Department of Sustainability and Environment

Western Region Sustainable Water Strategy

State Government Victoria

Volumes of water

Different volumes of water are referred to in this document.
Volumes of water are measured in litres.

One Litre	1 litre	**1 litre**	**1 L**
One thousand litres	1,000 litres	**1 kilolitre**	**1 KL**
One million litres	1,000,000 litres	**1 megalitre**	**1 ML**
One billion litres	1,000,000,000 litres	**1 gigalitre**	**1 GL**

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Cover images
Clockwise: South Mokanger, Cavendish (Southern Grampians Shire Council), Windmill (Michael Jensz), Moonlight Head, Great Ocean Road (Tourism Victoria), Hamilton (Southern Grampians Shire Council).

Western Region Sustainable Water Strategy

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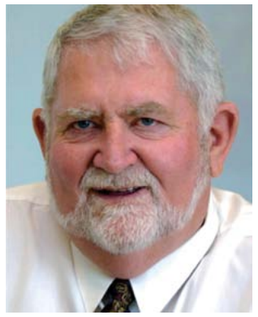
Consultative Committee Chair's foreword



The Western Region is large and diverse. We make up a third of the State, from the Otway Ranges to the southern Mallee. Our water resources, and the way they are used, are just as diverse. Those resources support remarkable environmental diversity and values in the region's rivers, creeks, wetlands and estuaries.

Communities across the Western Region suffered through the long dry years from 1997 to 2009 that affected the whole region but were felt the hardest further inland. These dry times were followed by the floods in 2010 and early 2011 – some of the biggest on record. Our farmers, industries, townships and the environment bore real hardship and stress during those years. However, they have bounced back. The rain brought damaging floods, but it refreshed the region's rivers and wetlands and eased the strain on farmers, towns and communities.

The Western Region Sustainable Water Strategy was prepared with these experiences in mind. Water is vitally important for our region. As a community, we work together to be better at managing and protecting our water resources, and this Strategy is an important part of our efforts.

The policies and actions in the Strategy will support resilient communities, strong industries and a healthy environment in the region over the next 50 years. They will ensure our region makes the most of its water resources and support water users to adapt successfully to changing conditions. The Strategy is designed to help the region cope with pressures from future drought and climate variability, population growth and land use changes.

The Strategy has been developed in consultation with the Western Region community, who showed their enthusiasm to be involved through 272 written submissions about the Draft Strategy. It draws on the expertise in government departments, urban and rural water corporations and catchment management authorities. We also sought the perspective of the region's Indigenous communities.

I met many people throughout the region during the development of the Strategy, and I thank them for their contributions. I heard their concern about pressures on water resources in different parts of the region as well as the invaluable knowledge they have about those resources. I also saw their desire to mange water well – to make the smartest use of it while protecting the environment too.

The Consultative Committee guiding the development of the Strategy sought to address these important concerns using that local knowledge. We went through the 272 submissions in detail and listened to people in public forums and other meetings to get a broader perspective about water in the region.

Many people contributed to this Strategy. In particular, I want to thank the Consultative Committee for their positive approach to the task and for their persistence though the many meetings where they contributed so fully and frankly to the robust debate about these important issues.

We sought to balance the security of supply for urban and rural users, environmental needs and the protection of water resources for future use. I am confident this Strategy takes significant steps towards achieving these goals. This was not a simple job, but I believe the Strategy will help us meet the challenges and grasp the opportunities ahead. I'm proud to have been a part of it, and of the Western Region.

Darryl Argall, AM
Chair, Western Region Sustainable Water Strategy Consultative Committee

Executive summary

The Western Region Sustainable Water Strategy identifies potential challenges for water management and opportunities to secure water resources for the next 50 years. It outlines policies and actions to ensure sustainable water supply and management over that period.

Consultation with regional water managers and the community helped to develop the policies and actions in this Strategy. The Consultative Committee received 272 written submissions about the Draft Strategy, which was released for comment in March 2010. These comments helped develop policies and actions to:

- ensure secure supplies for towns and industry;
- encourage economically viable and sustainable agriculture;
- support tourism, recreation and other social values; and
- protect and improve the health of rivers, wetlands, estuaries and aquifers.

The Western Region

The Western Region covers about one-third of the State extending from Colac and Lorne in the south-east to Ouyen in the north-west (Figure E.1). It has a diverse range of landscapes, climates, water resources and communities including the Otway Ranges with relatively reliable rainfall, the wet coastal fringe, the temperate western district and the semi-arid north-west. It includes the towns of Horsham, Stawell, Ararat, Hamilton, Warrnambool and Camperdown. The region contains the Avoca, Wimmera-Avon, Millicent Coast, Glenelg, Hopkins, Portland Coast, Corangamite and Otway Coast river basins and the southern half of the Mallee River Basin.

Managing the region's water resources into the future

This Strategy considers:

- pressures and risks to water availability (Part One);
- policies and actions to give water users, water corporations, environmental managers and communities the information and tools they need to respond to changes in water availability (Part Two); and
- how these policies and actions will be applied in the four sub-regions (Part Three):
  - Otways;
  - South-west Coast;
  - Western District; and
  - North-west.

Figure E.1 The Western Region

The Strategy at a glance

The policies and actions in the Strategy are designed to:

- provide increased certainty for water users and environmental managers;
- promote sustainable urban, industrial and rural water use; and
- protect and improve the health of waterways, aquifers, wetlands and estuaries.

Actions to increase certainty

- Recognising existing rights and confirming that permanent changes to existing entitlements cannot be made arbitrarily.
- Developing local management plans to manage licensed water use more responsively and document rules for sharing water in times of shortage.
- Monitoring water use outside the entitlement framework to assess the potential risks to water supplies.
- Managing the adverse impacts of significant land use change on water availability.

Actions to promote sustainable water use

- Making the best use of existing supplies.
- Exploring the potential to use alternative, fit-for-purpose supplies.
- Making more water available for sustainable use where it can be done without risk to existing water users or the environment, including:
  - 18 GL from pipeline savings in the Wimmera-Mallee supply system
  - surface water from unregulated streams for the winter-fill period, including:
    - » 3.5 GL in parts of the Otway Coast Basin
    - » 5.3 GL in parts of the Portland Coast Basin
    - » 2.6 GL in the Lake Colac catchment of the Lake Corangamite Basin
    - » 1.3 GL in parts of the Hopkins Basin
- Assessing the potential to make more water available from the deep Dilwyn (Lower Tertiary) Aquifer.

Actions to protect and improve region's waterways, aquifers, wetlands and estuaries

- Increasing and protecting the environment's share of water, including:
  - confirming the 83 GL of additional environmental water on average each year from the Wimmera-Mallee Pipeline
  - supporting-in-principle the commonwealth Government's buy-back of the Wimmera irrigation entitlements to provide another 28 GL per year.
- Adopting an adaptive and integrated management approach with complementary river restoration activities and a seasonally adaptive approach to make the best use of available water.

The Strategy outlines integrated approaches to manage groundwater resources, land use change and the Wimmera-Mallee supply system.

Improving groundwater management

- Better aligning the management of licensed groundwater use with the characteristics of each groundwater system.
- Developing local management plans to clearly specify rules for sharing groundwater in times of shortage and for water trading.
- Promoting sustainable use of the resource through trade and carryover of water from year to year, where possible.
- Undertaking strategic resource appraisals to determine if more groundwater can be made available for consumptive use.
- Using a risk-based approach to consider the needs of groundwater dependent ecosystems in management decisions.
- Protecting the health of groundwater resources with long-term, viable and cost-effective groundwater monitoring.

Managing the adverse impacts of significant land-use change on water availability

- Monitoring changes in the water balance caused by significant land use change.
- Amending the *Water Act 1989* to enable the Minister for Water to declare and manage "intensive management" areas to protect other water users and the environment.
- Recognising the rights to existing use in intensive management areas but controlling expansion of new forestry developments covering at least 20 ha or more than 10 per cent of a property, whichever is greater.
- Requiring approval for forestry developments greater than 20 ha or 10 per cent of a property in intensive management areas.
- Appointing regional committees to assess the need to declare areas and make recommendations to the Minister, with the first committee to consider the Crawford River catchment, the Stokes River catchment and the Glenelg Water Supply Protection Area, particularly around Lake Mundi.

Managing the Wimmera-Mallee Pipeline and the Wimmera-Glenelg system

- Clarifying how water from the pipeline will be shared between different users, particularly in times of shortage.
- Improving management of the system and clarifying the roles and responsibilities to maximise the benefits for users, the environment and recreation and to protect against future drought.
- Encouraging adaptive management and periodic reviews of the water sharing and operating arrangements to make the system more efficient.
- Improving reliability of supply from the pipeline and managing drought risks with a system reserve, carryover and trade.
- Making the best use of environmental water.
- Clarifying principles for providing water for recreational use in wet years and improving opportunities for recreation in the supply area.

Chapter overview

What is the Western Region Sustainable Water Strategy? (Chapter 1)

This Strategy is a key part of Victoria's water resource planning framework.

It examines the needs of the region's towns, industry, agriculture and the environment over the next 50 years and sets water resource management priorities and actions. The Strategy will guide the development, integration and implementation of local strategies and plans prepared by water managers in the region.

Chapter 1 describes the purpose of regional sustainable water strategies, the features of the Western Region, the guiding principles of the Strategy, the process used to develop it and how it will be implemented.

The Western Region's water resources, now and in the future (Chapter 2)

Better water management must be based on a sound understanding of how water is sourced, allocated and used in the region, and the pressures and risks those resources face.

Chapter 2 describes surface water and groundwater available in the region and how these resources are managed and used. It also describes the pressures and risks that future water management must address.

Water resources vary throughout the region. The south has relatively reliable rainfall, with conditions becoming drier to the north. The south and west of the region have good groundwater reserves. Supply systems transfer some of the water from areas with more reliable water resources to support towns, farms and industry in drier parts of the region.

Water available to towns, farms and industry in the Western Region is sourced from surface water (62 per cent of total water use), groundwater (37 per cent) and alternative supplies, such as recycled water (1 per cent) (Figure E.2).

Figure E.2a Proportion of water available for extraction in the Western Region

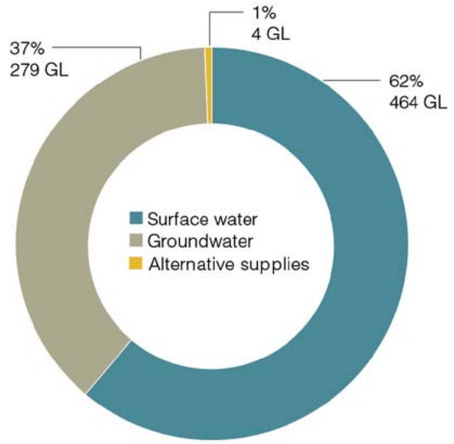


Figure E.2b Surface water available for different uses

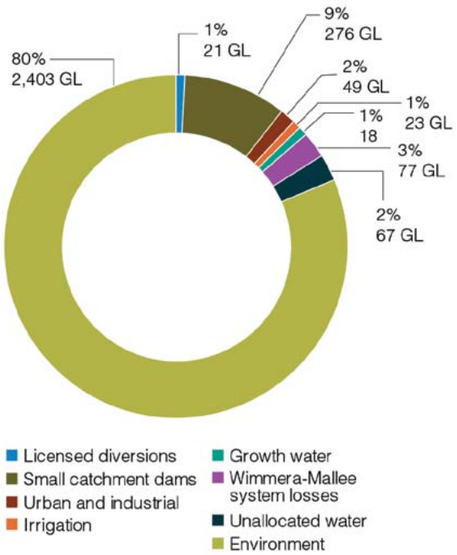
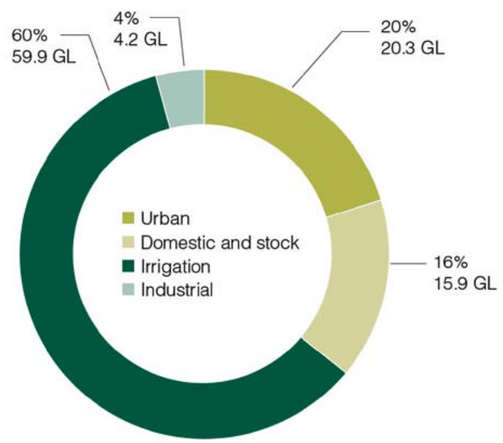


Figure E.2c Groundwater use



The exceptional climate conditions of the past 14 years were felt heavily in the region. During the prolonged dry period from 1997 to 2009, waterways were very stressed with flows up to 90 per cent lower than the long-term average. Water supplies in many inland areas were tested. Much of the north-west was spared the worst impacts by the early completion of the Wimmera-Mallee Pipeline. After 13 years of drought, heavy rain in 2010 and early 2011 lead to the highest floods on record in parts of the region.

Climate variability and drought creates uncertainty about future water supplies, particularly away from the wetter coastal areas. Water management needs to consider the risks associated with possible repeats of the climate of the past 14 years. Other pressures include increased demand from towns, agriculture and industry, and activities that intercept water before it reaches rivers and aquifers.

Promoting sustainable water management (Chapter 3)

Victoria's water resource management framework allocated water effectively for 100 years. However, the past 14 years have highlighted areas for improvement.

Chapter 3 outlines policies and actions to better manage climate variability and other pressures, and make the most from the region's water resources.

Greater certainty for water users and environmental managers

The Strategy recognises existing rights to water. Entitlements-holders have a secure right to a share of the available water in any year.

This Strategy strengthens the water entitlement framework by:

- better aligning management of licensed groundwater use with the characteristics of each groundwater system (Chapter 4);
- monitoring and managing the adverse impacts of significant land use change on water availability (Chapter 5); and
- establishing local management plans to clearly document water sharing arrangements and allow management of licensed water use to be more responsive and adaptable to local conditions (see Section 3.1.3).

Promoting sustainable water use

The Strategy promotes sustainable use of the region's surface and groundwater resources based on:

- better understanding the risks to those resources, including climate variability;
- using current water supplies as efficiently as possible; and
- allocating more water where it is available under existing caps and the risks to third parties are low.

Efficient use of existing supplies will be encouraged by:

- continuing to promote water efficiency by urban, industrial and rural users;
- promoting fit-for-purpose use of alternative sources, such as recycled water and stormwater;
- exploring opportunities to improve storage capacity by, for example, using off-stream storages or aquifers;
- investigating options for section 51 take and use licence-holders to harvest high flows in unregulated waterways year-round; and
- encouraging water users to trade or carryover water from year to year to manage the risk of changing water availability.

The Strategy outlines principles for managing unallocated water to balance economic potential and protection of existing users and the environment. Groundwater is available in some areas under existing permissible consumptive volumes. Additional groundwater may be made available if future resource appraisals confirm it can be extracted sustainably. Unallocated water for winter-fill extraction remains available in some unregulated streams.

The Strategy promotes sustainable regional development by:

- adopting a balanced approach to releasing unallocated water for consumptive use in stages through competitive processes where possible;
- releasing the remaining 18 GL set aside from water savings for new growth in the Wimmera-Mallee supply system;
- assessing the potential to make more water available from the deep Dilwyn (Lower Tertiary) Aquifer; and
- using a precautionary approach to identify 12.7 GL of unallocated water in unregulated waterways available for winter-fill use.

Improving reliability of supply

The Strategy builds on the experience from drought and floods during the past 14 years to improve the reliability of supply for urban and rural water users under different climate conditions.

Urban water users

- Urban water corporations will review their water supply-demand strategies by March 2012 following consultation with the community and customers to determine the agreed levels of service under different conditions.
- Together with the Government's response to the Ministerial Advisory Council's Roadmap and Implementation Plan, this will protect the reliability of urban water supplies.

