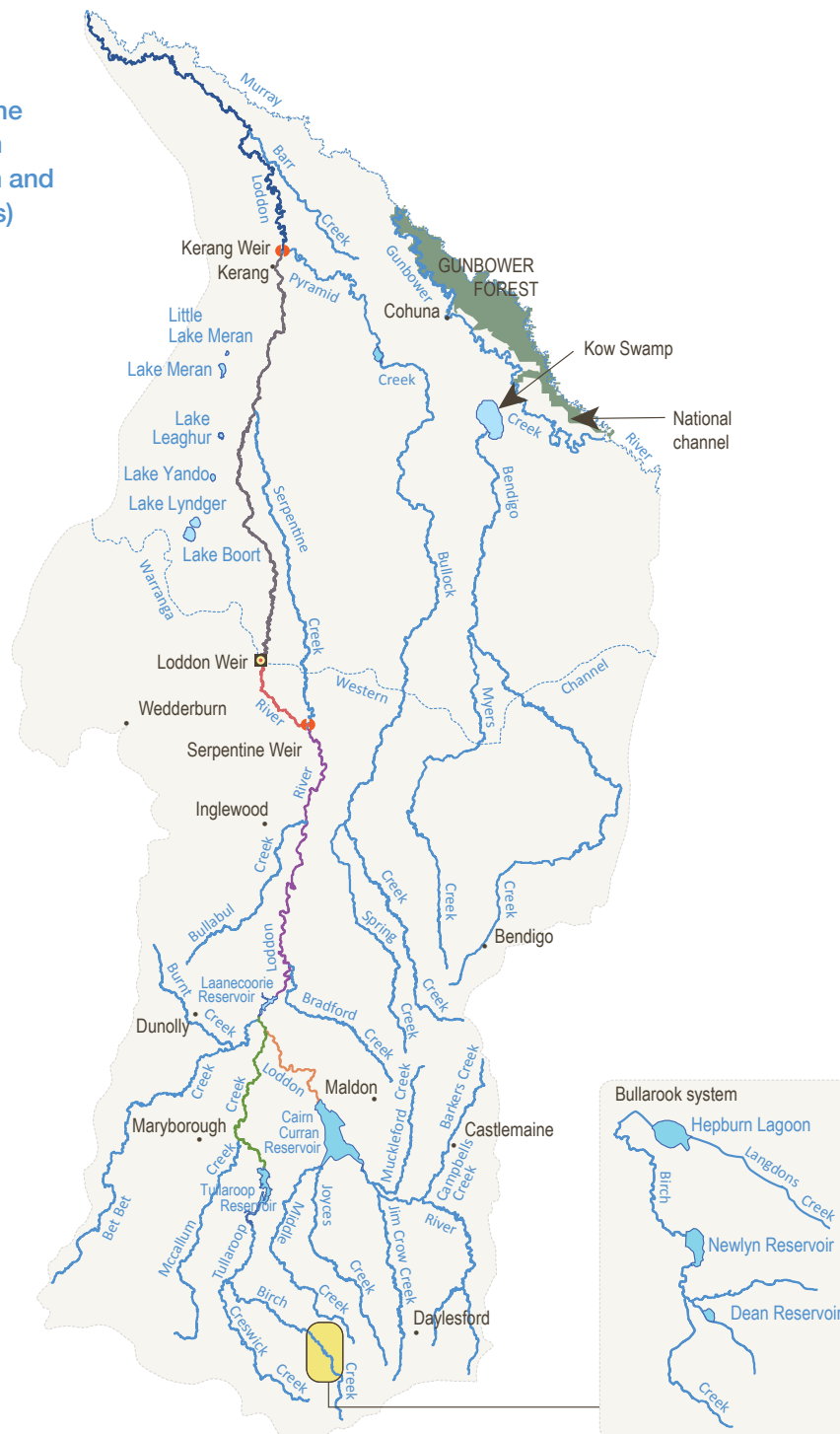
1. Sourced from the Murray system but can be transferred for use in the Loddon system, subject to trading rules.

2. Sourced from the Goulburn and Murray systems but can be transferred for use in the Loddon system, subject to trading rules. Actual volumes determined and allocated after audit of water savings in September each year. The long-term average audited saving for the environment from 2011 are: Murray 4,533 ML; and Goulburn 24,375 ML.

3. Available from December of any year to November of the following year.

4. Decisions about the use of Commonwealth Water Holdings are the responsibility of Commonwealth Environmental Water. The VEWH will submit proposals for the use of Commonwealth environmental water for Victoria's priority rivers and wetlands. Current as at 31 May 2012. Does not include Commonwealth Environmental Water Holdings in other systems/States which may be able to be transferred for us in the Loddon system, subject to trading rules.

Figure 9.16.1 The Loddon system (including Birch and Pyramid Creeks)



Symbol	Description
	Reach 1 - Loddon River - Cairn Curran Reservoir to Laanecoorie Reservoir
	Reach 2 - Tullaroop Creek - Tullaroop reservoir to Laanecoorie Reservoir
	Reach 3a - Loddon River - Laanecoorie Reservoir to Serpentine Weir
	Reach 3b - Loddon River - Serpentine Weir to Loddon Weir
	Reach 4 - Loddon River - Loddon Weir to Kerang Weir
	Reach 5 - Loddon River - Kerang Weir to River Murray
	Measurement point
	Water infrastructure
	Town

System overview

The priority river reach for environmental watering is reach 4 (Loddon Weir to Kerang Weir) as it has been most affected by river regulation; in particular, its in-stream and riparian vegetation has been impacted. Reach 1 (between Cairn Curran and Lannecoorie), reach 2 (between Tullaroop and Lannecoorie) and reach 3 (between Lannecoorie and Loddon Weir) benefit from flows being passed to the lower reaches, providing habitat for macroinvertebrates and native fish such as blackfish. Reach 5 (downstream of Kerang Weir) will benefit from water provided to reach 4, in particular providing fish movement from reach 5 through the Kerang fishway upstream to reach 4. The measurement point for target flows is downstream of Loddon Weir. Environmental water releases from Tullaroop or Cairn Curran Reservoirs also benefit reaches 1 and 2, while releases from Lannecoorie will only benefit reach 3 and beyond. The environmental flow reaches are shown in Figure 9.16.1.

Water Holdings in the Loddon system are released from Cairn Curran, Tullaroop and Lannecoorie reservoirs. Water in the Goulburn system can be delivered through the Waranga Western Channel to the Loddon Weir. Water can also be traded from other systems into the Loddon, subject to trading rules.

In addition to the Water Holdings, passing flows are provided under Goulburn-Murray Water's bulk entitlement, and consumptive water is delivered down the Loddon River to meet downstream irrigation needs. Environmental water releases will be combined with passing flows, consumptive water and unregulated flows to maximise environmental outcomes.

Current situation

Following 10 years of drought, the Loddon system received above-average rainfall over spring and summer 2010-11. Flows during 2011-12 were close to average for the region. The flows over the last two years started the recovery of the Loddon system, removing terrestrial plants such as river red gum saplings from the middle of the channel, improving water quality and providing good habitat for macroinvertebrates and fish.

Summer flows were reinstated in 2011-12, which had previously been ceased to prevent further terrestrial growth in the channel. As a result of 2011-12 flows, there were also opportunities for fish migration from the River Murray through reach 5 of the Loddon up the fish ladder at Kerang Weir into reach 4 of the Loddon as well as Pyramid Creek.

Environmental objectives

The overarching environmental objective for the Loddon system is to continue building the resilience in the system from the last two years, with a focus on improving the condition in reach 4. Therefore, the focus will be on: maintaining channel form; maintaining in-stream and riparian vegetation; reducing encroachment of terrestrial vegetation; and maintaining water quality.

Priority watering actions

To achieve the environmental objectives detailed in the previous section, the priority watering actions to be undertaken during 2012-13 and considered for 2013-14 for reach 4 of the Loddon system, in priority order, are as follows:

- autumn/winter/spring low flows (100 ML per day from May to October)
- spring fresh (up to 750 ML per day for 6-10 days during September to November)
- carryover for winter/spring low flows in 2013-14 (100 ML per day from July to October 2013)
- carryover for spring fresh in 2013-14 (up to 750 ML per day for 6-10 days during September to November 2013)
- summer freshes (two freshes of 100 ML per day for 10-14 days each during December to February).

Environmental flow requirements were determined for bankfull flows in reach 4 of the Loddon River; these were provided naturally in 2010-11 and are not a priority in the next two to three years.

Table 9.16.2 outlines the priority objectives and watering actions under a range of planning scenarios. Figure 9.16.2 illustrates the priority watering actions for 2012-13.

The VEWH also coordinates the delivery of Commonwealth environmental water and authorises waterway managers to implement

watering actions for downstream sites, provided there are no adverse impacts on the Loddon system.

The VEWH will liaise with Commonwealth Environmental Water to maximise the environmental benefits of this water delivery in the Loddon system

Table 9.16.2 Priority watering actions in the Loddon system under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet
Expected availability of Water Holdings¹	9,461 ML Victorian Water Holdings 820 ML Commonwealth Environmental Water Holdings	9,991 ML Victorian Water Holdings 1,619 ML Commonwealth Environmental Water Holdings	10,349 ML Victorian Water Holdings 2,159 ML Commonwealth Environmental Water Holdings	10,349 ML Victorian Water Holdings 2,159 ML Commonwealth Environmental Water Holdings
Environmental objectives	Maintain channel form Maintain in-stream and riparian vegetation Reduce encroachment of terrestrial vegetation Maintain water quality	Maintain channel form Maintain in-stream and riparian vegetation Reduce encroachment of terrestrial vegetation Maintain water quality	Maintain channel form Maintain in-stream and riparian vegetation Reduce encroachment of terrestrial vegetation Maintain water quality Sediment flushing in pool to allow for fish habitat	Maintain channel form Maintain in-stream and riparian vegetation Reduce encroachment of terrestrial vegetation Maintain water quality Sediment flushing in pool to allow for fish habitat
Priority watering actions	Autumn/winter/spring low flows Spring fresh Winter low flows (2013-14)	Autumn/winter/spring low flows Spring fresh Winter low flows (2013-14)	Autumn/winter/spring low flows Spring fresh Winter/spring low flows (2013-14) Spring fresh (2013-14) Summer freshes	Autumn/winter/spring low flows Spring fresh Winter/spring low flows (2013-14) Spring fresh (2013-14) Summer freshes
Possible volume required from the Water Holdings^{2,3}	10,418 ML	10,418 ML	11,498 ML	11,498 ML
Possible carryover into 2013/14⁴	392 ML	1,721 ML	1,539 ML	1,539 ML