Large industrial water users

- Large industries, such as mining and electricity generation, are unlikely to drive significant changes in demand in the region in the next 10 years. These potential demands will be managed by water corporations as they arise.
- Other industrial users, such as food processing industries, may expand, and this will be helped by several actions in the Strategy.

Agricultural water users

- Of the region's agricultural industries, the most likely to grow are dairying in the south-west and other high value industries closer to urban areas. This growth will rely on access to water for dairy wash-down and other purposes. The Strategy supports this growth with actions to facilitate access to these smaller volumes through new allocations or trade.
- The Strategy includes actions to improve reliability for domestic and stock water users, including trade opportunities in the Wimmera-Mallee supply system (see Chapter 6). The more comprehensive approach to managing groundwater (see Chapter 4) will also help to protect domestic and stock supplies.

Protecting the region's environment

The region's waterways, floodplains, wetlands and estuaries provide social, cultural and environmental benefits to the community throughout the region. However, they are at risk from climate variability in many areas. In addition to specific actions in the sub-region chapters, the Strategy will protect the region's environment by:

- safeguarding the environment's existing share of water;
- documenting rules for managing section 51 take and use licences through local management plans (see Section 3.1.3);
- improving the way groundwater dependent ecosystems are considered in licensing decisions (see Section 4.4.2);
- managing water interception by land use changes (see Chapter 5);
- establishing precautionary caps on consumptive use from unregulated rivers by balancing likely future agricultural demands, the interests of existing users and protection of high environmental, recreational and tourism values; and
- making the best use of environmental water through integrated and adaptive management and complementary works.

Involvement of Traditional Owners

Traditional Owners and Indigenous communities have a strong link to the region's water resources. Their views, perspectives and knowledge will be utilised better by:

- building their capacity to contribute to water management processes and decisions; and
- ensuring effective consultation when developing the new regional strategies for healthy rivers, wetlands and estuaries.

Making the best use of the region's groundwater resources (Chapter 4)

Better understanding of the State's groundwater resources gained over the past 20 years gives an opportunity to improve the way those resources are managed.

Groundwater is an important resource in many parts of the region, particularly during droughts such as between 1997 and 2009. With increased interest in using groundwater, management needs to be improved to balance the needs of current and future users and the environment. Chapter 4 outlines a new framework for managing groundwater throughout Victoria.

The key element of this new approach is managing whole groundwater systems rather than areas of intensive water use. Groundwater management boundaries will be aligned with these systems to cover all parts of the State. This will allow each aquifer to be managed based on the major influences on that groundwater system. Short-term variability in groundwater systems will be managed by using restrictions, rosters or bans.

Water users will have more ways to manage the risk of future variability in groundwater supplies including water trade and, where possible, the ability to carryover unused water from year to year. Trade will be facilitated by:

- managing and zoning groundwater systems;
- removing water supply protection area restrictions where they are no longer needed; and
- documenting trading rules in local management plans.

The Strategy defines risk-based principles to protect high value groundwater dependent ecosystems.

Additional groundwater may be made available in the future. Ongoing strategic assessments will assess the capacity and ability of aquifers to provide additional supplies.

Management will be supported through a program of works to upgrade and refine the groundwater monitoring network. A process will be established to secure ongoing funding for future maintenance and renewal of this network.

Managing adverse water resource impacts from land use change (Chapter 5)

In the past, changes in land use and vegetation cover were thought to have negligible impacts on water availability. In some situations, this is no longer the case – these changes can affect other water users and the environment, particularly during dry periods.

Chapter 5 outlines the policy framework for managing the impacts of land use changes on water resources in Victoria. This framework includes three elements:

- getting the best estimates of water use by vegetation, tracking changes over time and including these estimates in water accounting;
- changing the *Water Act 1989* to enable the Minister for Water to declare and manage 'intensive management' areas to protect other water users and the environment; and
- recognising the rights to existing use in intensive management areas but controlling expansion of new forestry developments covering at least 20 ha or more than 10 per cent of a property, whichever is greater.

Intensive management areas will be declared in consultation with water users, water and environmental managers, industry stakeholders and the community. The Minister for Water will appoint a regional committee to assess the need to declare an area, and will make a decision based on the committee's advice. A regional committee will be established to consider declaring all or part of three priority areas: the Crawford River and Stokes River catchments, and the Glenelg Water Supply Protection Area, particularly around Lake Mundi.

Only landholders in intensive management areas will be affected by this policy. Even then, most landholders in these areas will not be affected because their existing land use will be recognised and they can plant 20 ha or 10 per cent of a property, whichever is greater, to farm forestry or native re-vegetation without restriction.

This approach establishes a mechanism to protect water rights and the environment where they are at risk, without imposing unnecessary costs on landholders, the community and industry.The policy framework is compatible with the approaches being developed in South Australia and consistent with the National Water Initiative.

The Wimmera Mallee pipeline and the Wimmera Glenelg system (Chapter 6)

The Wimmera-Mallee pipeline brings many benefits, including much more reliable and higher quality supply to towns, domestic and stock users, industry and the environment. The pipeline system will be managed to fully realise these benefits.

Chapter 6 explains how the water savings from the pipeline will be shared, particularly during dry times, and how the system will be managed and operated. It includes actions to:

- ensure clear roles and responsibilities for operating the system; and
- improve the operating efficiency to be prepared for prolonged dry conditions in the future.

The Strategy promotes sustainable use of water in the supply system by facilitating the staged sale of the growth water and establishing a mechanism to sell and buy tradeable water allowances.

The Strategy confirms the environment's share of water savings from the pipeline – 83 GL each year on average. The benefits of this water will be maximised with adaptive management and by:

- using structural works and carryover; and
- integrating management of releases for consumptive use with environmental flows, whenever possible.

The Victorian Environmental Water Holder will manage the environmental entitlement for the Wimmera and Glenelg rivers to deliver the best outcomes and review the benefits of separating the entitlement.

Water savings from the pipeline will support recreation opportunities in rivers, weir pools and lakes throughout the area.

The Strategy supports-in-principle the Commonwealth Government's purchase of the Wimmera irrigation entitlements. This will improve environmental flows in the Wimmera River and in lakes with high recreation, amenity and environmental values.

The operation of the bulk entitlements and system management arrangements will be reviewed after three years of experience in operating the new pipeline system.

Sustainable water management in the sub-regions (Chapters 7 to 10)

Given the diversity throughout the region, the Strategy provides a snapshot of the water management challenges and opportunities facing the four sub-regions – the Otways, the South-west Coast, the Western District and the North-west.

These chapters give an overview of the resources in each sub-region and identify ways to improve supply reliability and protect the environment.

Delivering the Strategy (Chapter 11)

Chapter 11 outlines how the Strategy will be implemented. Each action identifies the organisation(s) responsible and timeframe for progressing the action. Implementation will be monitored over the next 10 years, with the Strategy reviewed by 2021.

The Otways

A heavily forested area with highly valued national parks and rivers supporting a major tourism industry. Most private land is used for dairying and grazing. Surface water and groundwater are relatively plentiful and reliable, and supply cities and towns in surrounding areas.

Improving reliability of supply

- Updated water supply-demand strategies for urban supplies by March 2012, including agreed levels of service, an annual water supply outlook and an atlas of alternative supplies.
- Local management plans for more responsive management of licensed surface water and groundwater use.

Protecting the environment

- Precautionary caps on unregulated rivers to protect high environmental, recreation and tourism values.
- Investigating options to improve summer environmental flows on the Gellibrand River.

Western District

A mainly broadacre grazing and cropping landscape with many wetlands. Forestry is concentrated in a few high rainfall catchments. The main sources of water are domestic and stock dams and groundwater bores. Large storages in the Grampians capture water to supply the Wimmera-Mallee.

Improving reliability of supply

- Updated water supply-demand strategies for urban supplies by March 2012, including agreed levels of service, an annual water supply outlook and an atlas of alternative supplies.
- Managing land use changes in the Glenelg Water Supply Protection Area, particularly around Lake Mundi.

Protecting the environment

- Improving the management of the Woady Yaloak Diversion Scheme to restore Lake Corangamite
- Balancing water-sharing between the Wimmera and Glenelg rivers.

South-west Coast

Relatively plentiful water supporting towns, dairying, grazing, forestry and heavy industry. Strong population growth expected in coastal centres.

Improving reliability of supply

- Updated water supply-demand strategies for urban supplies by March 2012, including agreed levels of service, an annual water supply outlook and an atlas of alternative supplies.
- Assessing the potential for staged development of the Dilwyn (Lower Tertiary) Aquifer.
- Balanced release of available unallocated water on unregulated rivers to provide for growth while protecting high environmental, cultural and tourism values.
- Managing land use changes in the Crawford and Stokes catchments and the Glenelg Water Supply Protection Area.

Protecting the environment

- Local management plan for the Merri River to formalise water-sharing and improve environmental flows.
- Precautionary caps on waterways to account for plantation water use.
- Preserving cultural values of Lake Condah by formalising water management arrangements in a local management plan.

North-west

A large area supporting grazing and broadacre cropping. It contains many wetlands, including nationally and internationally important lakes. Streamflows vary greatly from year to year. The Wimmera-Mallee Pipeline (see Chapter 6) and groundwater (to the west) provide reliable water supplies.

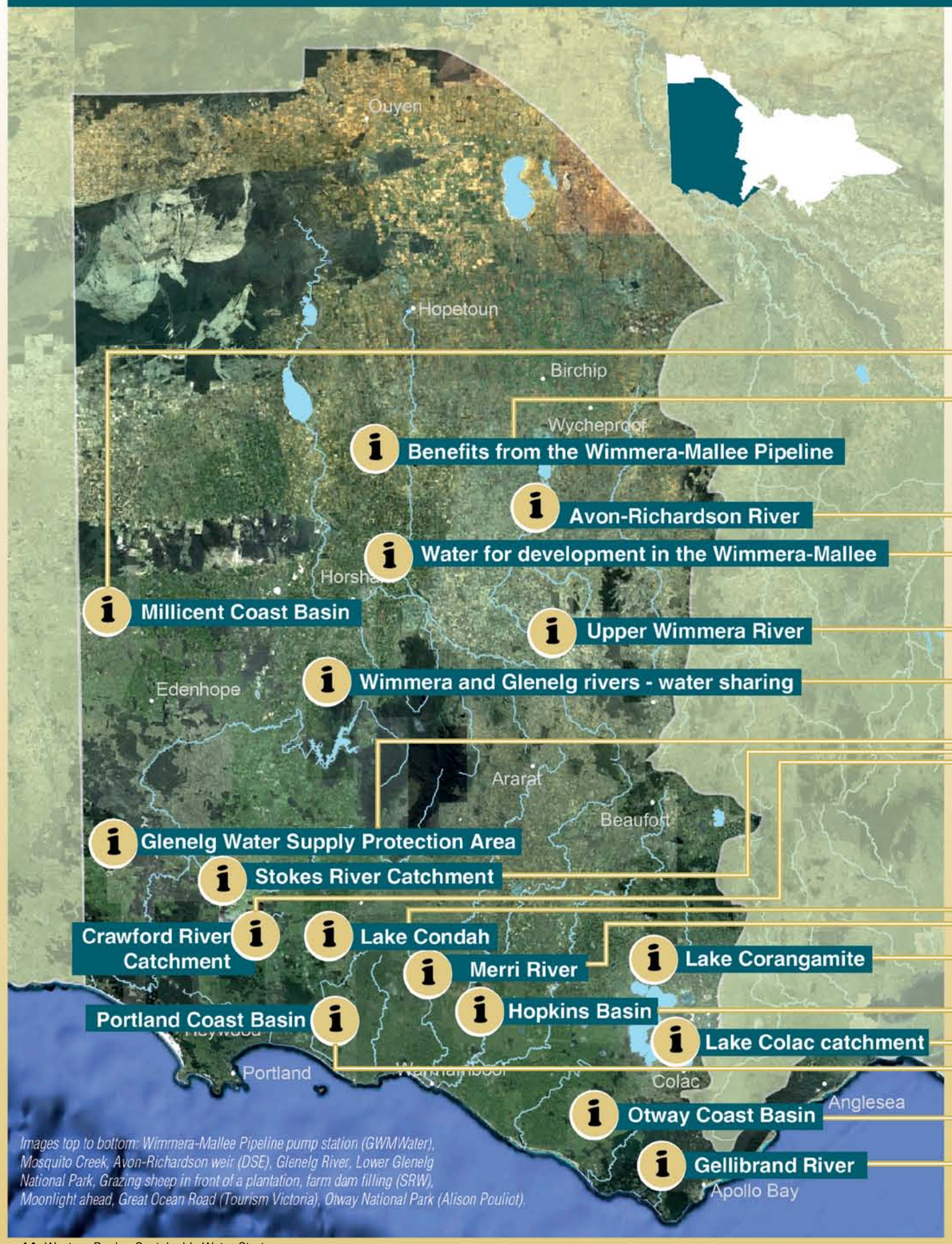
Improving reliability of supply

- Updated water supply-demand strategies for urban supplies by March 2012, including agreed levels of service, an annual water supply outlook and an atlas of alternative supplies.
- Release of 18 GL of Wimmera-Mallee Pipeline growth water.
- Local management plans to facilitate better management of the Upper Wimmera and Avon-Richardson rivers.
- Clarifying roles and responsibilities for managing the Wimmera and Mallee catchments under the Murray-Darling Basin Plan.

Protecting the environment

- Confirming 83 GL each year for the environment from the Wimmera-Mallee Pipeline and supporting-in-principle the Commonwealth Government's buy-back of 28 GL of Wimmera irrigation entitlements.
- Victorian Environmental Water Holder managing the Wimmera-Glenelg environmental entitlement.
- Capping extractions from Mosquito Creek and other waterways in the Millicent Coast.

Strategy at a glance



Images top to bottom: Wimmera-Mallee Pipeline pump station (GWMWater), Mosquito Creek, Avon-Richardson weir (DSE), Glenelg River, Lower Glenelg National Park, Grazing sheep in front of a plantation, farm dam filling (SRW), Moonlight ahead, Great Ocean Road (Tourism Victoria), Otway National Park (Alison Pouliot).

Key elements of the Strategy

- Providing increased certainty to water users and the environment
- Promoting sustainable water use
- Protecting and improving the health of waterways, aquifers, wetlands and estuaries

More benefits from the **Wimmera-Mallee Pipeline**
- Sharing water savings for environmental, economic and social benefits
- System reserve and carryover for more resilience to dry conditions
- More opportunities for rural water users to trade water
- Improving the efficiency of operating the supply system
- **83 GL** for the environment on average with potential for **28 GL** more from Wimmera irrigation entitlements

Protecting waterways in the Millicent Coast Basin by capping licensed extraction

18 GL from pipeline water savings for new growth in the Wimmera-Mallee supply system

Local management plans to improve management of the **Upper Wimmera and Avon-Richardson rivers**

Balancing water-sharing between **Wimmera and Glenelg rivers**
- Victorian Environmental Water Holder managing environmental flows
- Where possible, using consumptive water *en route* for environmental benefits

Managing **land use changes** in the Crawford and Stokes catchments and the Glenelg Water Supply Protection Area

Lake Condah - Local management plan to improve flow management to preserve cultural values

Merri River - Balancing security of supply and environmental flows

Restoring Lake Corangamite - Works to improve flows into the lake

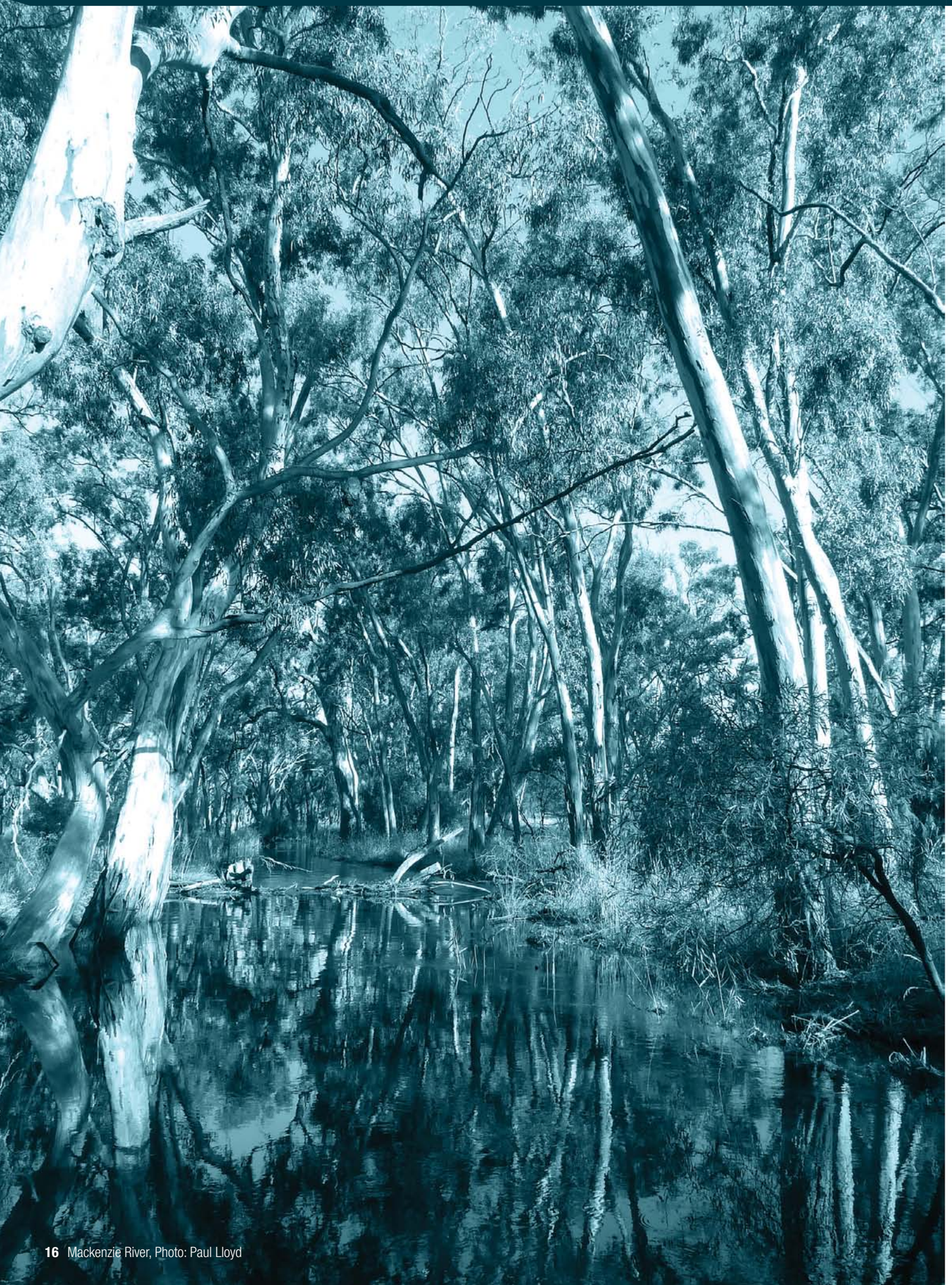
1.3 GL for winter-fill use from waterways in parts of the Hopkins Basin

2.6 GL for winter-fill use from waterways in the Lake Colac catchment

5.3 GL for winter-fill use from waterways in parts of the Portland Coast Basin

3.5 GL for winter-fill use from waterways in parts of the Otway Coast Basin

Gellibrand River - Investigating improved environmental flows



16 Mackenzie River, Photo: Paul Lloyd

What is the Western Region Sustainable Water Strategy?

Guide to this chapter

Key points of this chapter

- This Strategy aims to secure water supplies and protect water resources and the environment for the future. It sets out actions to ensure water entitlements are secure and provides more choice and flexibility for entitlement-holders to manage the risks imposed by drought and climate variability.
- The Western Region covers about one-third of Victoria and includes a diverse range of landscapes, climates, water resources and communities.
- The Strategy is the result of a three-year collaborative process involving government departments, independent experts, key stakeholders in the water industry and the broader regional community.

1.1 The Western Region Sustainable Water Strategy – vision and guiding principles

Vision for the Western Region's water future

The Western Region community will work together to achieve a future where healthy rivers, lakes, estuaries and aquifers support a healthy environment and regional prosperity, providing water security for individuals, agriculture, industry and the environment, and access to water resources for the benefit of current and future generations.

Guiding principles

The following principles have been used to guide the development of the Western Region Sustainable Water Strategy. These principles take into account the need to be prepared for a future with variable water availability by providing a flexible and adaptive approach to water management. They guide the actions in this Strategy to maximise benefits for all water uses, the regional economy, the community and the environment, while recognising existing rights.

All policies and actions outlined in this Strategy have been assessed against these principles.

1. Maximising efficiency and seeking multiple benefits

- Water is scarce and will be accessed and used as efficiently and effectively as possible to maximise the benefits for water users, the environment and the broader community.
- Strategy actions target multiple benefits – economic, social and environmental.

2. Shared responsibility and shared benefit

- Everyone needs to act to secure water.
- All entitlement-holders, including rural and urban water users and the environment, need to share the risk of reduced water availability and other risks.
- Overall community benefits will be maximised, and the costs and benefits of managing water will be shared fairly between all groups now and in the future.
- All stakeholders will be treated equitably.

3. Recognising existing rights and entitlements

- Water entitlements to a share of the available resource will remain secure with legal tenure that is certain and protected.
- The amount of water provided by water entitlements will vary from year to year depending on how much is available in that year. This will depend on climate variability and other risks such as bushfires.
- Any material third party impacts from Strategy actions will be defined and minimised, mitigated, offset or compensated by the beneficiary.
- In defining impacts on existing rights, the assessment will be appropriate to the magnitude of the impact and accuracy of information available.

4. Allowing individuals to manage their own risk and exercise their choices

- As far as possible, risk will be the responsibility of those best equipped to manage it. In most cases, this will be individual entitlement-holders.
- Strategy actions aim to maximise the ability of entitlement-holders to manage their own risk.
- Strategy actions facilitate informed decision-making and maximise the ability of individuals to exercise choice.

5. Being prepared without acting prematurely

- Strategy actions are robust under all water availability scenarios.
- Strategy actions address the risks associated with climate variability and avoid unacceptable costs if this doesn't occur.
- Ongoing monitoring and evaluation will facilitate adaptive management to ensure that the Western Region is prepared to respond to conditions in the future as they unfold.

6. Maintaining healthy environments and maximising environmental outcomes

- Strategy actions, when considered together, result in net benefits to the community and, where possible, environmental gain.
- Strategy actions seek opportunities to improve water delivery and outcomes for the environment.
- Strategy actions, when considered together, maintain healthy waterways and estuaries.

7. Socially responsible decision-making

- Decisions about water resource management will be socially responsible and consider economic, social, public health and environmental impacts.
- Decisions about water resource management will include meaningful engagement with Indigenous people and provide opportunities to develop their skills to be effective partners in managing the region's water resources.
- Decisions about water sharing will be equitable and consider community values identified through the Strategy's consultation processes, which will be open and transparent.
- Strategy actions are transparent in terms of the benefits gained or costs imposed (that is, trade-offs).
- Decisions about water sharing will consider impacts at all scales, including on:
  - individuals;
  - businesses (farm and non-farm); and
  - local, regional and State communities.
- Strategy actions are based on a precautionary approach to managing water resources.

1.2 Role of regional sustainable water strategies

Sustainable water strategies cover the four regions of Victoria: Western, Northern, Gippsland and Central regions. These strategies take a long-term view of water resource planning, considering all sources of water and the needs of towns, industry, agriculture and the environment. They guide the development, integration and implementation of management plans prepared by water corporations and catchment management authorities operating within each region.

Sustainable water strategies fulfil Victoria's commitment to the National Water Initiative to carry out open, statutory-based water planning.

Under the *Water Act 1989*, the role of sustainable water strategies is to identify:

- threats to the reliability of supply and quality of water for both environmental and consumptive uses in the region;
- ways to improve and set priorities for improving the reliability of supply and quality of water for existing and future consumptive users; and
- ways to improve, protect and increase the environmental water reserve to improve the environmental values and health of water ecosystems.

The Western Region Sustainable Water Strategy aims to:

- identify and understand challenges to water availability and quality, including the implications of climate risk and climate variability;
- help regional communities to manage dry periods;
- ensure secure entitlements for towns, industry and the environment;
- secure reliability of supply for economically viable and sustainable agriculture;
- improve choice and flexibility for entitlement-holders to manage climate risks, floods and drought;
- protect and improve the health of rivers, wetlands and aquifers from the impacts of climate risk and variability and other risks; and
- recognise and respond to Indigenous and other cultural and heritage values associated with the region's rivers and catchment areas.

1.3 The Western Region

The Western Region Sustainable Water Strategy considers the Western Region as extending from the southern Mallee in the north to the south-west coast, and from the Victoria/South Australia border in the west to the Avoca, Corangamite and Gellibrand rivers to the east (see Figure 1.1).

The region includes the Avoca, Wimmera-Avon (including the Avon-Richardson River), Millicent Coast, Glenelg, Portland Coast, Hopkins, Lake Corangamite and Otway Coast river basins and the southern half of the Mallee river basin.

It includes a diverse range of landscapes, communities, climate and water resources.

Major towns include Horsham, Stawell, Ararat, Hamilton, Warrnambool and Portland.

The region's population is about 400,000, and this is predicted to increase to about 441,000 by 2031. Population data used in this Strategy is based on *Victoria in Future*[a] estimates, adjusted for Census-based population estimates.

The region supports a significant and varied agricultural sector, including dairy, cropping, grazing and forestry, as well as associated processing industries. Recreation and tourism industries are important, and energy and mining industries are being established in some areas.

The Western Region has many significant rivers, estuaries and wetlands, including the Ramsar-listed Western District Lakes (centred on Lake Corangamite) and Lake Albacutya, and Lake Condah.

Figure 1.1 The Western Region

[a] 2008 projections from Department of Planning and Community Development.

Southern Rural Water and Grampians Wimmera Mallee Water (GWMWater) manage groundwater and rural water supplies. Wannon Water and GWMWater manage urban supplies and wastewater services in the south-west and north-west of the region, respectively. Three other urban water corporations operate in the region:

- Central Highlands Water provides services to Avoca, Amphitheatre, Beaufort, Landsborough, Navarre and Redbank.
- Coliban Water provides services to Borung, Korong Vale, Wedderburn and Wychitella.
- Barwon Water provides services to Colac, Lorne, Apollo Bay, Skenes Creek, Aireys Inlet and Fairhaven.

The Glenelg Hopkins, Wimmera, Corangamite, Mallee and North Central catchment management authorities are responsible for floodplain management and protecting and improving the health of waterways in the region.

Figure 1.2 Sub-regions considered in this Strategy

Given the diversity in landscapes, community, climate and water uses in the region, the Strategy firstly considers the policies and actions that will apply to the whole region (Part Two) and then considers how these policies and actions will be applied to the four sub-regions (Part Three). These sub-regions are (see Figure 1.2):

- **Otways** (Chapter 7) – a heavily forested area from Anglesea to Peterborough with relatively high rainfall and good groundwater resources (Note: the Barwon River catchment is not in the Western Region and was included in the Central Region Sustainable Water Strategy);
- **South-west Coast** (Chapter 8) – has relatively plentiful water with significant demand, a growing population and relatively reliable groundwater resources;
- **Western District** (Chapter 9) – an inland area with variable water supply; groundwater resources are limited by salinity, and water use is dominated in some places by farm dams; and
- **North-west** (Chapter 10) – has scarce water supply and ephemeral river flows, placing greater demand on groundwater, which is of variable quality. Diversion from the Glenelg River and the Wimmera-Mallee pipeline has secured water supplies for a large part of the area.

1.4 Development of the Strategy

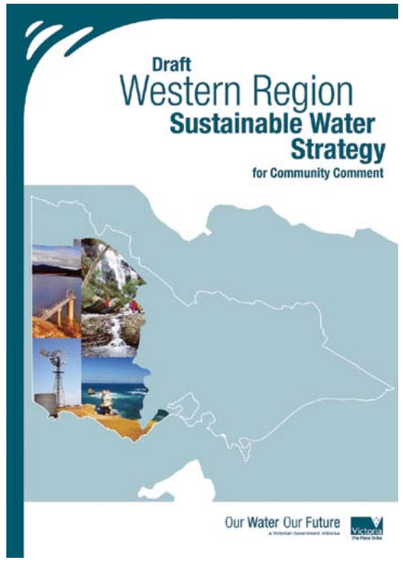
The Western Region Sustainable Water Strategy is the result of a three-year collaborative process involving government departments, independent experts, key water industry stakeholders including urban, rural and environmental water users, and the broader regional community (see Figure 1.3).

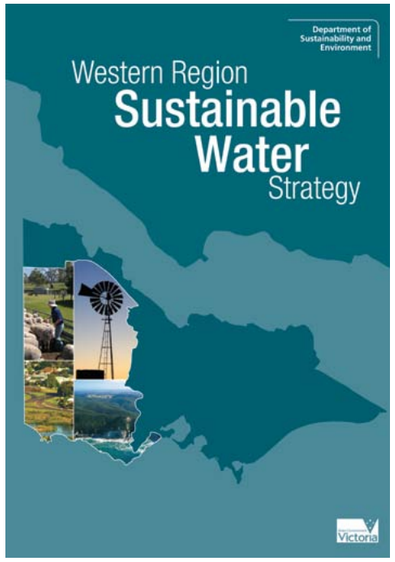
The Minister for Water appointed a Consultative Committee of regional stakeholders to provide strategic guidance, advice and oversight of the Strategy's development (see Table 1.1).

The committee met 22 times between October 2008 and August 2011. Its deliberations helped shape the required technical work and provided local perspective on the Strategy's consultation, option development and assessment process.

In addition to the Department of Sustainability and Environment and the Department of Primary Industries, government agencies that helped develop the Strategy include the Department of Premier and Cabinet, the Department of Treasury and Finance, Regional Development Victoria, Environment Protection Authority Victoria and the Department of Planning and Community Development.