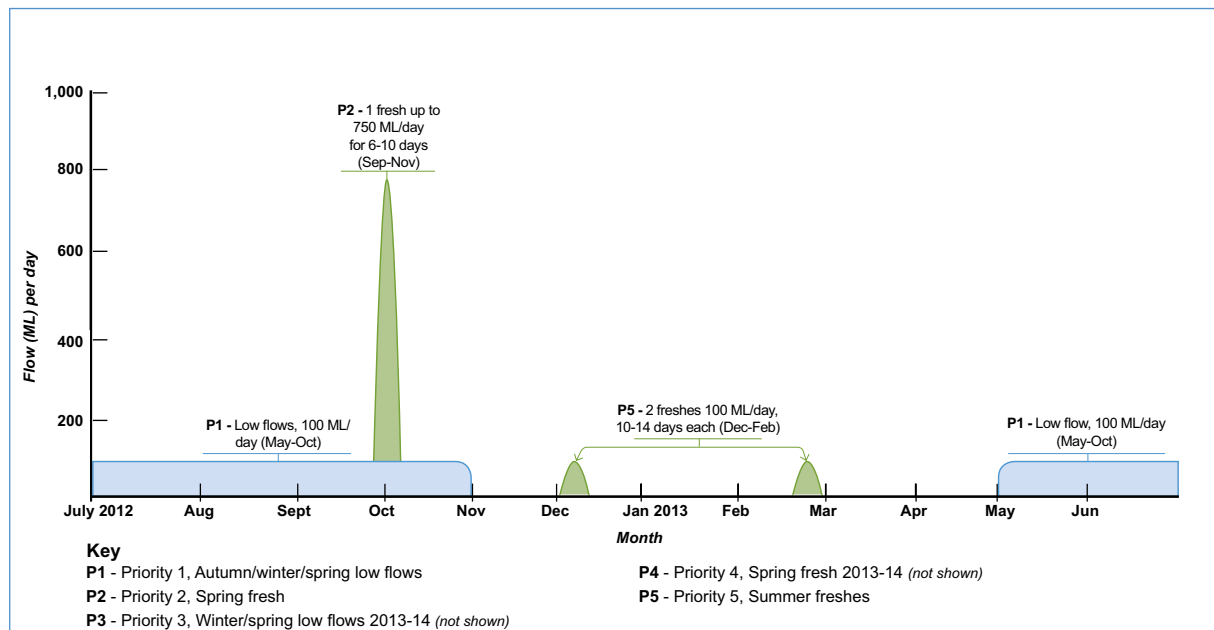
1. Does not include water available in the Goulburn and Murray systems, which could be traded into the system if required, subject to trading rules.

2. Assumes passing flows are provided, but no unregulated flows occur, therefore volumes are upper limits.

3. This does not include the water required for priority watering actions identified for 2013-14.

4. Decisions to carry over will depend on other Victorian and Commonwealth Environmental Water priorities in 2012-13.

Figure 9.16.2 Priority watering actions in the Loddon system¹



¹ This figure is for illustrative purposes only. Scheduling and delivery of particular watering actions within the stated timeframes will vary.

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the Loddon system. North Central Catchment Management Authority will monitor catchment conditions, likely seasonal forecasts, water availability, the likelihood of storage spills and water quality to determine the best time to make releases to provide priority watering actions efficiently and with maximum environmental benefit.

Summer passing flows are currently specified under the Loddon River bulk entitlement. It has been proposed that the entitlement be amended to allow summer passing flows to be withheld in drier times to meet higher priority flow components.

Summary of planned environmental watering in Birch Creek

The Bullarook system is a tributary of the Loddon River and includes Birch Creek which rises on the northern slopes of the Great Dividing Range. The area is highly developed from mining which continued after the gold rush and from broad acre agriculture and dairy farming. However, Birch Creek still supports some significant environmental values, including important habitat for the regionally endangered river blackfish.

The environmental flow reaches in the Bullarook system are shown in Figure 9.16.1. The associated entitlement includes passing flow requirements for each of the reaches. The 100 ML that can be actively managed can be released from Newlyn Reservoir or Hepburn Lagoon and provided to all reaches. The water cannot be carried over.

The environmental objectives in 2012-13 are to: maintain river blackfish populations; flush sediments; allow fish movement; reinstate in-stream and riparian vegetation diversity; and minimise low dissolved oxygen risks.

To achieve these environmental objectives, the priority watering actions to be targeted during 2012-13 for reach 3 of the Bullarook system, in priority order, are as follows:

- summer low flows (8 ML per day from December to May)
- winter low flows (20ML/day per day from June to November)
- summer freshes (four freshes of 15 ML per day for three days each between December and May).

There is insufficient water to meet all priority flow components, particularly winter low flows.



Birch Creek downstream of Lawrence Weir, North Central Catchment Management Authority

Summary of planned environmental watering in Pyramid Creek

Pyramid Creek is a tributary of the Loddon River in north-central Victoria. It connects the Loddon River to the Gunbower Creek via Kow Swamp and Taylors Creek.

Water from the River Murray can enter Pyramid Creek via the National Channel (upstream of Torrumbarry Weir), Taylors Creek, Kow Swamp and Box Creek. Pyramid Creek then flows into the Loddon River immediately upstream of Kerang Weir. The metering point is at the Box Creek regulator. The creek delivers irrigation and consumptive water from the River Murray to the Kerang Weir. Pyramid Creek is shown in Figure 9.16.1.

Pyramid Creek is considered important for native fish including golden perch, silver perch, bony herring and Murray cod, with species using the Kerang Weir fishway to migrate upstream from the River Murray during high flow events.

The environmental objective for the creek is to maintain and improve the health of resident native fish populations by increasing access to habitat and food resources. During 2012-13, flows will be targeted to increase food production for resident native fish and those migrating into the system.

To achieve this environmental objective, the priority watering action for the Pyramid Creek system is: one to two spring freshes (1,000 ML per day for seven days in late September and early October). It is intended that this would be provided under average and wet conditions.

Coordinating Pyramid Creek freshes with a spring fresh in the Loddon River will provide additional opportunities for fish movement.

Consumptive water en route would be used to meet the flow components, with any additional loss from delivering through the Creek to be met with environmental water. It is estimated that approximately 1,000-3,000 ML of environmental water would be required to cover losses.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise North Central Catchment Management Authority to implement these decisions.

Priority watering actions in the Loddon system will be undertaken by the North Central Catchment Management Authority in accordance with seasonal watering statements and any agreements with other water holders, and in consultation with Goulburn-Murray Water. They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by the North Central Catchment Management Authority through media releases and website updates.

Risk assessment and management

In the Loddon system, a number of risks have been assessed, and mitigating strategies identified, relating to the implementation of priority watering actions. Table 9.16.3 summarises the medium and high risks, and the mitigating strategies identified by the North Central Catchment Management Authority.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Table 9.16.3 Risk management in the Loddon system

Risk type	Mitigating strategies
Release volume is insufficient in meeting required flow at target point	Monitor and observe flow and recommend increasing rate if delivered flow is inadequate
Storage operator maintenance works affect ability to deliver water	Coordinate with Goulburn-Murray Water to ensure timing of flow delivery does not coincide with maintenance works
Storage operators cannot deliver required volume or flow rate (ie. outlet/capacity constraints, insufficient storage volume)	Ongoing consultation with Goulburn-Murray Water throughout the year regarding system constraints and timing of releases
Environmental water account is overdrawn	Close monitoring of water usage through Goulburn-Murray Water reports
Environmental release cause injury to river users	Keep community well informed and advise to minimise access to river during flow Ensure staff are accompanied and follow field work occupational health and safety procedures
Environmental releases causes flooding of private land	Monitor flows and limit to approximately 650 ML/day when being actively delivered Keep landholders informed
Environmental release cause flooding to public infrastructure	Monitor flows in the Loddon River and limit to approximately 650 ML/day when being actively delivered
Current recommendations on environmental flows are inaccurate	Monitor conditions before during and after flow delivery, including long-term monitoring via VEFMAP Revisit flow recommendations if evidence indicates objectives not being met
Unable to provide evidence in meeting ecological objective	Implement VEFMAP monitoring and review in the long term
Releases cause water quality issues (eg. black water, low dissolved oxygen, mobilisation of saline pools, acid sulphate soils etc)	Avoid releases of low flow rates in summer Ensure spring flow is preceded by winter low flow
Improved conditions for non-native species (eg. carp)	Mitigation difficult; uncertain how to control carp in reach 4

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Key stakeholders and community members with an interest in the Loddon River were consulted in the development of the seasonal watering proposal for the Loddon River. The Loddon Environmental Watering Advisory Group is the key consultation mechanism for environmental water planning in the Loddon system. It consists of landholders, community members, regional Victorian Government departments and Goulburn-Murray Water.

Further information

More detailed information can be sought from the North Central Catchment Management Authority (see section 10).



Twelve Mile Frosts Road, Loddon River, North Central Catchment Management Authority



Richardson's Lagoon, North Central Catchment Management Authority

Waterway manager – Goulburn Broken Catchment Management Authority, North Central Catchment Management Authority and Mallee Catchment Management Authority

The northern Victorian wetlands and floodplains are made up of the Living Murray icon sites (see section 9.18) and over 50 regional wetlands covering the Mallee, North Central, and Goulburn Broken catchment management authority boundaries. The system contains individual wetlands that are part of the Kerang Wetlands Ramsar Site, recognised as wetlands of international importance, as well as a number of nationally and regionally significant sites. The system provides a wide range of habitat types that support rare and threatened waterbird species including the painted snipe, brolga, royal spoonbill and white-bellied sea eagle. In addition, they support a variety of recreational activities and Indigenous cultural heritage values.

Summary of planned environmental water use in 2012-13

The overall environmental objective for the northern wetlands and floodplain system is to protect and improve the health of the individual wetlands. A key focus of environmental water management is to improve the diversity of vegetation and opportunities for use of the sites by a range of species including waterbirds, fish and turtles. This will occur by providing environmental water to up to 13 wetlands, and allowing others to dry, returning a more natural watering regime to these systems.

To achieve these objectives, the systems which may require environmental water in 2012-13 include: Black Swamp, Kinnaids Swamp, Moodies Swamp and Reedy Swamp in the Goulburn Broken wetlands; Round Lake, McDonald Swamp, Richardson's Lagoon and Hird Swamp in the North Central wetlands; and Cardross Lakes Basin 1, Lake Koorlong, Robertson Wetland east and west, Narrung wetlands and Sandilong Creek in the Mallee wetlands. Other wetlands system, including Lake Boort, Lake Yando, Lake Leaghur and Lake Meran, in the North Central region, are sufficiently full or currently entering a drying phase. The threat of irreversible damage to vegetation communities from prolonged inundation is considered significant at Doctors Swamp, part of the Goulburn Broken region; an active drying phase is recommended for this wetland.