Figure 1.3 How the Western Region Sustainable Water Strategy was developed





	1. Draft Strategy: March 2010	2. Final Strategy: November 2011
Documentation	• provides resource review and outlook • assesses potential responses based on guiding principles • outlines the Government's proposals for community comment • incorporates feedback provided by Consultative Committee members	• incorporates feedback provided in public submissions to the Draft Strategy • outlines the Government's committed actions to secure the region's water future over the next 50 years • includes an implementation plan, and the timing and level of investment of key actions
Consultation	**March – June 2010** • Public consultation period including: • submissions period • stakeholder information sessions	

Table 1.1 Consultative Committee members

Independent Chair	**Darryl Argall**
Government departments	
Department of Sustainability and Environment - Western Region Department of Primary Industries	Campbell Fitzpatrick Ian Hastings Terry Lewis
Catchment management authorities	
Wimmera CMA Corangamite CMA Glenelg Hopkins CMA North Central CMA Mallee CMA	Marc Thompson, David Brennan Don Forsyth, Gareth Smith Peter Butcher, Kevin Wood Damien Wells Jenny Collins
Water corporations	
Grampians Wimmera Mallee Water Wannon Water Southern Rural Water Central Highlands Water Barwon Water	Jeff Rigby Grant Green Graham Hawke Neil Brennan Michael Malouf
Local government	
Great South Coast Municipal Group North West Municipalities Association	Paul Younis, Richard Perry James McKay
Industry and environment	
Environment Victoria Victorian Farmers Federation (North West) Victorian Farmers Federation (South West) Victorian Association of Forest Industries	Juliet LeFeuvre Ian McEwen Basil Ryan Philip Dalidakis, Lisa Marty
Observers	
Western Coastal Board South East Natural Resources Management Board (SA) Department of Water, Land and Biodiversity Conservation (SA) National Water Commission	Steve Blackley Hugo Hopton, David Williamson Drew Laslett Murray Radcliffe, Nigel Hayball

Allocations and licensing, land use change and urban working groups supported the Committee. Membership of these groups included regional water corporations and catchment management authorities, farmers, peak industry representatives, local environment group members and relevant State Government agencies. Collectively these groups met 18 times between December 2008 and September 2009 to assess issues and identify options for the Committee to consider.

Traditional Owner groups throughout the Western Region (see Table 1.2) were consulted as part of developing the Strategy. Each group has its own unique way of operating and its own issues and aspirations, but several key points were consistently made about future water management in the region, including:

- the importance of health of Country; and
- ensuring that Traditional Owners are active participants in managing water.

Feedback from Traditional Owner groups through this engagement has been incorporated into the development of the Final Strategy. Further information on the issues, concerns and aspirations raised by Western Region Traditional Owners can be found online in Technical Reports 2a and 2b.

Table 1.2 Indigenous groups consulted in the development of the Strategy

Gunditj Mirring[a]	Ballarat and District Aboriginal Co-operative[c]
Barengi Gadjin Land Council[a]	Brambuk Incorporated[c]
Martang[b]	Wadda Wurrung Aboriginal Corporation[c]
Dja Dja Wurrung[b]	Worn Gundidj Aboriginal Co-operative
Framlingham Aboriginal Trust[c]	Windamara Aboriginal Co-operative
Victorian Indigenous Seafood Committee	

Notes:
[a] Traditional Owner group and Registered Aboriginal Party (RAP)
[b] RAP
[c] RAP applicant

Broader consultation with the Western Region community was based on the release of the Draft Strategy in March 2010. A series of meetings were held during the three months in which the Draft Strategy was open for public comment, including:

- public forums in Colac, Warrnambool, Hamilton and Horsham;
- meetings with VFF branches in Larpent, Cobden, Koroit, Heywood, Lake Bolac, Edenhope and Warracknabeal;
- meetings with other landholder groups in Port Fairy, Cressy, Horsham and Wallacedale;
- briefings with local government (including the Municipal Association of Victoria);
- a plantation industry forum organised by the Victorian Association of Forest Industries; and
- briefings for boards and customer committees of water corporations and catchment management authorities.

The Consultative Committee received 272 written submissions about the Draft Strategy. These provided a range of perspectives from the irrigation, environment, tourism, cultural and industry sectors.

1.4.1 Assessing potential responses

The consultation processes helped to identify, filter and progress key proposals (from the Draft Strategy) into the actions and policy commitments in this Strategy (see Figure 1.4). In particular, deliberations by the Consultative Committee and working groups helped to assess each option against the Strategy's guiding principles and identify where further hydrological modelling and socio-economic data was needed.

An Independent Panel was appointed by the Minister for Water to consider public submissions and other feedback from the consultation program. Appendix 1 provides more information about the Independent Panel's role and outlines the Government's response to its key findings on the Draft Strategy submissions. Public submissions and the Panel report are available at: http://www.water.vic.gov.au/programs/sws/western/draft-strategy-submissions.

This final Strategy incorporates feedback from the public meetings and submissions, as well as comments and recommendations from the Independent Panel.

Gulgurn Manja Shelter, Mount Difficult, Grampians Photo: Tess Paproth

1.5 Implementation of the Strategy

This Strategy enables water managers to adapt and make the best use of the water that is available. It does not rule out future opportunities. It aims to help Western Region communities be prepared for the risks of climate variability and drought without forgoing opportunities to improve the viability, resilience and vitality of the region.

The Strategy sets out a broad range of actions and policies that together provide an implementation plan. It includes a general description of each action or policy and statements outlining how each one will be implemented, who will be responsible for delivering it, the timeframe in which it will be completed and the benefits of the action or policy.

Figure 1.4 Process to develop Draft Strategy proposals into Strategy actions

Reference Guide 1: Water Entitlements

Tier 1 - Rights held by Crown

Water entitlements are defined in the *Water Act 1989* and are issued by the Minister for Water. A water entitlement is the amount of water authorised to be stored, taken and used by a person under specific conditions. Associated entitlements set conditions for water delivery or use.

Tier 2 - Rights to authorities

Environmental water reserve*

- Environmental entitlements
- Obligations on consumptive entitlements
- 'Above cap' water

Bulk entitlements

- Source bulk entitlements
- Delivery bulk entitlements

* The Environmental Water Reserve can also include water shares

Environmental water reserve (EWR)

The EWR is the legally recognised amount of water set aside to meet environmental needs. The objective of the EWR is to preserve the environmental values and health of water ecosystems.

Environmental entitlements are generally identical in nature to bulk entitlements. They provide for a share of the available resource.

Obligations on entitlements include the passing flows that water corporations or licensed diverters are obliged to provide out of storage or past a diversion point. The portion of passing flows that is provided to meet environmental needs is considered a part of the EWR.

'Above cap' water includes water that is left over after limits on diversions have been reached and unregulated flows which cannot be kept in storage. Most of the EWR is comprised of 'above cap' water, and this component is most susceptible to climate change.

Bulk entitlements

Held by water corporations with secure tenure in perpetuity. They provide the right to water for system operations, seasonal allocations and other rights and obligations.

Source bulk entitlements provide a share of inflows, storage capacity (if applicable) and releases.

Delivery bulk entitlements provide a set volume of water each year, subject to defined restrictions during periods of water shortages.

Tier 3 - Rights granted to individuals

Rights to water

- Water shares
- Section 51 licences
- Section 8 rights
- Supplies to urban customers
- Supplies by agreement

Associated entitlements

- Delivery shares
- Water-use licences
- Section 67 licences

Water shares have secure tenure held in perpetuity. A share of the available resource in most regulated systems is allocated annually (through seasonal allocations), which can then be ordered to a specified location, at a specified time and rate.

Section 51 take and use licences allow for diversions from unregulated (and some regulated river systems) and extractions of groundwater. Licences are issued for a specified volume, period of time and with a range of conditions.

Section 8 rights provide for an individual to take and use water from a range of surface and groundwater sources for domestic and stock use under certain circumstances without a licence.

Supplies to urban customers must be provided by water corporations throughout their defined districts.

Supplies by agreement are arranged by water corporations to provide water outside of defined districts, and recycled and drainage water in special circumstances.

Delivery shares provide for water to be delivered to land in an irrigation district via a channel. Delivery shares are linked to delivery infrastructure and stay with the property if the water share is traded.

Water-use licences allow an irrigator to use water to irrigate land up to an annual use limit.

Section 67 licences provide for the construction and operation of a groundwater bore or any works on a waterway, such as a private pump or dam, when a section 51 licence is required.

Reference Guide 2:

Limits on water entitlements

It is important that water allocation and diversions do not reduce reliability of supply for other entitlement-holders or impact on important environmental values. There are a range of tools to limit water entitlements to achieve this.

The Murray-Darling Basin Cap limits the volume of surface water that can be diverted from each of the basin's major rivers. The limit is set at the volume that was diverted under the 1993/94 levels of development. As a result, Victoria does not issue any new entitlements or licences unless water is created from water-saving projects. Allocations to existing entitlements must remain below the Cap.

Permissible consumptive volumes (PCVs) are the maximum volume of water that can be used for consumptive purposes for groundwater or surface water. PCVs are progressively being set for all groundwater management areas and water supply protection areas. For these areas, licences are not issued if the PCV is already reached or if licences would cause it to be exceeded.

Sustainable diversion limits (SDLs) limit water use in unregulated systems. They prevent the issuing of summer licences and determine the upper limit on winter-fill diversions, beyond which there is an unacceptable risk to the environment. SDLs have been set for 1,584 sub-catchments across Victoria. They determine if a licence can be traded from one sub-catchment to another.

Key processes to change entitlements

To protect the integrity of Victoria's entitlements, the *Water Act 1989* outlines clear, consultative processes that must be undertaken before entitlements can be changed.

Permanent changes

15-year review of water resources

A water resource assessment must be undertaken every 15 years to identify if there has been any long-term reduction in water availability and whether this has fallen disproportionately on water users or the environment. It will also identify any flow-related deterioration in waterway health. If either is the case, a review must be undertaken to determine the appropriate action considering social, economic and environmental values. This could include a permanent change to entitlements. The first 15-year review is due in 2019.

Management plans for water supply protection areas

In highly stressed groundwater and unregulated river systems, a management plan can be used to change conditions on section 51 licences to ensure long-term sustainable use.

Temporary changes

Qualification of rights

The *Water Act 1989* provides the Minister for Water (as a last resort under severe conditions) with powers to declare a water shortage and temporarily override existing water entitlements to reallocate water to priority uses. This process is known as a qualification of rights. In effect, water is taken from some entitlement-holders and used to supply others; normally to meet critical human needs.

Critical human needs can be defined as the amount of water required to meet Stage 4 restricted demand in urban areas, supply domestic and stock needs and operate the distribution system to deliver that water.

As qualifications advantage one group of water users at the expense of another, generally with no compensation, qualifying rights is undertaken only in line with clear and transparent guidelines.

Victorian Water Register

To improve the recording and transparency of its water entitlements, Victoria has developed the Victorian Water Register (see www.waterregister.vic.gov.au). The register records bulk entitlements, environmental entitlements, water shares and licences to improve integrity and enable proper water accounting. It keeps track of the water market and produces crucial information for managing the State's water resources.

Water trading

Trading water entitlements is a process that allows water to be reallocated between users. The water market allows for water to move from lower value to higher value uses, boosting the regional economic returns that can be made from the available water. Water trading also allows new developments to occur in systems where all available resources have been allocated, and helps individuals to manage their own water supplies.

Water Resource Management

Management areas

Management areas define the scale at which diversion limits and other plans will be applied.

A river basin or system is the area of land where surface water run-off drains into streams and creeks that eventually flow into a single river. These streams and creeks are known as 'tributaries'.

Water supply protection areas (WSPAs) can be declared where strict management is required to protect the groundwater and/or surface water resources in the area. Once an area has been declared, a management plan is prepared. **Groundwater basins** are the major underground water storages and are made up of a series of aquifers. The two main basins in the Western region are the Otway and Murray basins. **Groundwater management areas (GMAs)** are the defined areas from which water is extracted from an aquifer, generally where groundwater has been well developed or has the potential to be developed. **Unincorporated areas** are generally areas in which groundwater resources are of poor quality and yield.

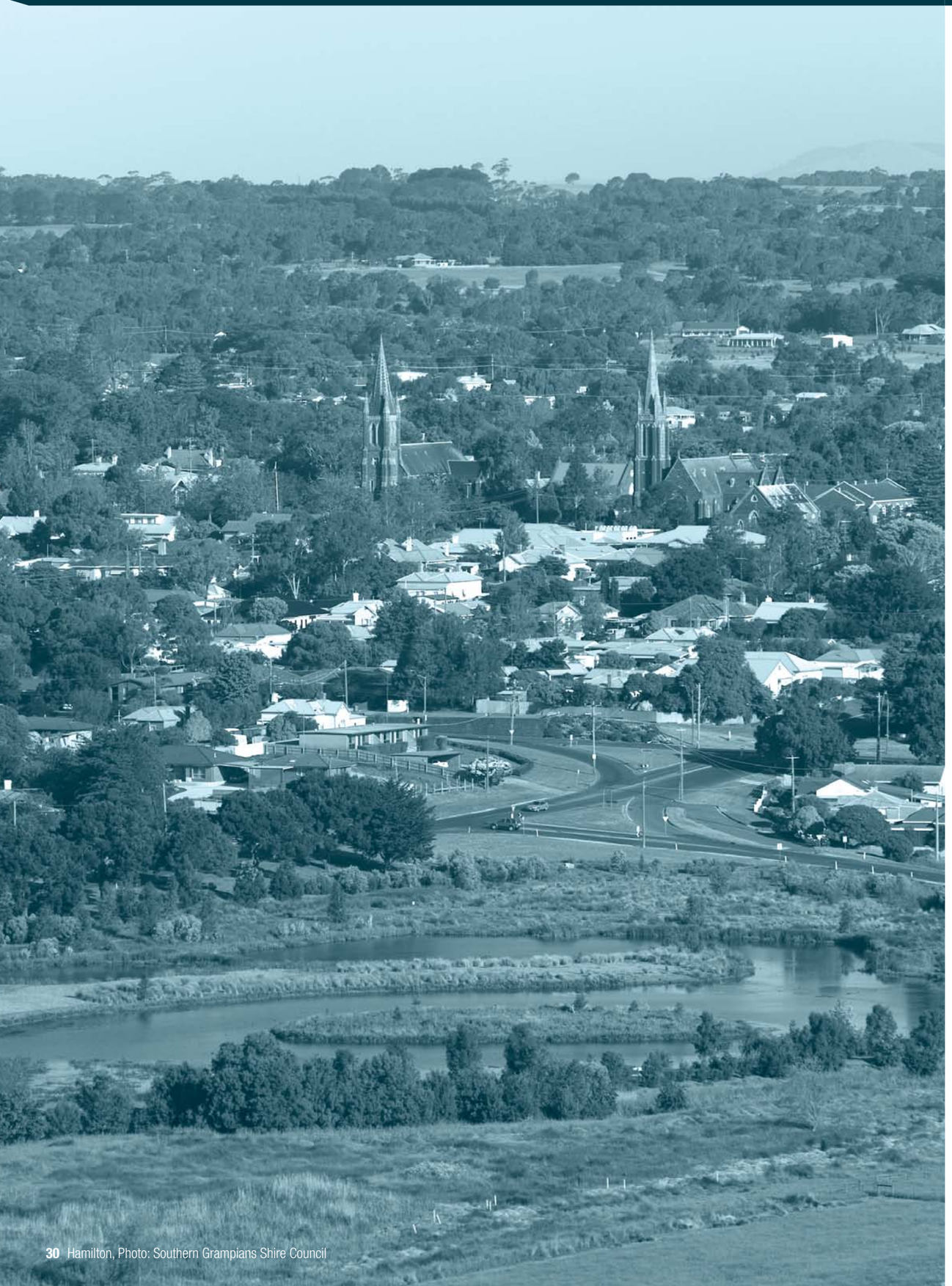
Responding to seasonal variability

Water availability varies considerably from year to year. This means an entitlement-holder may not always have access to their full entitlement volume. Annual use is determined by the following methods.

Seasonal allocations are the volume of water provided to water shareholders in a given year, expressed as a percentage of the total entitlement volume.

Urban water restrictions are introduced by water corporations in towns and cities to restrict outdoor use in times of shortage.

Rosters, restrictions and bans are applied in unregulated river and groundwater systems to limit the timing or amount of water extraction. The rules for applying these are documented in local management rules, or management plans.