System overview

The northern Victorian wetlands and floodplains form part of the southern-connected Murray-Darling Basin. This is highly regulated and can deliver water from a number of storages including: Lake Victoria, and Hume and Dartmouth reservoirs on the River Murray system; Lake Eildon on the Goulburn River; Lake Eppalock on the Campaspe River; Cairn Curran and Tullaroop reservoirs in the Loddon system; and the mid-Murray storages including Kow Swamp near Kerang.

The Northern wetlands and floodplain system include wetland complexes in the following regions: Goulburn Broken, North Central and Mallee (see Figure 9.17.1).

The Goulburn Broken wetlands consist of nine wetlands that can currently be managed with environmental water between Yarrawonga, Benalla, Murchison and Echuca. They contain vegetation communities ranging from river red gum dominated swamps to cane-grass wetlands. Provision of environmental water to these wetlands relies on irrigation infrastructure within the Shepparton, Central Goulburn and Murray Valley Irrigation Districts.

Wetlands within the North Central region include wetlands between Echuca and Swan Hill and wetlands which are part of the Boort complex, between Boort and Kerang on the Loddon River floodplain. The region includes three wetlands of the Kerang Wetlands Ramsar Site. The wetland types range from naturally saline environments to freshwater marshes. There are currently 13 wetlands that can be managed with environmental water in the Torrumbarry and Pyramid-Boort irrigation districts. The delivery of water relies heavily on infrastructure and channel operations within both irrigation districts.

Wetlands and waterways in the Mallee region of this system also contain a range of habitats, including saline wetlands and freshwater marsh environments. Environmental water delivery can currently occur at a total of 32 sites within the system from Nyah to the South Australian border, relying on a combination of irrigation infrastructure and pumping directly from river systems to actively water the sites. Also see section 9.12 for information on Mallee wetlands that are part of the Wimmera-Mallee system.

The Ovens and Kiewa systems are also included in the northern wetlands and floodplains; however they currently contain no wetlands or floodplains which can receive regulated environmental water.

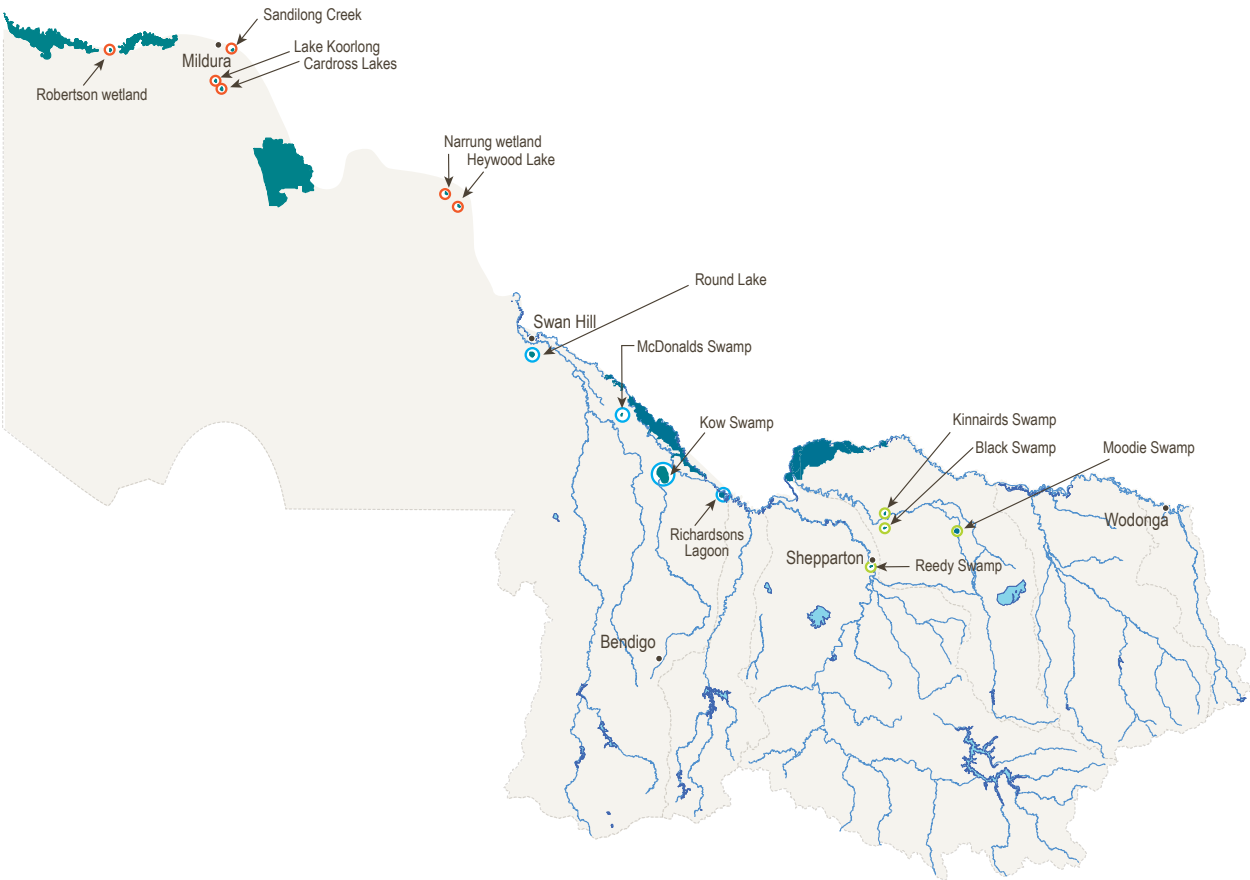
The diversity of wetland types within the whole Northern wetlands and floodplains system mean that there is also a diversity of habitats catering for a range of important plant and animal species. For example, the Murray hardyhead, a nationally-listed fish species, only survives in saline environments and relies upon salt-tolerant vegetation to provide suitable habitat for spawning and successful recruitment. On the other hand, brolgas, a threatened waterbird species, use shallow semi-permanent freshwater environments with emergent aquatic vegetation species suited to wetting and drying cycles. Colonial nesting waterbirds such as royal spoonbills also rely on freshwater wetlands, but prefer those sites with longer inundation periods as this promotes growth of different vegetation species such as reeds and rushes. These waterbird species also require species such as giant rush and river red gum trees to be over or near the water for nesting.

Environmental water releases will be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

9.17

Northern wetlands and floodplains

Figure 9.17.1 The northern wetlands and floodplains



Symbol	Description
○	North Central wetlands
○	Mallee wetlands
○	Goulburn Broken wetlands

Table 9.17.1 Water Holdings available for use in northern Victorian wetlands and floodplains

Entitlement	Description
Victorian Water Holdings	
Bulk Entitlement (River Murray Flora & Fauna) Conversion Order 1999	<ul style="list-style-type: none"> • 27,600 ML high-reliability entitlement • 40,000 ML unregulated entitlement
River Murray Environmental Water Savings Supply Deed ¹	<ul style="list-style-type: none"> • One-third of water savings created in the Murray system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project • Mitigation water (required to mitigate against impacts of modernisation; can only be used at prescribed sites)
Goulburn Environmental Water Savings Supply Deed ¹	<ul style="list-style-type: none"> • One-third of water savings created in the Goulburn system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project • Mitigation water (required to mitigate against impacts of modernisation; can only be used at prescribed sites)
Goulburn River Environmental Entitlement 2010	<ul style="list-style-type: none"> • 1,432 ML high-reliability entitlement (for use in the Loddon system)
Bulk Entitlement (Loddon River Environmental Reserve) Order 2005	<ul style="list-style-type: none"> • 2,000 ML high-reliability entitlement for Boort wetlands • 7,490 ML high-reliability entitlement for use at or below Loddon Weir
Other Water Holdings	
Commonwealth Environmental Water Holdings ^{2, 3}	<ul style="list-style-type: none"> • 206,884 ML Murray high-reliability water shares • 11,205 ML Murray low-reliability water shares • 181,897 ML Goulburn high-reliability water shares • 10,654 ML Goulburn low-reliability water shares • 47 ML Broken high-reliability water shares • 4 ML Broken low-reliability water shares • 6,409 ML Campaspe high-reliability water shares • 395 ML Campaspe low-reliability water shares • 2,746 ML Loddon high-reliability water shares • 527 ML Loddon low-reliability water shares

1. Actual volumes determined and allocated after audit of water savings in September each year. The long-term average audited saving for the environment from 2011 are: Murray 4,533 ML; and Goulburn 24,375 ML.

2. As at 30 April 2012. Does not include Commonwealth Environmental Water Holdings in other States, which may be transferred to Victoria for use depending on trade restrictions.

3. Decisions about the use of Commonwealth Environmental Water Holdings are the responsibility of Commonwealth Environmental Water. The VEWH will submit proposals for the use of Commonwealth environmental water for Victoria's priority rivers and wetlands.

Current situation

After more than a decade of dry conditions through this system, 2010-11 saw natural flooding inundate a number of the wetlands, resulting in the return of waterbirds, turtles, fish and frogs, and growth of aquatic vegetation. Flooding observed during this time was widespread, impacting on all the northern catchment management authority regions. In some cases, it was considered to be the largest flood ever recorded. Since that time, there has been further natural flooding in some regions; however the rainfall was more isolated than during 2010-11.

Above-average and unseasonal rain during 2011-12 in the Goulburn Broken region in particular has resulted in some wetlands being permanently inundated for over two years. All wetlands within this area are currently full and no environmental water was provided during 2011-12.

Further west, wetlands within the North Central region did not receive natural flooding during 2011-12. Round Lake was managed with environmental water during the season to support the Murray hardyhead, while the other wetlands were allowed to draw down naturally. Smaller wetlands have now dried completely, while larger wetlands are still holding water from the 2010-11 rain events.

In the Mallee region, all managed wetlands are currently holding water, with the majority of sites considered full or near full. Five wetlands were managed with environmental water during 2011-12 (Lake Powell, Cardross Lakes, Sandilong Creek, Heywood Lake and Lake Carpul), while the other sites were allowed to fluctuate naturally with rainfall and evaporation conditions.

There has been a high use of the northern wetlands and floodplains by a range of species during 2011-12. In particular waterbirds, including rare and threatened species, have been using the various habitats provided by the diversity of wetland types through the system. In most cases, the continued inundation at the wetlands has been a welcome change from the decade of drought.

However, for wetlands in the Goulburn Broken region, the 2011-12 conditions have resulted in inundation exceeding the tolerable levels for wetland vegetation. Prolonged inundation can alter wetland vegetation communities temporarily or permanently by favouring species that are adapted to extended inundation durations.

This alters the structure and habitat of vegetation species. River red gums are of particular concern as they can die as a result of waterlogging if they remain permanently inundated over two to three years. The loss of these trees can have a major impact on the vegetation structure and habitat provided by wetlands. For example, mature hollow bearing trees can take over 100 years to grow.

Environmental objectives

The overall environmental objective for the northern wetlands and floodplain system is to protect and improve the health of the individual wetlands. A key focus of environmental water management is to improve the diversity of vegetation and opportunities for use of the sites by a range of species including waterbirds, fish, frogs and turtles.

Priority watering actions

The majority of wetlands and floodplains in northern Victoria have wetting and drying cycles, reflecting the requirements of important ecological communities. The importance of wetting and drying cycles is discussed at the start of section 9.

To achieve the environmental objectives detailed in the previous section, 2012-13 will see wetlands within the system topped up, filled from dry, allowed to draw down or remain dry. Priority watering actions identified within the northern wetlands and floodplain system are as follows:

- **Goulburn Broken wetlands:** As a first priority, allow the wetlands to draw down and dry out. If significant waterbird breeding occurs and the threat of irreversible damage to wetland vegetation structure is considered low, top up wetlands between October and January to replace water lost to evaporation. Drawdown Doctors Swamp using existing regulating infrastructure to hasten wetland drying and avoid river red gum death due to prolonged inundation.
- **North Central wetlands:** Provide regular flows to Round Lake throughout the season to support Murray hardyhead in the wetland. Deliver water to Richardson's Lagoon in late winter/early spring. Fill McDonald Swamp from dry in October. Provide water to Hird Swamp to extend the duration of inundation only if unregulated flows enter the wetland from Pyramid Creek during spring or early summer. Allow Boort wetlands to draw down naturally.

- **Mallee wetlands:** Provide regular flows to Cardross Lakes Basin 1 and Lake Koorlong to support Murray hardyhead in the wetlands. Pump water to Robertson Wetland east and west, Narrung wetland and Sandilong Creek during spring and autumn.

Table 9.17.2 outlines the priority watering actions under a range of planning scenarios. This table only shows those wetlands that may require watering in 2012-13. Sites that require a drying phase under all planning scenarios have not been included.

Table 9.17.2 Priority watering actions for the northern wetlands and floodplains under a range of planning scenarios

	Planning scenario					
	Dry		Average		Wet	
Wetlands and floodplains	Priority sites to receive environmental water in 2012–13	Total volume (ML)	Priority sites to receive environmental water in 2012–13	Total volume (ML)	Priority sites to receive environmental water in 2012–13	Total volume (ML)
Goulburn Broken wetlands	<ul style="list-style-type: none"> • Black Swamp • Kinnairds Swamp • Moodies Swamp • Reedy Swamp 	2,113	<ul style="list-style-type: none"> • Black Swamp • Kinnairds Swamp • Moodies Swamp • Reedy Swamp 	1,057	<ul style="list-style-type: none"> • Black Swamp • Kinnairds Swamp • Moodies Swamp • Reedy Swamp 	1,057
North Central wetlands	<ul style="list-style-type: none"> • Round Lake • McDonald Swamp • Richardson's Lagoon 	3,700	<ul style="list-style-type: none"> • Round Lake • McDonald Swamp • Richardson's Lagoon 	3,700	<ul style="list-style-type: none"> • Round Lake • McDonald Swamp • Richardson's Lagoon • Hird Swamp 	5,700
Mallee (River Murray) wetlands	<ul style="list-style-type: none"> • Cardross Lakes Basin 1 • Lake Koorlong • Robertson Wetland east and west • Narrung wetland • Sandilong Creek 	2,450	<ul style="list-style-type: none"> • Cardross Lakes Basin 1 • Lake Koorlong • Robertson Wetland east and west • Narrung wetland • Sandilong Creek 	7,450	<ul style="list-style-type: none"> • Cardross Lakes Basin 1 • Lake Koorlong • Robertson Wetland east and west • Narrung wetland • Sandilong Creek 	7,450
Total (ML)		8,263		12,207		14,207

Adaptive management considerations

Environmental water will be adaptively managed as conditions unfold throughout the season. There are a number of factors that will be considered before and during the implementation of priority watering actions in the northern wetlands and floodplains. The Mallee, North Central and Goulburn Broken catchment management authorities will work closely with the relevant land managers of these sites throughout the season to monitor their condition, and determine when priority watering actions should be undertaken most efficiently and with maximum environmental benefit.

Decisions on priority watering actions will be influenced by the amount of water available for use, the current condition of the wetland (ie. where the wetland is in its wetting and drying cycle), and local rainfall or catchment runoff that may influence the watering requirements of wetland or floodplain system as the water year progresses.

The Northern Victorian Environmental Watering Project Control Board consists of representatives of the Mallee, North Central and Goulburn Broken catchment management authorities and Parks Victoria. The group assists in the prioritisation process throughout the year, making recommendations to the VEWH. This group will continue to review the volumes and management actions required for the sites as seasonal conditions unfold and allocation progressively becomes available for use.

As storages are relatively full across northern Victoria, there is a possibility that flooding may occur during the season. This may impact on the ability of some floodplain wetlands to dry in the Goulburn Broken and North Central regions (as is the priority at this stage), and could result in environmental water being required to support specific wetland responses associated with wet conditions.

Decisions on use of the Victorian Water Holdings will be influenced by seasonal conditions and the decisions of other water holders, who have varying interests in the northern Victorian wetlands and floodplains, reflecting their different objectives.

Implementation arrangements

Seasonal watering statements will be issued by the VEWH to communicate decisions on the priority watering actions to be undertaken, and to authorise the relevant waterway manager to implement these decisions. There will be many statements released for the northern Victorian wetlands and floodplains, reflecting the complexity associated with different water holders, progressive water allocations, and multiple catchment management authorities.

Detailed implementation arrangements for northern Victorian wetlands and floodplains, including costs, funding sources and land manager endorsement, will be confirmed through the development of a delivery plan before each watering action is authorised.

Delivery of environmental water to wetlands located on private land will not be undertaken until agreements with affected landholders are successfully negotiated.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Throughout the season, watering actions will be communicated by the Goulburn Broken, North Central and Mallee catchment management authorities through media releases and website updates.

Risk assessment and management

A number of risks have been assessed, and mitigation strategies identified, relating to the implementation of priority watering actions. Table 9.17.3 summarises the medium and high risks, and the mitigating strategies identified by the catchment management authorities. The costs of mitigating strategies will be considered in light of funding availability.

More detailed risk assessments will be completed by the relevant waterway manager as part of the delivery plan for each priority watering action.

Table 9.17.3 Risk management for the northern wetlands and floodplains

Risk type	Mitigating strategies	CMA
Release volume is insufficient in meeting required flow at target point	Modifying infrastructure at the watering sites (eg. increasing size of pump) to allow for the required volume of water to be delivered	MCMA
Storage operator cannot deliver required flow rate (ie. outlet/capacity constraints, insufficient storage volume)	Ongoing dialogue with Goulburn-Murray Water regarding consumptive demand in the system to assist in timing releases when there is available capacity to meet desired flow rates Ensure pumps are functioning and able to deliver at required rates	GBCMA; NCCMA
Storage operator maintenance works affect ability to deliver water	Engage with Goulburn-Murray Water throughout the watering season to assist with timing of releases when there is sufficient capacity to meet requirements	NCCMA; MCMA
Environmental water account is overdrawn	Ongoing dialogue with resource manager regarding the volume of water delivered so additional water uses can be identified in advance and negotiated with water holders	GBCMA
Limited catchment management authority resources to deliver environmental releases	Ensure that environmental water management within the catchment management authority is adequately resourced to undertake required delivery tasks	NCCMA; MCMA
Cost of delivery exceeds available funding	Undertake watering with single lift pumping and minimal earth works where possible	MCMA
Environmental releases cause personal injury to wetland user	Engage the community and undertake local media prior to releases Liaise with land manager regarding public communication activities	NCCMA
	Ensure there are appropriate safety measures around pump outlets and any access that may become inundated	MCMA
Environmental releases cause flooding of private land	Work closely with the land manager to ensure one (or more) agencies are monitoring the wetland level and water movement during the environmental water deliveries	NCCMA; MCMA
	Work closely with Goulburn-Murray Water and cease regulated deliveries if high catchment runoff conditions are expected	
	Landholder agreements undertaken for intentional flooding on private land	
Environmental release cause flooding to public infrastructure	Work closely with the land manager to ensure one (or more) agencies are monitoring the wetland level and water movement during the environmental water deliveries	NCCMA
	Work closely with Goulburn-Murray Water and cease regulated deliveries if high catchment runoff conditions are expected	
Environmental releases cause flooding of Crown land	Agreements undertaken with land manager for flooding on Crown land	MCMA

Risk type	Mitigating strategies	CMA
Current recommendations on environmental flows are inaccurate	<p>Ensure proposed deliveries (including timing and rates) are undertaken in accordance with relevant environmental water management plans and best available science</p> <p>Undertake a review of watering actions with relevant stakeholders to ensure watering recommendations are adaptively managed over time</p> <p>Undertake ongoing ecological monitoring of releases to assist in refining flow recommendations over time</p> <p>Use annual operational monitoring to inform annual priority flow components</p>	NCCMA; MCMA
Unable to provide evidence in meeting ecological objective	<p>Ensure monitoring activities are undertaken as specified in this proposal and relevant delivery plans to demonstrate ecological outcomes in association with the provision of environmental water</p> <p>Regularly update environmental water management plans with knowledge of ecological outcomes</p>	NCCMA; MCMA
	Support the Department of Sustainability and Environment in undertaking the regular monitoring of the Murray hardyhead population at Round Lake	NCCMA
Releases cause water quality issues (eg. blackwater, low dissolved oxygen, mobilisation of saline pools, acid sulphate soils etc)	Undertake relevant water quality monitoring activities at wetlands to ensure any water quality issues are observed in a timely manner, and can be managed appropriately (eg. with the addition of additional water at Round Lake)	NCCMA; MCMA
Improved conditions for non-native species	There is currently no strategy to mitigate this risk. However, minimising summer inundation and placing carp screens on inlet channels can reduce the risk	GBCMA
	Ensure water level and salinity are closely monitored and managed at Round Lake so that salinity does not drop low enough for gambusia to thrive and predate on Murray hardyhead	NCCMA
	Avoid delivery through summer, as this can facilitate large-scale carp breeding	MCMA
Key stakeholders not supportive of environmental water use	Continue engagement throughout 2012-13 with the local community surrounding the watering sites	MCMA

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

Stakeholder and community consultation regarding priority watering actions has been undertaken by each catchment management authority through the development of their seasonal watering proposals.