The Western Region's water resources, now and in the future

Guide to this chapter

2.1 Overview of the region's water resources

- Surface water and groundwater
- How the region's water is used now
- Unallocated water in the Western Region

2.2 Drought, climate variability and risk

- Recent climate extremes - the past 14 years
- Changes in climate over the longer term

2.3 Other pressures on water resources

- Population growth
- Changing industrial water needs
- Water to produce our future food and fibre needs
- Increases in catchment dams and groundwater extractions for domestic and stock use
- Land use change
- Bushfires
- Risks to water quality

Key points of this chapter

- Water resources vary throughout the region. The south has relatively reliable rainfall, with conditions becoming drier to the north. The south and west of the region have good groundwater reserves. Supply systems transfer some of the water from these wetter areas to support towns, farms and industry in drier parts of the region.
- Agricultural industries (dairy farming, plantations and broadacre cropping), cities and towns and industries (mineral sands and alternative energy) are the major water users in this diverse region. They use groundwater and surface water depending on their location.
- Rivers, lakes, wetlands and estuaries have high environmental value and are a major drawcard for regional and recreational tourism.
- Climate variability and drought creates uncertainty about future water supplies, particularly away from the wetter coastal areas. Other pressures include increased demand from towns, agriculture and industry and interception activities.

2.1 Overview of the region's water resources

2.1.1 Surface water and groundwater

Surface water

Surface water is created by rain that falls on the land and flows to waterways, wetlands, estuaries and reservoirs. In some instances, surface water flows are also created by groundwater that rises to the surface and becomes part of streamflow.

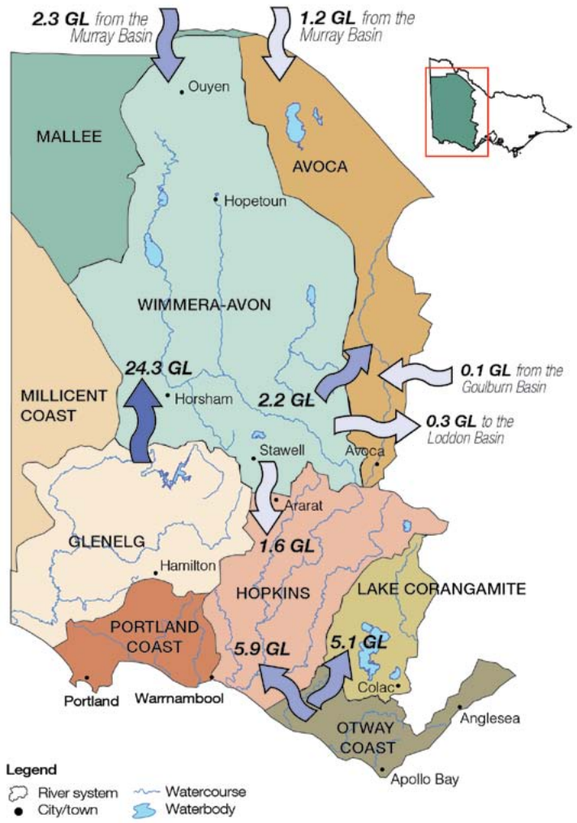
Waterways across the region are described as **regulated systems**, where water flow is regulated through the operation of large dams or weirs, or **unregulated systems**, where water flow is not affected by a major dam or weir. Most of the region's waterways are unregulated. The only major regulated rivers are the Wimmera and Glenelg.

There is on average 2,946 GL a year of surface water in the region. However, averages should be treated with care because of extreme variation in the amount of surface water in flood years compared to drought years, and even between summer and winter during any year, and variations between parts of the region.

Surface water transfers

Surface water is transferred between river basins to support water supply systems in and outside the region (see Figure 2.1). An annual average of 3.6 GL is transferred into the region and about 0.3 GL is transferred out[a]. An average of 24.3 GL is diverted from the Glenelg River and used in the Wimmera-Mallee supply system.

Figure 2.1 Water transfers between basins



[a] Groundwater transfers out of the region will increase as Barwon Water takes up all of its 7 GL per year bulk entitlement to transfer water from the Anglesea borefield for Geelong's supply.

Groundwater

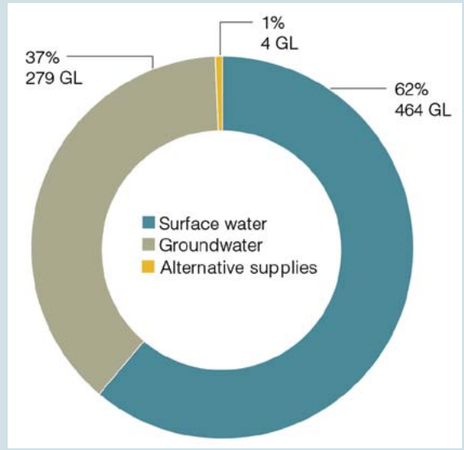
Groundwater provides water for domestic and stock, town, irrigation and industrial use. It also contributes to the environmental values of some ecosystems. Groundwater in the Western Region is contained in layers of sedimentary sands, gravels, clays, limestones and in fractured rock. An example cross-section of the aquifer systems in the region is shown in Figure 2.2.

The management of groundwater takes into account the amount of water that enters and is lost from the aquifer each year and how much water is stored in the aquifer. The process of water entering the ground to become groundwater is called recharge. The volume of recharge and how fast it enters groundwater depends on climate, the depth to the aquifer, the types of plants that use water in the soil and the types of soil and rock it must pass through.

Surface and groundwater extractions

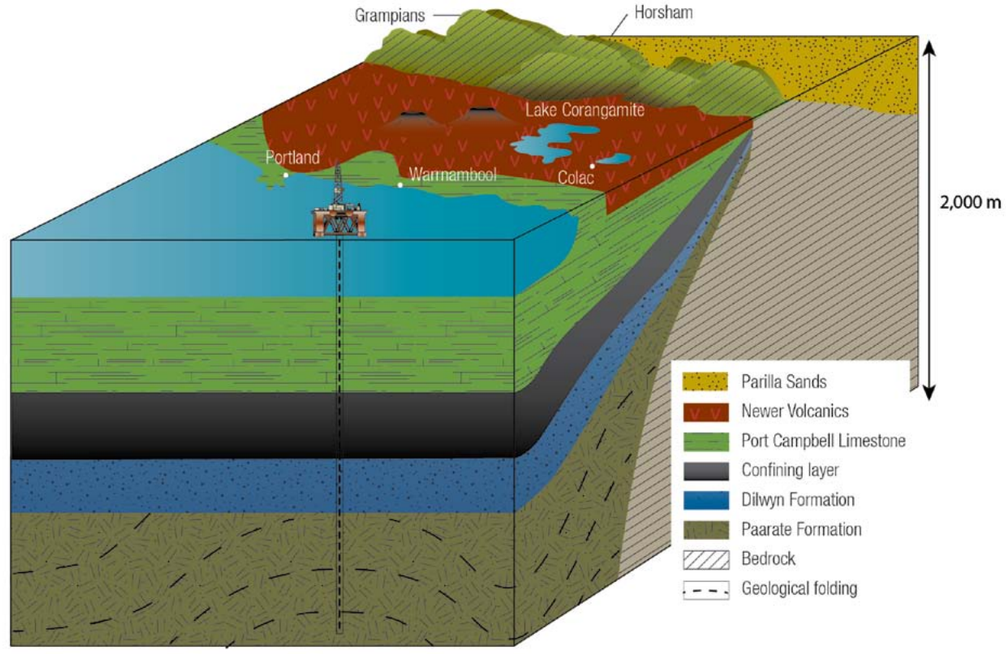
Water supply to Western Region towns, farm businesses and industry is sourced from surface water (62 per cent) and groundwater (37 per cent of total water use). Alternative supplies such as recycled water provide about one per cent of total water use (see Figure 2.3 – volumes are based on average annual volumes and are indicative only).

Figure 2.3 Proportion of water available for extraction in the Western Region



Notes:
- The surface water data is based on long-term modelling and Victorian Water Accounts (VWA) information and is the water available under current entitlements and caps.
- The surface water volumes include farm dams which account for a large proportion of surface water used in some areas.
- The groundwater volume is the total of permissible consumptive volumes (at 14/07/11); the volume of groundwater used in unincorporated areas is not included.
- Alternative supply volumes have been taken from VWA 2009/10.

Figure 2.2 Example of groundwater systems in the Western Region



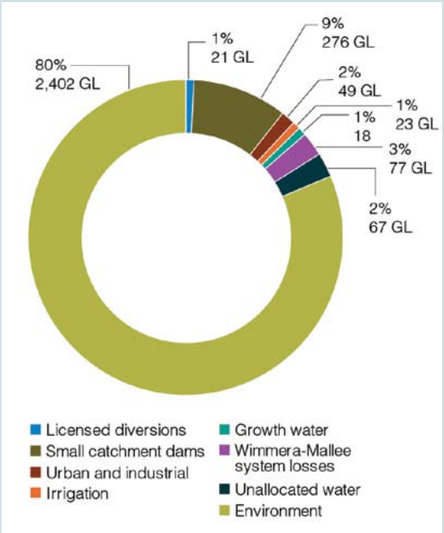
The Western Region is a large and diverse area. Total volumes of water used and sourced are different for each sub-region; it is wetter in the south, and drier in the north. Refer to each sub-region for more information:
- Otways, page 165
- South-west Coast, page 185
- Western District, page 203
- North-west, page 221

Groundwater is managed by capping extractions and managing licensed use to protect the resource and environmental values. There are about 246 GL of licensed groundwater entitlements in the region. In any managed groundwater area, the licensed entitlement is capped at the permissible consumptive volume (PCV). The total PCV for the region is 261 GL (see Appendix 2 for more details).

Figure 2.4 shows how the 2,933 GL of surface water available annually is divided into water available for consumptive use and water that remains in each basin for the environment. Records based on the climate of the past 50 years show an average of 464 GL of surface water is available for consumptive use in the region each year. More than half of this volume is captured in small catchment dams (276 GL), which are usually used for domestic and stock water supplies. These estimates reflect the maximum that can be taken. Actual use is subject to seasonal and inter-annual variability.

Surface water use for urban, industrial and Wimmera-Mallee Pipeline domestic and stock supply is about 46 GL. About 23 GL (including delivery losses) is used on average by irrigators in the Wimmera irrigation district. There are about 21 GL of licensed diversions from unregulated streams. Water remaining in the basin for the environment makes up about 80 per cent of the region's surface water flows.

Figure 2.4 Surface water available for different uses in the Western Region



Notes:
- Figures are long-term averages taken from REALM modelling and the Victorian Water Accounts 2009/10.
- The small catchment dams figure includes licensed and unlicensed farm dams.

Figure 2.5 shows the uses of groundwater in the region for 2009/10. Unlike Figure 2.4, this graph does not include the environment's use of groundwater because this is difficult to determine for groundwater systems.

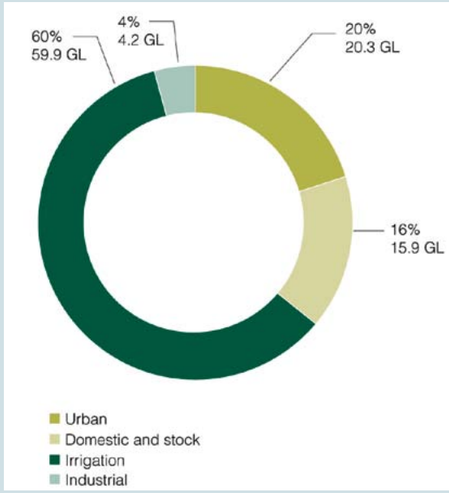
Some catchments in the region have water that has not been allocated to any user or to the environment. These include parts of the Otway, Portland Coast, Hopkins and Lake Corangamite basins.

Alternative sources

The main alternative water sources are rainwater and stormwater capture in urban areas, recycled water and desalination. These types of water can be used provided the quality is appropriate (i.e. 'fit-for-purpose'). Use of these water sources can help reduce reliance on water from rivers, reservoirs and groundwater.

Alternative water sources are becoming increasingly important throughout Victoria in response to the recent prolonged dry period.

Figure 2.5 Groundwater use in the Western Region*



*Source: Victorian Water Accounts 2009/10.

Figure 2.6 Why the Western Region depends on water

Agriculture
Agricultural production, sustained by rainfall and irrigation, is a key factor in Victoria's ongoing prosperity, with horticulture, dairy and mixed farming enterprises underpinning regional economies.

Towns, cities and industry
Households, businesses and urban communities rely on safe, secure supplies for drinking, washing, maintaining sports grounds and open spaces, and manufacturing and other industrial uses.

Environment
Healthy rivers, wetlands, floodplains and estuaries are home to important plants and animals such as Australian grayling, endangered freshwater catfish and migratory birds.

Indigenous culture
The health of waterways and land remains central to Indigenous culture, particularly significant fish

Recreation and tourism
Important recreational activities take place on or near rivers and wetlands, including fishing,

2.1.2 How the region's water is used now

Agriculture, towns, cities and industry throughout the Western Region all depend on reliable, good quality water. Water plays an important role in supporting the region's many social, economic, environmental and cultural values (Figure 2.6).

Use of water by households, agriculture and industry

Water use in urban systems

Urban water supply in the Western Region is sourced from surface water and groundwater. In some areas, groundwater supplements surface water supplies, and it is the primary source in the south-west for towns such as Portland. Some towns share a supply system, while others rely on their own dedicated system.

The Wimmera-Mallee and Gellibrand are the largest supply systems in the region. The Wimmera-Mallee system distributes water from storages in the Grampians and from the River Murray through an extensive pipeline network to 34 towns and over 3,000 domestic and stock users.

The Gellibrand system (including the Otway and Colac supply systems) sources water from the Otway ranges and the Gellibrand River catchment to supply towns (as well as some industries and more than 1,000 domestic and stock users) throughout the south and southwest of the region.

The major aquifer in the region is the Dilwyn Aquifer, which is used to supply Portland, Port Fairy, Heywood and Dartmoor.

During the dry conditions from 1997 to 2009, many towns in the north-west were on prolonged water restrictions. However, towns in the south that relied on groundwater had more secure supplies and restrictions were not needed.

Water use by agriculture

Rural water use, including irrigation from waterways, accounts for 75 per cent of total surface water use in the region. Use of groundwater is predominantly in the south and west of the region.

Agriculture is predominately rain-fed. Relatively small amounts of irrigation supplements rainfall in some areas using water extracted from rivers, aquifers, farm dams or recycled water sources. Most rural enterprises use domestic and stock water from rainfall (in farm dams), waterways or aquifers.

The main agricultural industries are dairy and forestry in the wetter southern areas, mixed farming in the western districts and cropping further north. These industries support a range of secondary processing industries.

Photo: Helen Hiscocks

Asses Ears Mountain Range, Wartook Valley

"The Western Region is one of the major food production regions in Victoria with a high potential to expand, provided its water resources are preserved." – Draft Strategy submission DS200

The dairy industry is growing in the south of the region. It is based on rain-fed production systems rather than irrigation, although water for dairies and stock is critical. The dairy industry in the Western Region produces 30 per cent of Victoria's and 22 per cent of Australia's dairy production. In 2010, Western Victorian dairy farmers produced 2,108 million litres of milk, which generated income of $864 million. This income was boosted with $54 million from the export of heifers and processing of cull cows. The industry employs almost 6,000 people in farming and processing. Western Victoria is one of the largest milk processing areas in the nation.

The region has a significant rain-fed grazing industry based on beef, wool and lamb production and cropping industries further north.

The forestry industry in the south-west makes a significant contribution to the region's economy. Plantation forestry is an important industry along the South-west Coast, with the areas of high rainfall containing a higher concentration of plantation forestry. Almost 20 per cent of the nation's forestry plantations are in, or near, the South-west Coast. Over the next few years, harvesting of 180,000 hectares of blue gum plantation will see the Port of Portland become Australia's largest hardwood chip handling port. Four million tonnes per year of grain, woodchips, livestock, aluminium ingots and mineral sands also move through the port.

Water use by industry

The region supports a range of industries that need water to operate or that can affect water resources. Mining of gold, mineral sands and coal occurs in the region.

Victoria's largest producing gold mine is at Stawell and the Wimmera is an important mineral sands province. Water is required for mining and processing mineral sands. Off-shore gas aluminium produced at Portland is exported to Asia. Portland Aluminium injects more than $100 million into the Portland region each year.

Alcoa also runs a brown coal-fired power station at Anglesea, which provides about 41 per cent of the total electricity needs of the Point Henry aluminium smelter in Geelong. This smelter produces 180,000 tonnes of aluminium per year.

The region is attracting interest from developing industries, such as geothermal energy generation, carbon capture and storage, and the extraction of methane and petroleum products from in-ground coal.

Water available for the environment

The region's waterways, floodplains, wetlands and estuaries have high environmental values and are a major drawcard for regional and recreational tourism.

The environmental water reserve is the term used to describe the water set aside by law to protect environmental values of water systems.

Environmental entitlements have been created on the regulated Wimmera and the Glenelg systems. Water from these entitlements is held in storage and managed by the Environmental Water Holder to provide environmental benefits to these rivers.

Environmental water in all of the unregulated river systems is provided by passing flow conditions on bulk entitlements, minimum flows set by rural water corporations and flows above consumptive caps. However, it is important to note that all water remaining in a river system contributes to the water available for supporting water dependent environmental values.

Environmental values that depend on groundwater are generally referred to as groundwater dependent ecosystems. The water needs of groundwater dependent ecosystems are protected by managing groundwater levels through controls on groundwater extractions.

Water for recreation, social and cultural values

For many in the community, rivers, lakes, wetlands and estuaries have a special place in their memories and are deeply associated with their 'sense of place' and 'belonging'. This is particularly true for Indigenous Victorians, for whom rivers are a spiritual and living entity.

Water provides important social resources to regional communities, including recreation opportunities.

"The value of recreation and environmental water to local towns and communities is critical to the viability of the region" – Draft Strategy submission DS034

Water holds a significant place in Aboriginal culture. Water is intimately linked to the health of Country and life, and Traditional Owner groups each have responsibility and obligations under their Lore and custom to protect, conserve and maintain the environment and the ecosystems in their natural state to ensure the sustainability of the whole environment.

Many Indigenous cultural sites in the Western Region are on or near waterways, and streams and water bodies are still important sources of food and medicine. Waterways are important meeting places for families and communities to come together for cultural, social and recreational activities, and to teach culture to young people. Access to healthy waterways is vitally important for these activities.

2.1.3 Unallocated water in the Western Region

In parts of the region, surface water or groundwater is available for new consumptive use under existing caps. Several basins have unallocated surface water available for the winter-fill period:

- 34.6 GL in the Otway Coast Basin;
- 28.8 GL in the Portland Coast Basin;
- 2.6 GL in the Lake Corangamite Basin; and
- 1.3 GL in the Hopkins Basin.

The total volume of groundwater licences for some aquifers is still below the PCV. The approximate volumes of groundwater available in each sub-region are:

- 2 GL in the Otways;
- 2 GL in the South-west Coast;
- 0.5 GL in the Western District ; and
- 6 GL in the North-west.

The opportunities presented by the region's unallocated water are discussed in Section 3.2.5, page 80.

In some parts of the region, existing water licences are under-utilised. Over time, it is likely that utilisation will increase through the growth of existing enterprises or water trade.

Lake Bolac during the recent drought ©Alison Pouliot

2.2 Drought, climate variability and risk

The Western Region faces a range of pressures on its water resources, and these pose a risk to the availability of water in the future. As the recent drought has shown, drought presents the most significant overall risk to future water availability.

2.2.1 Recent climate extremes – the past 14 years

The past 14 years have been exceptional – the recent prolonged drought from 1997 to 2009 followed by wetter than average conditions and severe floods in the western and northern parts of Victoria.

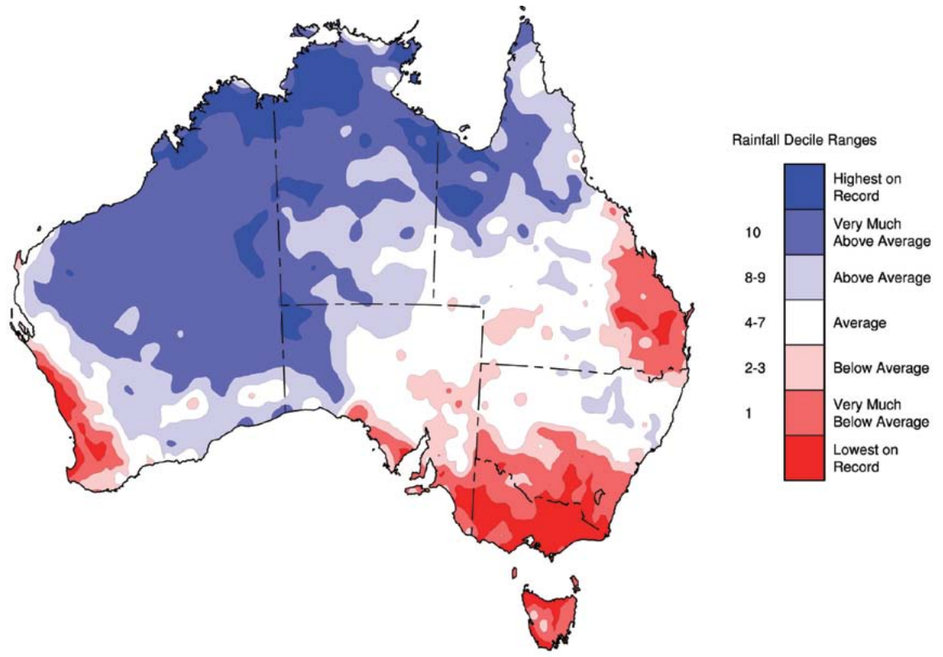
The recent drought

The drought from 1997 to 2009 was the worst in recent memory. In most of the Western Region, rainfall in every year was less than the long-term annual average. Figure 2.7 shows rainfall over the drought period.

Victoria has experienced periods of below average rainfall before, notably in the mid 1890s to early 1900s (the Federation drought) and from the mid-1930s to mid-1940s (the World War 2 drought), but the average rainfall reduction from 1997 to 2009 was greater than during these earlier droughts. This recent drought was also the longest on record, and there were no wet years to replenish depleted soil moisture and offset the dry years. It was also notable for its lack of very wet months.

In addition to its length and severity, the recent drought is unusual historically because of the shift in the seasonality of rainfall, with the biggest decreases in autumn, followed by winter and spring. The reduction in autumn rainfall meant that the catchments tended to be drier at the beginning of winter, which resulted in relatively less run-off from winter and spring rainfall.

Figure 2.7 Rainfall over the recent drought (10 October 1996 - 31 January 2010) in the context of the historical record



Source: Commonwealth of Australia 2011, Australian Bureau of Meteorology

Along with reduced rainfall, temperatures were above average across Victoria from 1997 to 2010 (see Figure 2.8), which compounded the impact of reduced rainfall and exacerbated the drying of the landscape. Increased temperatures also led to increases in crop water demands and a greater risk of bushfires.

A return to average and wetter conditions – 2010 to mid 2011

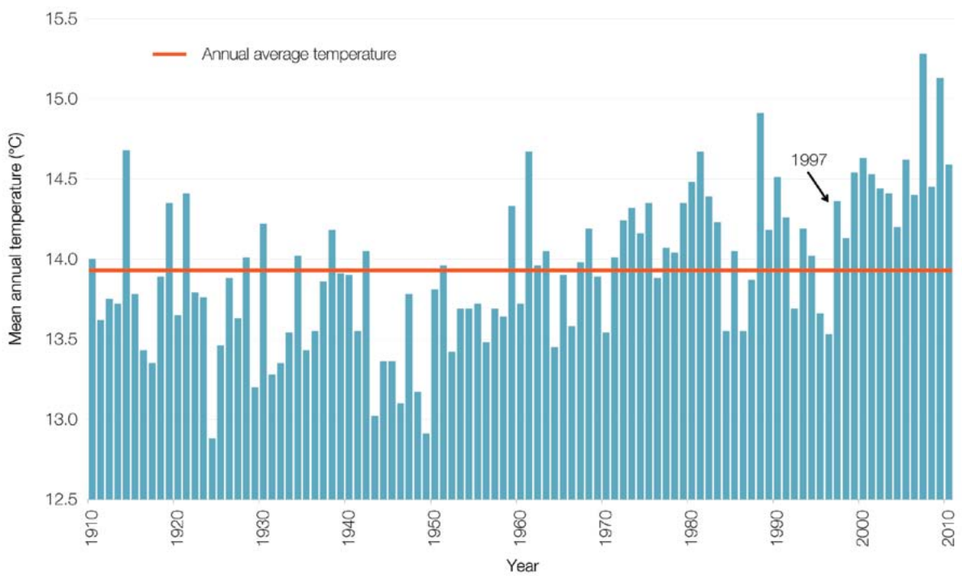
In contrast to 1997 to 2009, 2010 was the fifth wettest year on record in Victoria and the summer of 2010/11 was the wettest in Victoria since records began. Almost two-thirds of the State received rainfall totals very much above the long-term average in 2010, and the state-wide rainfall total for 2010/11 was more than double the long-term average and more than 25 per cent above the previous record high, set 100 years ago in 1910/11.

January 2011 was Victoria's wettest January on record: Mt William in the Grampians received the highest rainfall of 289.6 mm for the month; and Jeparit had the wettest day in January on record, with 161.2 mm on 12 January. More than 60 rainfall stations across Victoria recorded their wettest January on record[1].

During this time, most parts of the Wimmera experienced 1 in 200-year floods. Ground already saturated from rainfall in previous months, coupled with exceptionally heavy and intense rainfall in mid-January, resulted in major flooding of Victorian catchments in the Murray-Darling Basin. Rainfall was particularly high in the Avoca, Wimmera, Hopkins and Mount Emu Creek catchments.

Severe flooding occurred in towns such as Horsham, Warracknabeal, Charlton and Skipton. Communities and homes were isolated and many roads were closed. The floods caused widespread property damage and lost income for businesses, as well as downgrading of much of the region's grain harvest. The heavy rain also caused landslips, erosion of roads and walking tracks, and severely damaged bridges, culverts and other public infrastructure such as caravan parks, public halls, recreation areas, fences and waterways.

Figure 2.8 Annual mean temperature in Victoria

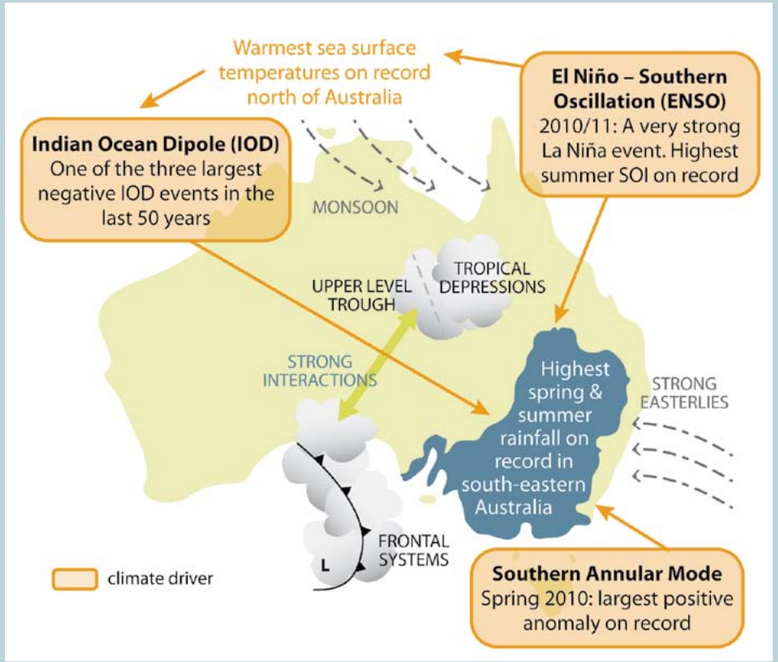


Source: Bureau of Meteorology

What has caused the recent high rainfall?[2]

Persistent wet conditions in the second half of 2010 and early 2011 resulted from a combination of the 'wet' phases of the three large scale drivers of climate variability known to influence the year-to-year variability of rainfall in south-eastern Australia – namely the El Niño – Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD) and the Southern Annular Mode (SAM) (see Figure 2.9 and Appendix 3).

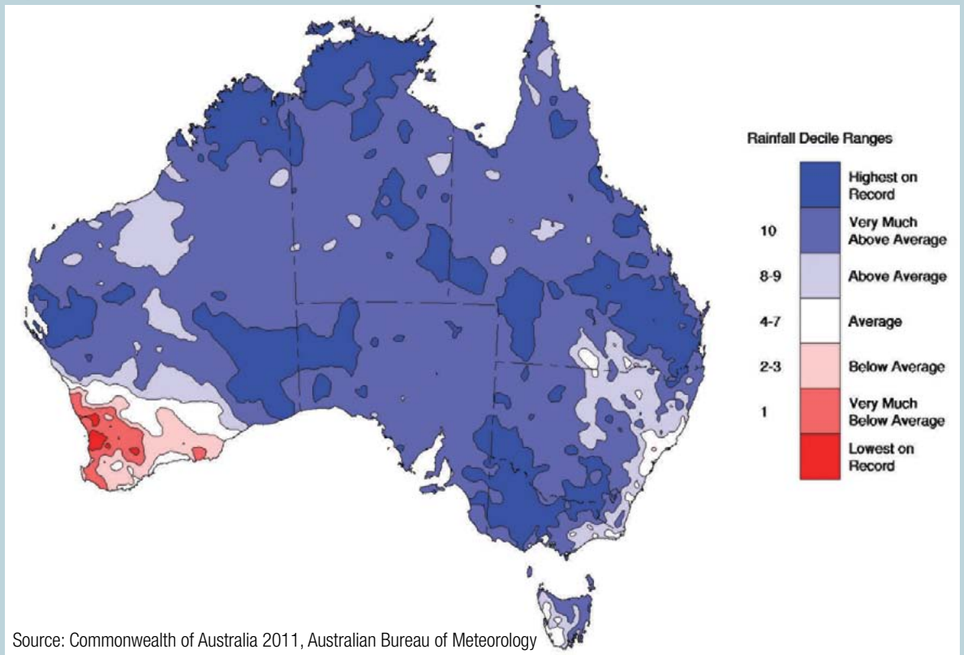
Figure 2.9 Influences contributing to the high rainfall in spring and summer 2010/11[2]



Sea surface temperatures in the tropical waters around northern Australia were the highest on record, providing a source of tropical moisture which penetrated into Victoria. One of the strongest La Niña events (the wet phase of ENSO) on record occurred in 2010/11. La Niña events are typically associated with above average rainfall over much of eastern Australia, although a few La Niña events during the recent drought did not bring significant rainfall to Victoria. The impacts of the strong La Niña event in 2010/11 were exacerbated by one of the largest negative IOD events (the wet phase of the IOD) of the past 50 years. This created conditions conducive to the formation of north-west cloudbands and contributed to the high spring rainfalls. In addition, SAM reached record positive values in late spring and early summer of 2010 resulting in moist on-shore easterlies.

Together, these influences resulted in more frequent and intense low pressure systems and much cloudier and more humid conditions than usual, resulting in very much above average rainfall across much of south-eastern Australia (see Figure 2.10).