To assist with the environmental water management program in the Goulburn Broken region, the Goulburn Broken Catchment Management Authority is establishing an advisory group to provide advice on environmental water use occurring in the rivers, creeks and wetlands. The membership will include representatives from a range of geographic locations in the system, and from key agencies such as Department of Primary Industries, Department of Sustainability and Environment, and Goulburn-Murray Water. Indigenous groups (through the Yorta Yorta as the Registered Aboriginal Party) will also be included in this engagement.

The North Central Catchment Management Authority's Natural Resource Management Committee provided community input to the proposed watering actions for 2012-13. Site specific engagement will be undertaken during the season with local community, land managers such as Parks Victoria and Goulburn-Murray Water.

Community consultation in the Mallee region has been conducted through the Mallee Irrigation and Environment Community Advisory Committee and the Mallee Technical Advisory Committee. Discussions are also held with the local community surrounding the watering sites, as well as land managers and Lower Murray Water (as infrastructure operators).

Further information

More detailed information can be sought from Goulburn Broken, North Central and Mallee catchment management authorities (see section 10).



Lake Carpul, Mallee Catchment Management Authority



Barmah Lake, Keith Ward, Goulburn Broken Catchment Management Authority

Waterway manager – Goulburn Broken Catchment Management Authority, North Central Catchment Management Authority and Mallee Catchment Management Authority

The Living Murray Initiative is one of Australia's most significant long-term river restoration programs. It aims to achieve a healthy working River Murray system for the benefit of all Australians. Victoria has four sites as part of the Living Murray program, known as 'icon sites': Barmah Forest; Gunbower Forest; Hattah Lakes; and Lindsay-Wallpolla Islands. Barmah Forest and Gunbower Forest are Australia's largest river red gum forests. These forests together with the Hattah Lakes are recognised as wetlands of international importance under the Ramsar Convention. The Living Murray icon sites have many important environmental and Indigenous values, supporting a wide range of plant and animal species, and containing many historical sites of Indigenous cultural significance.

Summary of planned environmental water use in 2012-13

The priority environmental objectives for the Living Murray icon sites broadly include: restoring the extent and distribution of healthy wetland and floodplain vegetation communities; providing feeding and breeding habitat for waterbirds, including colonial nesting species; providing successful breeding and recruitment of native fish; and providing habitat for native frogs, turtles and crayfish.

In order to achieve these objectives, it is intended that environmental water will be actively delivered to Gunbower Forest and Hattah Lakes. In Barmah Forest, it is intended that a dry phase be initiated (with the exception of watering Boals Deadwood) due to the forest being permanently inundated for the last two years. However, if Barmah Forest is naturally inundated, environmental water may also be actively delivered. In Lindsay-Wallpolla Islands, the lower-lying wetlands which can be actively watered require a drying. The higher floodplain cannot currently be actively watered, apart from Mulcra Island in which it is intended to commence watering in autumn/winter and into spring 2013.

System overview

The Living Murray Initiative is a partnership of the Victorian, New South Wales, South Australian, ACT and Commonwealth governments, coordinated by the Murray-Darling Basin Authority. The 'First Step' of the initiative focused on achieving environmental benefits for six 'icon sites' through the recovery of up to 500,000 ML (long-term average) of environmental water, and investment in a works and measures program to maximise the benefits of this water recovery.

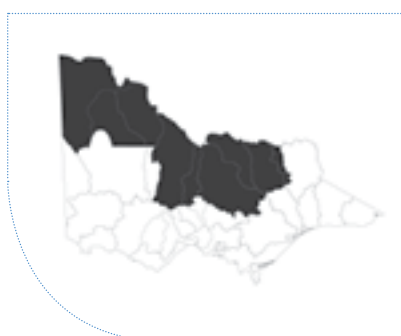
The Living Murray icon sites are part of the highly-regulated, southern-connected Murray-Darling Basin. Water can be delivered from a number of sources including the upper Murray (Hume Reservoir), Goulburn (Lake Eildon and Goulburn Weir), Campaspe (Lake Eppalock), Murrumbidgee (Burrinjuck Dam) and Darling (Menindee Lakes) systems. Environmental water releases can be combined with unregulated flows and the delivery of consumptive water en route to maximise environmental outcomes.

Of the six icon sites, four are partly or fully located in Victoria. These sites are Barmah-Millewa Forest; Gunbower-Koondrook-Perricoota Forest; Hattah Lakes and Chowilla Floodplain, Lindsay and Wallpolla Islands (see Figure 9.18.1). The sites were chosen for their high environmental value, and their cultural significance to Indigenous people and the broader community. All of the Victorian sites are recognised as wetlands of international importance under the Ramsar Convention.

The Barmah-Millewa Forest is the most upstream icon site and is the largest river red gum forest in Australia. It covers 66,000 ha and straddles the Murray and Edwards rivers between the townships of Tocumwal, Deniliquin and Echuca. The site is a forest and wetland system that is reserved as the Barmah National Park and Murray River Regional Park in Victoria, and part of the Murray Valley National Park in New South Wales. It is a significant breeding site for waterbirds including egrets, spoonbills and night herons as well as significant frog and turtle populations. When flows are above 15,000 ML per day at Yarrawonga Weir, both sides of the forest are managed as a whole. When flows are below this, each side of the forest can be managed separately through the numerous regulators. No large-scale structural works have been identified for the forest.

The Gunbower-Koondrook-Perricoota Forest is also one of Australia's largest river red gum forests and covers around 50,000 ha. It straddles the River Murray and is located downstream of Torrumbarry Weir, between Echuca and Swan Hill. The Victorian component is 19,450 ha of which 10,988 ha has been declared National Park, while the remainder is listed as State Forest. Gunbower Creek is an integral part of the Gunbower system as it is a natural waterway used as an irrigation carrier that supplies water to the Torrumbarry Irrigation District as well as to the Gunbower Forest. The creek also provides good habitat for native fish such as Murray cod, trout cod and freshwater catfish. A structural works program is underway allowing for managed watering of up to 2,500 ha of wetland within the forest. Further works are scheduled to be undertaken on the creek this year allowing managed watering of the broader floodplain. Collectively, the works aim to enable watering of the forest through the Torrumbarry irrigation system to maintain wetland and floodplain condition and to provide water to the forest to allow waterbirds to fledge.

The Hattah Lakes are located adjacent to the River Murray between Mildura, Robinvale and Ouyen. They consist of over 20 semi-permanent freshwater lakes, and form part of the Hattah-Kulkyne National Park. The Hattah Lakes are important because of their extent, condition, diversity and habitat values as well as their social and cultural importance. They are important habitat for colonial waterbird species including spoonbills, egrets, night herons and bitterns. They also provide habitat for a range of migratory bird species. Under natural conditions, the lakes were fed from high River Murray flows, influenced by all major Murray tributaries from the Murrumbidgee upwards. Currently, large-scale works are underway (due to be completed in the first half of 2013) to allow water to be pumped into the Hattah Lakes system to meet environmental watering requirements which are no longer possible due to river regulation.



Symbol	Description
○	Icon sites

Clockwise: Mulcra Island, Mallee Catchment Management Authority, Barmah Lake, Keith Ward, Goulbourn Broken Catchment Management Authority, Little Hattah, Mallee Catchment Management Authority, Gunbower Forest, Anna Chatfield, North Central Catchment Management Authority

Table 9.18.1 Water Holdings available for use in the Living Murray icon sites

Entitlement	Description
Victorian Water Holdings	
Bulk Entitlement (River Murray Flora & Fauna) Conversion Order 1999	<ul style="list-style-type: none"> • 27,600 ML high-reliability entitlement • 40,000 ML unregulated entitlement
Barmah-Millewa Environmental Water Allocation	<ul style="list-style-type: none"> • 50,000 ML high-reliability entitlement • 25,000 ML low-reliability entitlement
River Murray Environmental Water Savings Supply Deed ¹	<ul style="list-style-type: none"> • One-third of water savings created in the Murray system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Goulburn River Environmental Water Savings Supply Deed ¹	<ul style="list-style-type: none"> • One-third of water savings created in the Goulburn system as a result of modernisation works completed as part of Stage 1 of the Northern Victoria Irrigation Renewal Project
Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007 ²	<ul style="list-style-type: none"> • 126 ML high-reliability entitlement • 5,048 ML low-reliability entitlement
Environmental Entitlement (Goulburn System – Living Murray) 2007 ²	<ul style="list-style-type: none"> • 39,625 ML high-reliability entitlement • 156,980 ML low-reliability entitlement
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Living Murray ²	<ul style="list-style-type: none"> • 5,710 ML high-reliability entitlement • 101,850 ML low-reliability entitlement • 34,300 ML unregulated entitlement
River Murray Increased Flows ³	<ul style="list-style-type: none"> • 70,000 ML long term average
Other Water Holdings	
Other Living Murray entitlements	<ul style="list-style-type: none"> • 17,518 ML high-reliability water share in Victoria • 1,887 ML of high-security entitlement in New South Wales • 212,127 ML of general-security entitlement in New South Wales • 12,965 ML of unregulated entitlement in New South Wales • 350,000 ML of supplementary entitlement in New South Wales • 43,765 ML water licence entitlement in South Australia
Commonwealth Environmental Water Holdings ⁴	<ul style="list-style-type: none"> • 206,884 ML Murray high-reliability water shares • 11,205 ML Murray low-reliability water shares • 181,897 ML Goulburn high-reliability water shares • 10,654 ML Goulburn low-reliability water shares • 6,409 ML Campaspe high-reliability water shares • 395 ML Campaspe low-reliability water shares

1. Actual volumes determined and allocated after audit of water savings in September each year. The long-term average audited saving for the environment from 2011 are: Murray 4,533 ML; and Goulburn 24,375 ML.

2. Water allocated to this entitlement must be used for the Living Murray icon sites.

3. Ability to call on water from Snowy Hydro scheme to provide increased flows from Hume Reservoir. Entitlement currently under development.

4. Decisions about the use of Commonwealth Environmental Water Holdings are the responsibility of Commonwealth Environmental Water. The VEW will submit proposals for the use of Commonwealth environmental water for Victoria's priority rivers and wetlands. Current as at 31 May 2012. Does not include Commonwealth Environmental Water Holdings in other States which can be transferred for use in Victoria, subject to trade restrictions.

The Chowilla Floodplain and Lindsay-Wallpolla Islands span parts of Victoria, New South Wales and South Australia. The Victorian component of the icon site includes Lindsay, Wallpolla and Mulcra Islands and covers over 26,100 ha downstream of Mildura. It is fed by high River Murray flows influenced by the upper Murray tributaries and flows in the Darling River. A combination of structural works and weir manipulation allows Mulcra Island to be watered, whereas Lindsay and Wallpolla rely on very large floods or temporary pumping to water low level wetlands. Structural works at Lindsay Island (stage 1) are to be undertaken this summer including construction of inlet regulators. Repair works at Mulcra Island are due to be completed by autumn 2013.

Current situation

After a decade of drought, 2010-11 was characterised by widespread flooding throughout the four icon sites in Victoria. In 2011-12, inflows into the southern-connected basin were considered very much above average for the year while rainfall was considered around average. Large isolated rainfall events resulted in the high inflows and flooding during 2011-12 and inundation of all the sites to varying degrees.

Widespread flooding occurred in Barmah Forest throughout 2011-12, continuing on from flooding experienced during 2010-11. Low-lying wetlands within the forest have been permanently inundated for up to 21 months. While waterbirds did breed at the site during the season, with 428,000 ML of environmental water released to ensure the successful fledging, the numbers recorded were less than during 2010-11 which saw the largest bird breeding event at the site in 60 years. Of concern is the moira grass-plain wetland community, which has been inundated over its maximum required duration. This is starting to put stress on this wetland community and has the potential to change the wetland vegetation community structure.

Major flooding during 2010-11 resulted in overbank flooding in Gunbower Forest, inundating 9,000 ha of the forest. During 2011-12, minor spring flooding resulted in a small bird breeding event, with additional flooding occurring in March 2012. Managed environmental flows were provided to Gunbower Creek to complement irrigation supplies to provide benefits to native fish during summer and autumn. Managed environmental flows through the creek are continuing through the winter period to provide suitable fish habitat during the non-irrigation period. While there is good diversity of fish species, the abundance is low, indicating the potential for flows to improve the overall number of fish in the creek.

Lindsay-Wallpolla Islands have received environmental water since 2005, providing drought refuge for waterbirds such as spoonbills, and frogs such as the growling grass frog. In 2010-11 and 2011-12, the majority of the site was inundated improving river red gum condition. However, the flood also caused some damage to the newly-constructed works at Mulcra Island. The permanent and semi-permanent wetlands which can receive water from the watering program are either full or require a drying phase.

The Hattah Lakes have received environmental water over the last few years through pumping. The flooding in spring and summer 2010-11 resulted in overbank flows provided connectivity between the River Murray and the Hattah Lakes and surrounding floodplain, with the majority of the major lakes still holding water.

Environmental objectives

Through the Living Murray program, environmental objectives have been identified for all the icon sites. These broadly include: restoring the extent and distribution of healthy wetland and floodplain vegetation communities; providing feeding and breeding habitat for waterbirds, including colonial nesting species; providing successful breeding and recruitment of native fish; and providing habitat for native frogs, turtles and crayfish.

For 2012-13, the specific environmental objective for each site is as follows:

- **Barmah Forest:** increase the diversity and condition of vegetation communities
- **Gunbower Forest:** increase the diversity and abundance of native fish populations

- **Hattah Lakes:** complete the construction of structural works and improve the diversity and condition of wetland communities
- **Lindsay-Wallpolla Islands:** improve the diversity and condition of vegetation communities.

Priority watering actions and adaptive management considerations

The inflows of the major tributaries during the year will influence the conditions along the River Murray and its associated floodplain, in turn influencing the management decisions at each individual icon site. In addition, the application of large volumes of environmental water at one site will influence the condition of the sites further downstream. There are opportunities to optimise water delivery to maximise environmental outcomes, particularly through the reuse of return flows, allowing large-scale multi-site watering events. Before implementing multi-site waterings, potential alignment or misalignment of the priority watering actions at each site, in terms of timing, magnitude and duration, must be considered. Water delivery from particular systems needs to consider the potential benefits and impacts on all downstream sites.

The current status of the works and measures program at all icon sites will influence the requirements for and the ability to deliver water. As some of these works are now nearing completion, water will need to be carefully delivered the first few times the structures are used. This may require slightly different delivery rates than planned into the future.

Tables 9.18.2 to 9.18.5 outline the environmental objectives and priority watering actions for each of the icon sites under a range of planning scenarios.

Decisions on use of the Victorian Water Holdings will be influenced by seasonal opportunities and the allocation of water by Commonwealth Environmental Water and the Murray-Darling Basin Authority.

The scenario planning was undertaken with assistance from Murray-Darling Basin Authority (River Operations), which defined approximate annual inflows into the Murray system under different probabilities of exceedence using the historic inflow record. Years which fitted these inflow scenarios were used to preview the possible river conditions in 2012-13 and therefore the possible watering activities which may be undertaken. The planning scenarios and approximate annual inflows were: drought (2,900 GL); dry (4,200 GL); average (11,200 GL); and wet 18,100 GL).

Barmah Forest

The low-lying wetlands of Barmah Forest have been inundated for nearly two years which is above their recommended inundation duration. The primary objective is to allow these wetlands to dry, however if unregulated flows occur in spring this will not be possible until at least summer and secondary objectives for the forest will be targeted. If unregulated flows occur in the River Murray just above channel capacity (10,500 ML a day at Yarrawonga), flows will be targeted up to 15,000 ML per day to inundate river red gums. If unregulated flows occur above 15,000 ML per day naturally, flows will be targeted up to 25,000 ML per day to inundate additional areas of river red gums higher in the forest.

Active environmental watering will target short, high peaks in flow to maximise vegetation response and reduce the inundation duration and the likelihood of a large-scale waterbird breeding event (this will mitigate the need to provide water in summer to allow the birds to fledge). This natural peak will be managed to increase inundation extent, recharging soil moisture in the river red gum forest before allowing the water to drain back into the river and attempting to initiate a drying regime at the site during summer and autumn.

If a large-scale waterbird breeding event does occur as a result of unregulated flows, environmental flows will be targeted where possible to allow for successful breeding (typically lower-lying wetlands areas), then the forest will be dried as soon as practical.

It is intended that environmental watering will occur at Boals Deadwood wetland, by opening that specific regulator in spring, to investigate the relationship between vegetation habitat and ibis nesting. It is likely that river heights will enable this to occur under all seasonal conditions.

Table 9.18.2 Priority watering actions for Barmah Forest under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet
Environmental objectives	<p>Dry out moira grass wetlands</p> <p>Maintain isolated waterbird breeding in Boals Deadwood</p>	<p>Inundate river red gums</p> <p>Maintain isolated waterbird breeding in Boals Deadwood</p>	<p>Inundate river red gums</p> <p>Limit waterbird breeding to selected areas</p> <p>Promote fish spawning and movement</p> <p>Dry forest as soon as possible to allow for dry forest in summer</p> <p>Maintain isolated waterbird breeding in Boals Deadwood</p>	<p>Inundate river red gum and black box higher in the floodplain</p> <p>Limit waterbird breeding to selected areas</p> <p>Promote fish spawning and movement</p> <p>Dry forest as soon as possible to allow for dry forest in summer</p> <p>Maintain isolated waterbird breeding in Boals Deadwood</p>
Priority watering actions	Inundate Boals Deadwood	<p>Aim for short high peaks on top of unregulated flow</p> <p>Inundate Boals Deadwood</p>	<p>Aim for short high peaks on top of unregulated flow</p> <p>Build on top of unregulated flow and provide pulses</p> <p>Dry forest as soon as possible to allow for dry forest in summer</p> <p>Inundate Boals Deadwood wetland</p>	<p>Aim for short high peaks on top of unregulated flow</p> <p>Build on top of unregulated flow, extend between peaks and provide pulses</p> <p>Dry forest as soon as possible to allow for dry forest in summer</p> <p>Inundate Boals Deadwood wetland</p>
Possible volume required from the Water Holdings¹	24,000 ML	24,000-114,000 ML	140,000-284,000 ML	154,000-308,000 ML

1. Assumes unregulated flows are occurring in addition to the volume of water required from the Water Holdings.

Gunbower Forest

It is intended that environmental water will be delivered to permanent and semi-permanent wetlands in spring to provide lateral connectivity across Gunbower Forest between Gunbower Creek and the River Murray. This will restore the seasonality of flooding in the system, improve vegetation communities and allow movement of native fish such as Murray cod and golden perch.

The objective in a drier year is to only fill the low-lying wetlands. Flows in the River Murray below Torrumbarry Weir will provide the opportunity to allow connectivity between the River Murray, Gunbower Forest and Gunbower Creek. Water could be added to these flows to extend their duration or to overtop the sills of floodrunners such as Yarran Creek. In the drier years, target flows might be 15,000 ML a day for 30-60 days. In wetter years, target flows might be 25,000 ML a day for 30 days and 15,000 ML a day for 30 days.

In Gunbower Creek, high flows during winter combined with a spring fresh and baseflows will improve native fish access to different habitats and food resources within the creek. This will encourage native fish breeding and promote an increased abundance of existing populations. Water has already been committed through the Living Murray program to provide winter flows in Gunbower Creek and will continue until the end of July 2012. These flows use consumptive water en route with any additional losses to be covered by environmental water. If conditions are wet and there is available water, it is intended these flows will be maintained throughout the remainder of the year.