Figure 2.10 Rainfall for the period August 2010 to April 2011



Source: Commonwealth of Australia 2011, Australian Bureau of Meteorology

Moist air moved into the region from the north-west, rather than from the south-west as it normally would as part of frontal systems associated with low pressure systems embedded in the westerly wind belt. It brought severe flooding throughout the region.

While any one event (or sequence of events such as occurred in 2010/11) cannot be attributed directly to climate change, there has been an increase in the frequency of extreme weather around the globe over recent decades, and this trend is consistent with what can be expected in response to human-induced climate change[5].

Lessons from the past 14 years

Several important lessons have been learned in the region from experiences over the past 14 years. Water supplies were tested during the drought, particularly during the driest years such as 2006. Many of the region's communities and farm enterprises suffered greatly during this time but many have proven resilient and are recovering from these hardships. Communities, farmers, industry, environmental water managers and water corporations all needed to deal with the dry conditions, with many investing in improvements to water supply reliability or water use efficiency. The Western Region was hit harder than any other part of the State from 1997 to 2009. The prolonged dry period caused severe declines in streamflows (of 30 to 90 per cent) and water supply in many parts of the region. Although not a major waterway in the region, the Avoca River has the longest reliable records for comparison. Average annual flows in the Avoca River at Coonooer decreased by 88 per cent compared with the long-term average (see Figure 2.11). The impacts were less severe in the south, but still significant – annual flows for the Merri River fell by 55 per cent (see Figure 2.12).

Figure 2.11 Annual streamflows for the Avoca River at Coonooer[3]

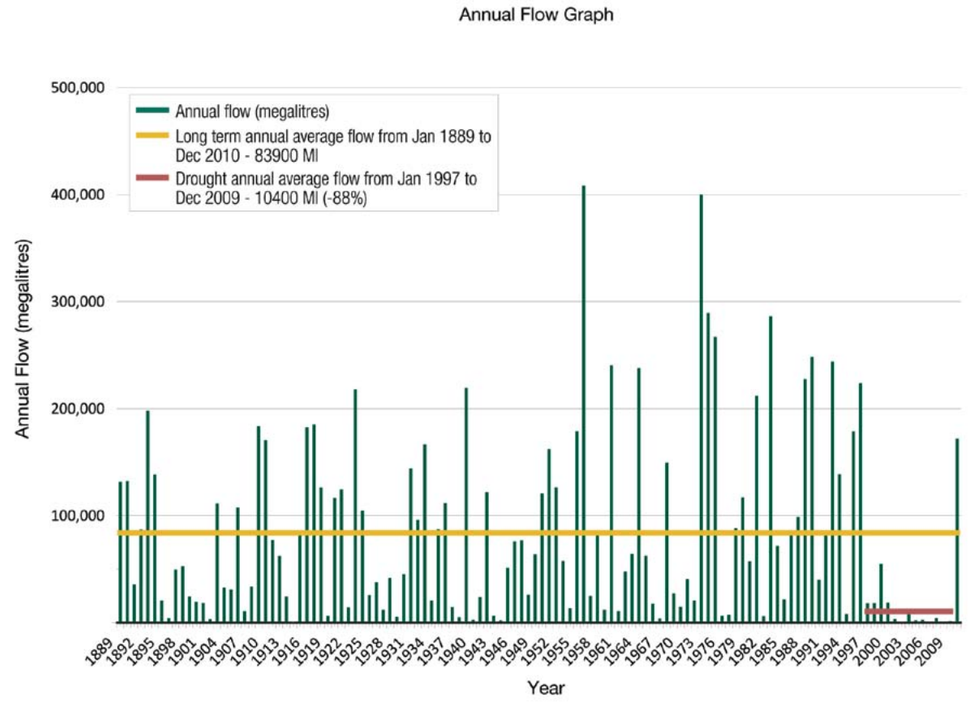
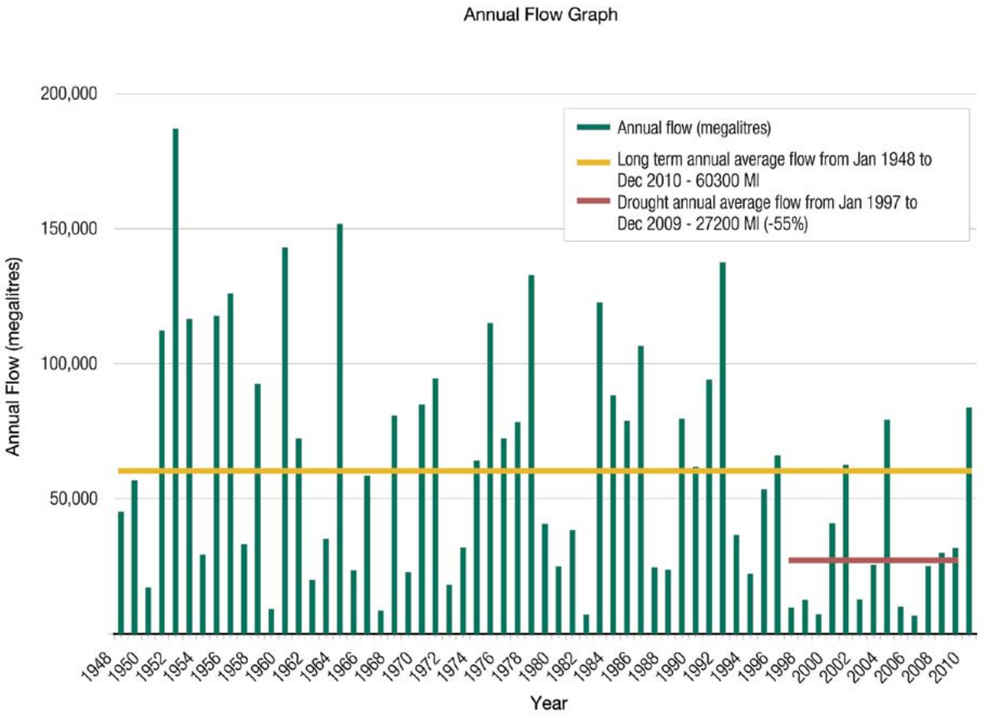


Figure 2.12 Annual streamflows for the Merri River at Woodford[4]



The recent floods in parts of Victoria have shown the importance of continuing to maintain and strengthen emergency planning and response, as well as ensuring that careful long-term land use planning is undertaken in flood-prone areas. The findings of the review into the 2010/11 summer flood response and recovery, emergency warnings and evacuations, led by Mr Neil Comrie AO APM, will help guide planning to ensure Victoria is better equipped to deal with similarly severe floods in the future. In addition, the Department of Sustainability and Environment is reviewing and updating the Victorian Flood Management Strategy.

The climatic conditions over the past 14 years highlight the need for water users to be able to adapt to changing water availability and use tools that help them respond effectively to prolonged dry conditions as well as wet periods. The policies and actions in this Strategy aim to achieve this.

Photo: DSE

Water over the road near Dimboola, after 2010/2011 floods

2.2.2 Changes in climate over the longer term

The global climate system is warming, as is now evident from observations of increases in global average air and ocean temperatures, and rising global average sea level[5]. A range of recent reports[6] taking into account published research since 2007 highlight that the observed changes appear to be at the more severe end of the predictions made by the IPCC in 2007.

Global average surface temperature has risen by 0.74ºC over the past century, and global ocean temperatures have risen by about 0.7ºC over the past 120 years, rising by 0.10ºC between 1961 and 2003 (to a depth of 700 metres). As water warms, it expands in volume. This thermal expansion of the ocean was the major cause of sea level rise in the 20th century. Globally, sea levels rose an average of 1.7 millimetres per year during the 20th century, and 3.4 millimetres per year from 1993 to 2007[7]. Erosion prone areas along the Western Region coast, including the highly valued estuarine areas, will be particularly prone to impacts from sea level rise.

Increasing global average temperatures and subsequent sea level rises in response to increasing levels of greenhouse gases are likely to continue. Although it is difficult to predict how rainfall patterns may change at a particular location, climate scientists predict that over the long term the mid-latitudes (which include Victoria in the southern hemisphere) are likely to get drier (IPCC 2007).

Understanding Victoria's key climate drivers

The Department of Sustainability and Environment is a participant in the South East Australian Climate Initiative (SEACI). The SEACI research program was established in 2006 to improve scientific understanding of the key drivers influencing the climate of south-eastern Australia over a range of timescales. Research for the SEACI research program is undertaken by scientists within the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology.

The SEACI research program has led to an improved understanding of the behaviour of ENSO, IOD and SAM and their associated impacts on rainfall – both in isolation and in their various combinations. These drivers will continue to influence year-to-year variability in rainfall across south-eastern Australia. However, while these drivers were responsible for the floods in 2010/11, SEACI research has found that these large-scale drivers of variability cannot explain the observed decline in rainfall during the recent drought.

Rather, SEACI research has found that the key factor influencing the recent rainfall decline in south-eastern Australia is a rise in atmospheric pressure across southern Australia associated with an intensification of the sub-tropical ridge (a belt of high pressure about 30 degrees south). This intensification of the ridge shifts south the cold fronts and low-pressure systems that used to bring reliable rainfall to south-eastern Australia. The intensification of the ridge has been found to account for about 80 per cent of the observed reduction in rainfall during the recent drought.

The intensification of the ridge has been shown to be linked to observed changes in the large-scale circulation of the atmosphere which effectively mean that the tropics are expanding. Research has shown that these changes in the global circulation (and hence the changes in the sub-tropical ridge), are linked to global warming. This means that global warming is likely to have contributed to the recent drought in south-eastern Australia. However, natural variability will also have been a contributing factor. SEACI research shows that these trends in the global circulation are expected to continue. As a result, the sub-tropical ridge is also expected to continue to intensify and move further south.

The observed changes in the hydroclimatic data during the recent drought may therefore indicate the beginnings of a shift in the climate for south-eastern Australia in terms of a reduction of our late autumn/winter rainfall. A similar shift in climate was experienced at the beginning of the 1970s in south-west Western Australia. This shift has been linked to global warming and a range of other factors.

The SEACI research has also:

- developed improved projections of climate change, which indicate an increasing risk of below average rainfall and runoff for south-eastern Australia over the longer term;
- shown that short-duration storms may become more intense across the region, especially over the inland plains; and
- developed improved seasonal forecasts of rainfall and streamflow.

Through SEACI, the Department of Sustainability and Environment is contributing to further research to better understand Victoria's climate drivers in the short and medium term. The ongoing research will be important in advancing our understanding of whether, and to what extent, further rainfall declines can be expected.

A synthesis report describing the first three and a half years of research under SEACI can be found at www.seaci.org, and more recent research results can be found on the same website in the 2009/10 Annual SEACI Program Report and in the fact sheets.

A diagram showing the key influences on Victoria's climate is presented in Appendix 3.

Climate scenarios to inform long-term planning in this Strategy

While our understanding of the potential impacts of climate variability on future water availability will continue to improve over time, uncertainty about future rainfall means that we need to be prepared for a range of future climate conditions. This Strategy considers several possible future climate scenarios to better understand how its policies and actions can deal with this uncertainty (see Table 2.1). This allows the risks to water supplies under a range of possible future climates to be considered in the long-term planning of Victoria's water resources.

The baseline scenario, which assumes that the long-term climate experienced to date will continue, provides a basis for comparison with the other scenarios. Scenarios A, B and C are based on a range of future climate projections derived using models of the global climate system. Scenario D is identified for risk management purposes to help water users and environmental managers consider the risks associated with returning to drought conditions, similar to those experienced between 1997 and 2009.

Table 2.1 Future streamflow scenarios

Baseline	**Historic conditions**	Long-term average, based on the long-term streamflow record. The length of record varies for each system according to available data.
Scenario A	**Potential low impact scenario**	Low end of predictions using CSIRO 2011 estimates – "Wet" CSIRO 2011 projection
Scenario B	**Potential medium impact scenario**	Middle of the set of predictions using CSIRO 2011 estimates – "Median" CSIRO 2011 projection
Scenario C	**Potential high impact scenario**	High end of predictions using CSIRO 2011 estimates – "Dry" CSIRO 2011 projection
Scenario D	**1997 to 2009 drought conditions**	A return of the dry conditions from 1997 to 2009 drought.

Different Draft Strategy submission views on climate change

"All possibilities should be kept in mind for the long-term future, less rainfall, more rainfall, droughts, floods and a changed seasonal distribution." DS031

"A great deal more scientific evidence is required about the impacts of various climate change scenarios on stream and river health and groundwater reserves before accurate trade-offs between water users can be made and justified." DS147

"The issues around either climate change or even prolonged drought are real and important. This document needs to tell the community what they might mean for the community and allow the community to understand the implications and make decisions on the steps forward." DS185

"…it is really important not to make permanent assumptions about permanent loss. Increased rainfall and water availability in spring 2009 showed how quickly apparently devastated systems can respond, and the immense social value of that response." DS264

Streamflow reductions in response to rainfall reductions are typically magnified by a factor of about 2.5 to 3.0 – for example, a 10 per cent reduction in rainfall would generally result in a reduction of 25 to 30 per cent for streamflow. However, in the recent drought, the impacts were generally larger, reflecting the consistently below average rainfall and also changes in the seasonal distribution of rainfall.

The potential impact of each scenario on the streamflow of the region's river basins has been modelled (see Table 2.2). The modelling indicates a reduction in long-term annual average streamflows compared with historic conditions. As well, changes in average streamflow, the intensity of storms may be greater under different climate scenarios and variability from year to year may increase.

Table 2.2 shows that under the medium impact scenario (Scenario B), reductions in streamflow throughout the region range from about 27 to 36 per cent. Under the high impact scenario (Scenario C), reductions in streamflow would be lowest (34 to 42 per cent) for the Otway Coast, Portland Coast and Lake Corangamite basins, with reductions of 48 to 54 per cent projected for the remaining basins.

The streamflows experienced during the 1997 to 2009 drought were substantially less than the modelled streamflows for the high impact climate scenario at 2060. During the drought the Avoca, Wimmera and Corangamite catchments experienced close to half the flows modelled for scenario C.

Table 2.2 Projected potential streamflow impacts for each river basin in under four climate scenarios

	River basins[a]	A[c] 2060 Low (%)	B[c] 2060 Medium (%)	C[c] 2060 High (%)	D 1997 to 2009 drought[b] (%)
Inland basins	Avoca	-12	-29	-48	-90
	Wimmera–Avon	-12	-32	-52	-77
	Lake Corangamite	-16	-33	-42	-84
Coastal	Glenelg	-19	-34	-54	-65
	Hopkins	-19	-36	-50	-40
	Portland Coast	-19	-29	-40	-56
	Otway Coast	-14	-27	-34	-30

Notes:
a) The seven river basins depicted in this table predominantly rely on surface water resources. The Mallee and Millicent Coast river basins rely mainly on groundwater resources.
b) Reduction of average annual inflows when comparing pre-July 1997 average inflows with inflows from 1997 to 2009.
c) Scenarios a, b and c are relative to the long-term average (ie., the full historical record up to and including 2010). These scenarios are taken from projections provided to Department of Sustainability by the CSIRO as part of the SEACI research program.

Although the potential impacts of these climate scenarios on groundwater are difficult to predict, some general observations can be made about how different groundwater systems might respond to different rainfall scenarios:

- Groundwater systems most at risk are unconfined aquifers, particularly those with shallow water tables. These systems respond rapidly to droughts and floods, and are most likely to respond rapidly to changes in rainfall.
- Smaller groundwater systems with less water in storage are likely to be more vulnerable because they do not have a storage capacity to buffer changes in recharge.
- Large regional groundwater systems have sufficiently large volumes in storage to buffer the effects of the changes in recharge for some time – usually decades depending on the aquifer.
- Confined systems will take longer to respond because of the longer time required for surface water to recharge these aquifers.