Table 9.18.3 Priority watering actions for Gunbower Forest under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet
Gunbower Forest				
Environmental objectives	Inundate permanent priority wetlands to provide drought refuge and protect key wetland values	<p>Inundate permanent and semi-permanent wetlands to improve wetland condition</p> <p>Encourage small-scale bird and fish breeding events</p> <p>Provide native fish connectivity between Gunbower Forest and Gunbower Creek</p>	<p>Inundate permanent and semi-permanent wetlands to improve wetland condition</p> <p>Encourage small-scale bird and fish breeding events</p> <p>Provide native fish connectivity between Gunbower Forest and Gunbower Creek</p> <p>Improve river red gum condition</p>	<p>Inundate permanent and semi-permanent wetlands to improve wetland condition</p> <p>Encourage large -scale bird and fish breeding events</p> <p>Provide native fish connectivity between Gunbower Forest and Gunbower Creek</p> <p>Improve river red gum condition</p>

Table 9.18.3 Priority watering actions for Gunbower Forest under a range of planning scenarios (continued)

	Planning scenario			
	Drought	Dry	Average	Wet
Priority watering actions	Releases through Gunbower Creek regulators into forest to fill permanent wetlands	Releases provided from Goulburn and upper Murray system to meet target flows of 13,000-15,000 ML a day at Torrumbarry Weir Releases through Gunbower Creek regulators into forest	Releases provided from Goulburn and upper Murray system to meet target flows of 10,000-25,000 ML a day at Torrumbarry Weir Releases through Gunbower Creek regulators into forest	Releases provided from Goulburn and upper Murray system to meet target flows of 10,000-25,000 ML a day at Torrumbarry Weir Releases through Gunbower Creek regulators into forest
Possible volume required from the Water Holdings	2,000 ML	750,000 ML	900,000 ML	450,000 ML
Gunbower Creek				
Environmental objectives	Provide fish habitat refuge	Provide habitat refuge and fish movement and spawning opportunities	Provide habitat refuge and fish movement, spawning and recruitment opportunities	Provide habitat refuge and fish movement and spawning and recruitment opportunities
Priority watering actions	Provide pulses to improve water quality for fish habitat	Provide a low flow fresh in summer and spring	Provide winter high flow, spring baseflow, spring and summer fresh	Provide winter high flow, spring baseflow, spring and summer fresh
Possible volume required from the Water Holdings	600 ML to cover losses (2,000 ML to be delivered in total)	600 ML to cover losses (2,000 ML to be delivered in total)	21,900 ML to cover losses (73,000 ML to be delivered in total)	21,900 ML to cover losses (73,000 ML to be delivered in total)
TOTAL				
Possible volume required from the Water Holdings¹	2,600 ML	750,600 ML	921,900 ML	471,900 ML

1. Assumes unregulated flows are occurring and consumptive water en route can be used in addition to the volume of water required from the Water Holdings.

Hattah Lakes

Once structural works are completed, water will be required to fill up the lakes, including providing flows to Lake Bitterang which has not received flows since 1993, and Lake Kramen which is an important blackbox wetland. This water will assist in improving the environmental health of 17 priority wetlands, improving river red gum condition and providing habitat for native fish species to grow, in turn becoming a food source for migratory and colonial waterbirds in the following water year.

It is expected that works will be completed in the first half of 2012-13 after which water delivery will begin. Delivery will be in accordance with the required commissioning needed for the operation of a new structure. If all the water is not delivered by the end of November 2012, further releases will only be delivered during summer if there are no capacity constraints. Further deliveries may be required in summer/autumn to further inundate the wetlands.

Water will be provided to the lakes by a combination of overbank flows (when the River Murray is high enough) and pumps. Therefore, water can be delivered under most conditions.

Table 9.18.4 Priority watering actions for the Hattah Lakes under a range of planning scenarios

	Planning scenario			
	Drought	Dry	Average	Wet
Environmental objectives	Provide in-stream vegetation and fish habitat	Provide in-stream vegetation and fish habitat	Provide in-stream vegetation and fish benefits	Provide in-stream vegetation and fish benefits
Priority watering actions	Pumping into system (preferred in spring)	Pumping into system (preferred in spring)	Pumping into system (preferred in spring)	Pumping into system (preferred in spring)
Possible volume required from the Water Holdings¹	44,000 ML	44,000 ML	44,000 ML	44,000 ML

1. Assumes no overbank flows will enter the Hattah Lake systems.

Lindsay-Wallpolla Islands

Lindsay, Wallpolla and Mulcra Islands have had good inundation over the last two years. There are no plans and no mechanism for large-scale watering at Lindsay or Wallpolla, though in very wet years, there will be some overbank flows into the low lying wetlands. Lake Wallawalla, which is part of Lindsay Island, contains a large number of carp which are impacting on the wetland vegetation, and are considered a serious risk to the achievement of the environmental objectives for the site. A small amount of water may be required as an attractant flow for a carp removal trial. Further investigations into the feasibility and benefits of capturing carp in Lake Wallawalla will be undertaken before water is delivered.

The structural works at Mulcra Island, located between Lindsay and Wallpolla Islands, were damaged during the 2010-11 floods. Once flows in the River Murray are low enough, construction will commence to fix the damaged structures. Once complete, expected in the first half of 2013, water will be required to commission the structure. The delivery of water to Mulcra Island requires the raising of Lock 8; therefore, this could be undertaken during all regulated conditions. The use of consumptive water en route to fill Mulcra (with the losses to be covered by environmental water) will be investigated and used in preference to environmental water subject to appropriate approvals. If unregulated flows occur in the River Murray past Mulcra, the regulators can be opened to allow water into the site. No environmental water needs to be debited during this event as prior to the works being completed, water would have entered the site naturally.

Water provided in autumn will target improving river red gum condition and providing habitat for native fish species to grow and become a food source for migratory and colonial water birds in the following water year.



Egret at Wallapolla Island, Murray-Darling Basin Authority

Table 9.18.5 Priority watering actions for Lindsay-Wallpolla Islands under a range of planning scenarios

	Drought	Dry	Average	Wet
Lindsay Island				
Environmental objectives	Reduce carp numbers in Lake Wallawalla by drying event	Reduce carp numbers in Lake Wallawalla by drying event	Benefit in-stream vegetation and provide fish connectivity in Lake Wallawalla Provision of attractant flow to eradicate carp	Benefit in-stream vegetation and provide fish connectivity in Lake Wallawalla Provision of attractant flow to eradicate carp
Priority watering actions	N/A	N/A	Pumping (preferred in spring)	Pumping (preferred in spring)
Possible volume required from the Water Holdings¹	0 ML	0 ML	3,000 ML	3,000 ML
Wallpolla Island				
Environmental objectives	Allow to dry naturally to provide vegetation diversity	Allow to dry naturally to provide vegetation diversity	Allow to dry naturally to provide vegetation diversity	Allow to dry naturally to provide vegetation diversity
Priority watering actions	N/A	N/A	N/A	N/A
Possible volume required from the Water Holdings¹	0 ML	0 ML	0 ML	0 ML
Mulcra Island				
Environmental objectives	Provide connectivity to the River Murray for fish movement Provide habitat for fish and birds Improve vegetation health	Provide connectivity to the River Murray for fish movement Provide habitat for fish and birds Improve vegetation health	Provide connectivity to the River Murray for fish movement Provide habitat for fish and birds. Improve vegetation health	Provide connectivity to the River Murray for fish movement Provide habitat for fish and birds Improve vegetation health
Priority watering actions	Raise Lock 8 to inundate island	Raise Lock 8 to inundate island	Raise Lock 8 to inundate island	Raise Lock 8 to inundate island
Possible volume required from the Water Holdings¹	5,000 ML to cover losses (40,000 ML for total delivery)	5,000 ML to cover losses (40,000 ML for total delivery)	5,000 ML to cover losses (40,000 ML for total delivery)	5,000 ML to cover losses (40,000 ML for total delivery)
TOTAL				
Possible volume required from the Water Holdings¹	5,000 ML	5,000 ML	8,000 ML	8,000 ML

1. Assumes no unregulated/overbank flows occur. 40,000 ML for total delivery represents the use of consumptive water en route.

Risk assessment and management

A number of risks have been assessed, and mitigation strategies identified, relating to the implementation of priority watering actions. Table 9.18.6 summarises the medium and high risks, and the mitigating strategies identified by the Goulburn Broken, North Central and Mallee catchment management authorities. The costs of mitigating strategies will be considered in light of funding availability.

If rainfall events are significant enough to create a flood threat (eg. a flood watch or flood warning being issued by the Bureau of Meteorology), environmental flows will be reduced or ceased, resuming again if required once the flood risk has passed.

Table 9.18.6 Risk management in the Living Murray icon sites

Risk type	Mitigating strategies	CMA
Release volume is insufficient in meeting required flow at target point	Ensure delivery channel has sufficient spare capacity to undertake delivery prior to starting watering event	NCCMA
	Ongoing dialogue with storage operators Murray-Darling Basin Authority and Goulburn-Murray Water) regarding consumptive demand in the system, to assist in timing releases when there is available capacity to meet desired flow rates	NCCMA GBCMA
	Alter flow target to ensure highest priority environmental objective are met or move to next priority	GBCMA
Storage operator maintenance works affect ability to deliver water	Ongoing dialogue with storage operators Murray-Darling Basin Authority and Goulburn-Murray Water) regarding maintenance schedule, to assist in timing releases when there is available capacity to meet desired flow rates	NCCMA MCMA
Storage operator cannot deliver required volume or flow rate (outlet/capacity constraints, insufficient storage volume)	Ongoing dialogue with storage operator Murray-Darling Basin Authority and Goulburn-Murray Water) regarding consumptive demand in the system, to assist in timing releases when there is available capacity to meet desired flow rates	NCCMA MCMA
	Ensure channels and regulators are in good working order so that water is delivered at required rates	NCCMA
	Work closely with contractors who are refurbishing regulators to manage time delays to best achieve delivery timelines	NCCMA
	Alter flow target to ensure highest priority environmental objective are met if possible or move to next priority	GBCMA
Limited catchment management authority resources to deliver environmental release	Ongoing dialogue between the catchment management authority, VEWB and Department of Sustainability and Environment regarding available resources and work demands	NCCMA MCMA
	Seek funding to ensure that environmental watering activities are adequately resourced	
Environmental releases cause personal injury to river users	Engage the community and undertake local media prior to releases	NCCMA
	Liaise with land manager regarding public communication activities	

Risk type	Mitigating strategies	CMA
Environmental releases causes flooding of private land	Work closely with the land managers to ensure adequate monitoring of wetland/creek level and water movement during the environmental water deliveries	NCCMA MCMA
Environmental release cause flooding to public infrastructure	Work closely with storage operators Murray-Darling Basin Authority or Goulburn-Murray Water) and contractors and cease regulated deliveries if high catchment runoff conditions are expected Undertake landholder agreements before watering private land	
Unable to provide evidence in meeting ecological objective	Ensure monitoring activities are undertaken	MCMA
Current recommendations on environmental flows are inaccurate	Undertake ongoing ecological monitoring of releases to assist in refining flow recommendations over time Use annual operational monitoring to inform annual priority flow components	NCCMA
Releases cause water quality issues (eg. blackwater, low dissolved oxygen, mobilisation of saline pools, acid sulphate soils etc)	Undertake relevant water quality monitoring activities at wetlands and creeks to ensure any water quality issues are observed in a timely manner, and can be managed appropriately	NCCMA
Improved conditions for exotic species (eg. carp)	There is currently no strategy to mitigate this risk Avoid delivery in summer where possible	NCCMA GBCMA MCMA

Implementation arrangements

Seasonal watering statements will be issued by the VEWB to communicate decisions on the priority watering actions to be undertaken, and to authorise Goulburn Broken, North Central and Mallee catchment management authorities to implement these decisions. There will be many statements released for the northern Victorian wetlands and floodplains, reflecting the complexity associated with different water holders, progressive water allocations, and multiple catchment management authorities.

Priority watering actions for the Living Murray icon sites will be undertaken by the relevant catchment management authority in accordance with seasonal watering statements and any agreements made with other water holders, and in consultation with storage operators, Goulburn Murray Water, Lower Murray Water and Murray-Darling Basin Authority (River Operations). They will also be implemented in line with operating arrangements, expected to be finalised in 2012-13.

The ability to provide the priority watering actions in the icon sites is dependent on decisions by other water holders and seasonal conditions. Partners in the Living Murray program and Commonwealth Environmental Water have varying interests, reflecting the different scope and objectives of their programs.

Where there are multiple-site benefits in delivering environmental water, the Murray-Darling Basin Authority's Operational Advisory Group will be used to optimise flows across the southern-connected basin. The role of the Operational Advisory Group will be to provide technical advice to the Murray-Darling Basin Authority (River Operations) and other responsible storage operators during a prescribed delivery period to enable the responsive delivery of environmental water, and to maximise environmental outcomes at both the site and whole-of-system scale. The group is chaired by the Murray-Darling Basin Authority (River Operations) and includes representatives of storage operators, water holders and waterway managers involved in or impacted by the watering action. Additional expertise is brought into the group as required.

The implementation of priority watering actions will be reported in the VEWH's bi-monthly watering update, annual report and annual watering booklet. These will be available from the VEWH website at www.vewh.vic.gov.au. Watering actions will also be communicated by Goulburn Broken, North Central and Mallee catchment management authorities through website updates.

Consultation

The successful implementation and management of environmental watering requires effective consultation and engagement with all relevant stakeholders.

The planning, construction of works and delivery of water at the icon sites has involved extensive consultation with key stakeholders, including storage operators, land managers, adjacent landholders and Indigenous groups.

Icon site consultation reference groups have been established to provide local advice on issues related to the development and implementation of each icon site management plan. In the development of each icon site management plan, input is sought from Indigenous communities through the establishment of localised reference groups. This consultation takes an inclusive approach by giving appropriate respect to the knowledge and views of Traditional Owners.

Throughout the season, consultation and engagement activities will be undertaken by the Goulburn Broken, North Central and Mallee catchment management authorities.

Further information

More detailed information can be sought from the Goulburn Broken, North Central and Mallee catchment management authorities (see section 10).

For further information on the Seasonal Watering Plan 2012-13, please contact the VEWH office:

15/8 Nicholson St, East Melbourne, Victoria, 3002
T: (03) 9637 8951
PO Box 500, East Melbourne, Victoria, 3002
E: general.enquiries@vewh.vic.gov.au

For specific information about each system, and details about specific seasonal watering proposals, please contact the relevant waterway manager:

Corangamite Catchment Management Authority

64 Dennis Street, Colac, Victoria, 3250
PO Box 159, Colac, Victoria, 3250
T: (03) 5232 9100
E: Info@ccma.vic.gov.au
W: www.ccma.vic.gov.au

East Gippsland Catchment Management Authority

574 Main Street, Bairnsdale, Victoria, 3875
PO Box 1012, Bairnsdale, Victoria 3875
T: (03) 5152 0600
E: egcma@egcma.com.au
W: www.egcma.com.au

Glenelg Hopkins Catchment Management Authority

79 French Street, Hamilton, Victoria, 3300
PO Box 502, Hamilton, Victoria, 3300
T: (03) 5571 2526
E: ghcma@ghcma.vic.gov.au
W: www.ghcma.vic.gov.au

Goulburn Broken Catchment Management Authority

168 Welsford Street, Shepparton, Victoria, 3630
PO Box 1752, Shepparton, Victoria, 3630
T: (03) 5820 1100
E: reception@gbcma.vic.gov.au
W: www.gbcma.vic.gov.au

Mallee Catchment Management Authority

DPI Complex, Corner Koorlong Avenue and Eleventh Street, Irymple, Victoria, 3502
PO Box 5017, Mildura, Victoria, 3502
T: (03) 5051 4377
W: www.malleecma.vic.gov.au

Melbourne Water

990 La Trobe Street, Docklands, Victoria 3008
PO Box 4342, Melbourne, Victoria, 3001
T: 131 722
E: enquiry@melbournewater.com.au
W: www.melbournewater.com.au

North Central Catchment Management Authority

628-634 Midland Highway, Huntly, 3551
PO Box 18, Huntly, 3551
P: (03) 5448 7124
E: info@nccma.vic.gov.au
W: www.nccma.vic.gov.au

West Gippsland Catchment Management Authority

16 Hotham Street, Traralgon, Victoria, 3844
PO Box 1374, Traralgon, Victoria, 3844
P: 1800 094 262
E: westgippy@wgcm.vic.gov.au
W: www.wgcm.vic.gov.au

Wimmera Catchment Management Authority

24 Darlot Street, Horsham, Victoria, 3400
PO Box 479, Horsham, Victoria, 3402
P: (03) 5382 1544
E: wca@wcma.vic.gov.au
W: www.wcma.vic.gov.au

For specific information about the other environmental water holders, please contact:

Murray-Darling Basin Authority

Level 4, 51 Allara Street, Canberra, ACT, 2601
GPO Box 1801, Canberra, ACT, 2061
P: (02) 6279 0100
W: www.mdba.gov.au

Commonwealth Environmental Water Office

John Gorton Building, King Edward Terrace, Canberra, ACT, 2601
GPO Box 787, Canberra, ACT, 2061
P: (02) 6275 9246
E: ewater@environment.gov.au
W: www.environment.gov.au/ewater/index.html

Allocation bank account – water share owners and many bulk entitlement and environmental entitlement holders allocation bank accounts (ABAs), which are credited as water allocations are made throughout the season

Blackwater events - occur when accumulations of organic matter, such as eucalypt leaves and twigs and nutrient run off from farms, decay in wetlands or waterways after being washed in by a major flood, drawing oxygen from the water. The water turns to a black colour and can have a very low level of dissolved oxygen, which can cause stress to fish, crayfish and other animals that breathe underwater. When the dissolved oxygen reaches a very low level it can result in fish deaths.

Carryover – allows entitlement-holders to retain ownership of unused water into the following season (according to specified rules)

Catchment management authority – statutory authorities established to manage regional and catchment planning, waterways, floodplains, salinity and water quality

Commonwealth Environmental Water – (part of the Department of Sustainability and Environment, Water, Populations and Communities) holds and manages the water entitlements purchased through the Restoring the Balance water recovery program

Environmental flow regime – the timing, frequency, duration and magnitude of flows for the environment

Environmental flow study – a scientific study of the flow requirements of a particular basin's river and wetlands systems used to inform decisions on the management and allocation of water resources

Environmental water entitlement – an entitlement to water to achieve environmental objectives in waterways (could be an environmental entitlement, environmental bulk entitlement, water share, section 51 licence or supply agreement)

Flow component – components of a river system's flow regime that can be described by timing, seasonality, frequency and duration (for example, cease to flow and overbank flows). See section 9 for more information.

Gigalitre (GL) – one billion (1,000,000,000) litres

Heritage rivers – are listed under the Heritage Rivers Act 1992, and are particular parts of rivers and river catchment areas in Victoria which have significant nature conservation, recreation, scenic or cultural heritage attributes

High-reliability entitlement – legally recognised, secure entitlement to a defined share of water, as governed by the reserve policy (full allocations are expected in most years)

Low-reliability entitlement – legally recognised, secure entitlement to a defined share of water, as governed by the reserve policy (full allocations are expected only in some years)

Macroinvertebrates – are animals that have no backbone and can be seen with the naked eye; they include worms, snails, mites, bugs, beetles, dragonflies and freshwater crayfish

Macrophytes - are aquatic plants, growing in or near water that are either emergent (growing out of the water; for example, phragmites), submergent (growing under water; for example, ribbonweed), or floating (for example, floating pond weed)

Megalitre (ML) – one million (1,000,000) litres

Monthly Water Report – a report produced by the Department of Sustainability and Environment, which provides a summary of the status of Victoria's water resources and water supplies at the end of the reporting month

Northern Victoria Irrigation Renewal Program – an irrigation modernisation project, involving upgrading irrigation infrastructure in the Goulburn Murray Irrigation District, which will provide water to irrigators, Melbourne and the environment

Passing flow – water released out of storages to operate river and distribution systems (to deliver water to end users), provide for riparian rights and maintain environmental values and other community benefits

Permanent trade – transfer of ownership of a water share or licence

Resource manager – an authority appointed by the Minister for Water to manage water resources, including allocating water to entitlement holders and maintaining water accounts

Restoring the Balance water recovery program – a Commonwealth Government program to return water to the environment through the purchase of water entitlements from irrigators

Seasonally adaptive approach – a planning approach which incorporates the likely availability of environmental water based on recent climate history and outlook, and determines the priority environmental objectives as a result

Seasonal allocation – the volume of water allocated to a water share in a given season, expressed as a percentage of total entitlement volume

Storage operator – an authority appointed by the Minister for Water to operate major storages and other water delivery infrastructure to deliver water to entitlement holders

Temporary trade – transfer of a seasonal allocation

The Living Murray – an intergovernmental program, which holds an average of 500,000 ML of environmental water per year, for use at six icon sites along the River Murray

Unregulated entitlement – an entitlement to unregulated flows in a river system, that is, flows that are unable to be captured in storages

Victorian Environmental Flow Monitoring and Assessment Program – assesses the effectiveness of environmental flows in delivering ecological outcomes

Victorian Environmental Water Holder – an independent statutory body responsible for holding and managing Victorian environmental water entitlements and allocations (Victorian Water Holdings)

Victorian Water Register – a public register of water-related entitlements in Victoria

Waterways – can include rivers, wetlands, creeks, floodplains and estuaries

Water entitlement – the right to a volume of water that can (usually) be stored in reservoirs and taken and used under specific conditions

Water Holdings – environmental water entitlements held by the Victorian Environmental Water Holder

Waterway manager – agency responsible for the environmental management of waterways (includes catchment management authorities and Melbourne Water)

Commonwealth Environmental Water – Commonwealth Environmental Water (Office)

CMA – Catchment management authority

EWR – Environmental Water Reserve

GL – Gigalitre

ML – Megalitre

MDBA – Murray-Darling Basin Authority

NVIRP – Northern Victoria Irrigation Renewal Project

VEFMAP – Victorian Environmental Flow Monitoring and Assessment Program

VEWH – Victorian Environmental Water Holder