If there is a long-term reduction in rainfall, it will affect communities, industry, agriculture, and environmental values. Impacts would vary, and may be felt by some water users more than others. For example, in surface water systems with large storages, spills from storages would be expected to reduce by a greater amount than would consumptive use from the storages. However, in catchments that do not have large storages, access to water for consumptive uses may reduce more due to a greater frequency of pumping bans during more frequent low flow periods.

The Bureau of Meteorology provides short-term seasonal climate forecasts of the expected climatic conditions over the coming three to six months. These forecasts can inform decisions on water availability over the short term, and can be found at: http://www.bom.gov.au/climate/ahead.

For more information on climate risk and variability see Appendix 3.

The scenarios described in this section represent the potential impact of climate variability on rainfall, streamflow and groundwater. Some of the other risks to water availability presented in the following sections may place water supplies under additional pressure, and may potentially interact with the climate risks.

Cows in a dry paddock, near Colac Photo: David Trevenen

2.3 Other pressures on water resources

In addition to climate risk and climate variability, the Western Region's water resources and waterway and wetland health face other pressures, usually acting in combination.

2.3.1 Population growth

Population growth could increase water requirements of the region's towns and cities. In the north, it is expected that the population of regional centres will continue to grow, while the population of rural areas and smaller inland towns will decrease (Victoria in Future, 2008). This is partly due to people migrating from smaller towns to larger regional centres. For example, the population of Horsham is expected to increase by 12 per cent by 2036, while the population in the Wimmera is predicted to decrease by four per cent in the same period.

In the south, significant increases are expected into the future. For example, the population of Warrnambool is expected to increase by 36 per cent by 2036. Overall, the population of the south-west is predicted to increase by 18 per cent by 2036.

2.3.2 Changing industrial water needs

Water underpins regional development and jobs. Major industries include agricultural industries, processing industries, mineral sand mining, plantation forestry and energy, just to name a few.

There is great potential for investment and growth in many of these sectors. Food and fibre production in the south of the region is growing. The development of alternative energy sources (such as gas, wind, geothermal and wave energy power plants) is growing and will be driven further by carbon-pricing or emission reduction policies. Sand mining for ilmenite, rutile, zircon and rare earth metals has developed to the west and north of the Grampians based on increasing world demand for these minerals. Intensive animal, horticultural and agricultural industries will expand with the completion of the Wimmera-Mallee Pipeline[8]. These industries will need secure water supplies to expand, and this will place pressure on water resources.

2.3.3 Water to produce our future food and fibre needs

Reliable and secure access to water will continue to be important for agricultural producers, particularly with increases in climate variability. Food and fibre production from the region will continue to be important, with future food security an issue for all levels of government.

The amount of water that can be sustainably extracted from the region's waterways and aquifers limits the amount of water available for agriculture. In some areas, there is additional water. Some of the water savings from the Wimmera-Mallee Pipeline are available for growth, and the pipeline will allow water to be traded between users. In other areas, some groundwater resources are available.

The Western Region does not have the large volumes of low cost water needed to support the growth of widespread irrigation. However, the region has sufficient water to support the growth of non-irrigated agriculture. Changes in the crops grown and improvements in water use efficiency will provide flexibility for the region to adapt in the future.

2.3.4 Increases in catchment dams and groundwater extractions for domestic and stock use

Growing populations and rural subdivisions are increasing the demand for domestic and stock water. Historically, the amount of water harvested for domestic and stock purposes from farm dams, waterways and groundwater bores was relatively low compared with the total amount of water available.

During the recent drought, many farmers invested to improve the reliability of their domestic and stock supplies by enlarging existing dams and installing domestic and stock bores. Farm dams harvest a greater proportion of the available water during droughts. The demand for this water can be significant at a local level, placing stress on local water resources and reducing availability for other users and the environment.

Domestic and stock use is a significant water use that remains outside the allocation and licensing framework. Currently, a person has the right to take and use water flowing or occurring on their land if that water is not in a waterway and provided it is for domestic and stock use. A person also has a right to take and use water from a groundwater bore for the same purpose.

Groundwater bores are used for domestic and stock supply throughout the region where groundwater with suitable quality can be found. While groundwater may be a more reliable water source than farm dams under dry conditions, like surface water, it is a limited resource.

2.3.5 Land use change

Some large-scale land use changes, such as forestry or deep-rooted perennial crops and pastures, can affect the water balance of a catchment by intercepting water that would otherwise become part of surface water or groundwater resources. They can also affect water quality, carbon storage and biodiversity.

Run-off and groundwater recharge are directly related to the extent and composition of vegetation cover. Typically, there is less run-off and groundwater recharge in treed areas than cleared areas or annual pastures because they intercept and use more rainfall. Trees and other deep-rooted perennial vegetation can also extract water directly from shallow aquifers.

The development of blue gum plantations over the past 15 years in the south-west of the region is a prominent example. However, cropping and perennial pasture have also expanded using more water than the annual pasture they often replace. Further changes may be driven by carbon pricing and emission reduction policies.

2.3.6 Bushfires

Bushfires occur naturally in the Australian landscape. Their impact on water yield varies with the type of vegetation burnt, the intensity of the fire, and the proportion of a catchment affected. Run-off rates from burnt out, heavily forested areas generally increase for several years after a fire, as vegetation cover is reduced. Once regenerating vegetation starts growing rapidly, surface run-off and groundwater levels may be lowered for the next 20 to 80 years (for example, up to 14 per cent in the West Barwon catchment[9]). As forests mature, water use eventually returns to pre-bushfire levels. This may take up to 120 years.

The 2009 bushfires caused short-term supply interruptions and significant water quality problems in many water supply catchments in the months that followed. Western Region water corporations have recognised this and have developed contingency plans to mitigate the impacts of future bushfires on urban water supplies.

The Victorian Government undertakes prescribed burning to reduce the intensity and size of bushfires when they do occur.

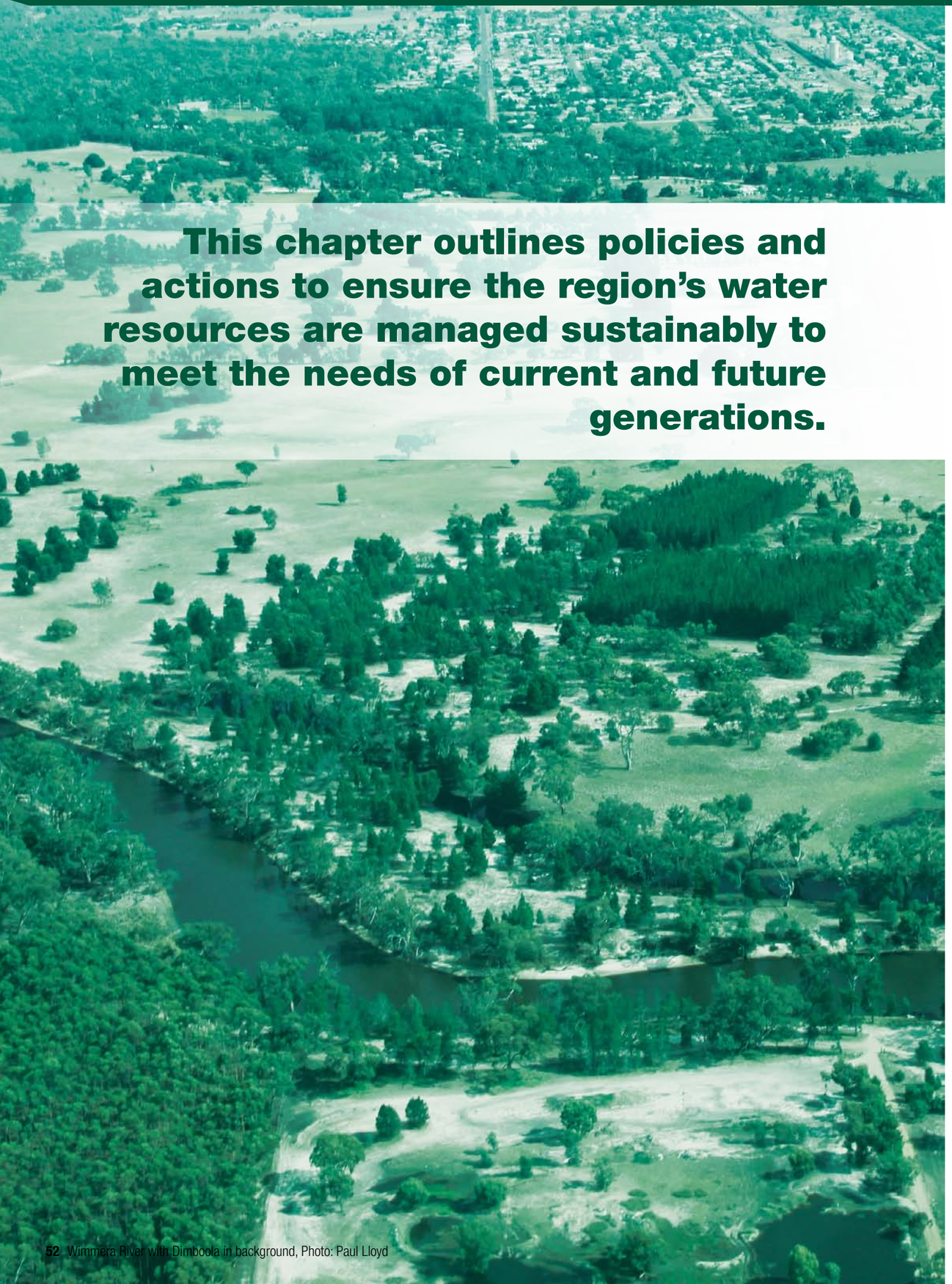
2.3.7 Risks to water quality

Poor water quality has major consequences for the health of people, livestock, waterways, wetlands and aquifers. It can reduce the water available for certain uses and increase the cost of urban water supplies. Poor water quality includes salinity, increasing sediment and nutrient loads, changing pH levels and temperature, and low dissolved oxygen.

A range of pressures can cause water quality problems and degrade aquatic habitats.

- Bushfire removes vegetation cover, and subsequent rainfall can wash high loads of ash, nutrients, organic material and soil into waterways.
- Agricultural run-off can carry agricultural chemicals and nutrients to water ways, and streamside grazing reduces the vegetation that naturally filters that run-off.
- Point source pollution, such as sewage and industrial outfalls, can lead to concentrated pollutants and nutrients in waterways.
- Land salinisation can lead to mobilisation of salts into waterways and wetlands. Some parts of the region have naturally high salinity stored in soils and groundwater. Increasing the salinity of water can make it too salty for drinking, irrigation and other purposes, as well as degrading environmental values. Salinity is now one of the major water quality problems in the region. It can be caused by land clearing and irrigation raising water tables, saline drainage water being discharged to wetlands, evaporation of surface waters, or where estuaries have been artificially opened to the sea.
- Saltwater intrusion can occur when too much fresh groundwater is extracted in an area, reducing the water pressures and allowing adjoining saltier groundwater to flow into the aquifer. It is most prevalent in coastal areas but can also occur inland, where freshwater and saline aquifers are adjacent.
- Acid sulfate soils contain or can form sulfuric acid when exposed to oxygen (for example, through drying or disturbance). When this acid is released it has major impacts on aquatic life and can cause water quality to deteriorate severely.
- Blue-green algal blooms are a common seasonal occurrence in Victoria and occur due to a number of factors, including warm weather, high nutrient levels and low water flows. They can pose a risk to livestock, water supplies and recreation activities.
- Low river flows can also cause or exacerbate water quality problems, as occurred in the Wimmera River at Jeparit during the recent prolonged dry period.

Wimmera River at Jeparit in early 2009 Photo: David Fletcher



This chapter outlines policies and actions to ensure the region's water resources are managed sustainably to meet the needs of current and future generations.

Promoting sustainable water management

Guide to this chapter

Key points of this chapter

- Victoria's water entitlement framework has allocated water effectively for most of the past 100 years. However, the past 14 years of prolonged dry conditions followed by floods have tested existing management arrangements, casting doubts on whether they provide adequate information and tools for water users, water corporations and environmental managers to adapt to significant changes in water availability.
- The Strategy will provide greater certainty to water users, water corporations and environmental managers about their rights to water and how water will be shared in times of shortage or high flows.
- It will strengthen Victoria's entitlement framework and management arrangements by ensuring the management of licensed groundwater use is better aligned with the characteristics of each groundwater system (Chapter 4). It will also establish arrangements for monitoring and managing the adverse impact of significant land use change on water availability (Chapter 5).
- The Strategy will provide the information and tools, such as trade and carryover where possible, to ensure water users and managers make the best use of existing supplies. It also helps to improve the reliability of supply through the sustainable use of alternative sources and where available, new supplies, which will be released for consumptive use through public auctions.
- The region's waterways, aquifers, wetlands and estuaries will be protected by safeguarding the environment's existing share of water and making the best use of that water through integrated and adaptive management.

 Wimmera River with Dimboola in background, Photo: Paul Lloyd

The past 14 years have been exceptional: first, 13 years of at times exceptionally dry conditions, followed by a wet 2010 – the fifth wettest year on record in Victoria – and then the State's wettest summer on record, with severe floods in January 2011.

This experience highlights the need for water users and environmental managers to be able to adapt to changing water availability and cope with the uncertainty of droughts and floods.

This Strategy builds on investments made in water infrastructure to date and aspires to make the best, sustainable use of the region's surface and groundwater resources. It aims to help water users, water corporations and environmental managers understand the risks associated with variable inflows and to identify ways for them to manage those risks. It draws on the experience of the past 14 years to identify policies and actions to provide water users and water corporations with the information and tools required to meet their future water needs while protecting and improving the health of the environment.

3.1 Providing increased certainty for water users and the environment

Before making decisions about how water should be managed, water entitlement-holders need to be sure that their rights to water are secure. They need to know that no one is extracting more than they are entitled to – and that the processes and rules for sharing water between entitlement-holders in times of shortage or high flows are well defined and transparent.

Entitlement-holders also need to be certain that potential risks to their water supply posed by water use outside the entitlement framework, such as land use changes that intercept significant amounts of water, are being monitored and managed appropriately.

They also need to be sure that while their supply may be subject to allocations, restrictions or bans in times of shortage, their rights to a certain volume will not be changed without evidence and consultation. Robust, statutory processes that respect individual rights must be followed to justify a change in entitlement-holders' access to defined volumes of water.

3.1.1 Secure rights to water

A secure entitlement has legal tenure that is certain and protected, with known arrangements for sharing available water during dry and drought years. Victoria's entitlement regime (see Reference Guide 1, page 26) ensures those rights can be changed only by clear and transparent processes (see Section 3.1.4).

The reliability of an entitlement is different to its security: it relates to the likelihood the full entitlement volume will be available each year. Reliability may be reduced by dry conditions. However, the security, or right to a share of the available resource, will be protected by law. Water users have a right to a well defined share of the available water in any year or season.

Policy 3.1 Recognising existing rights to water

All existing rights and entitlements, including those of water users and the environment, will be recognised consistent with the *Water Act 1989*. This includes the security of entitlements and the right to a share of available water in a given year.

This Strategy recognises the rights of all existing licence-holders regardless of the history of use. This applies to sleeper licences on unregulated rivers and groundwater systems. A sleeper licence is an inactive licence under section 51 of the Water Act to take and use water from a waterway or aquifer (see Reference Guide 1).

This approach reinforces the security of water rights and avoids potential impacts from sleeper licences being 'activated' to demonstrate use under a 'use it or lose it' policy.

Any impacts on the reliability of supply from increased use of existing licences (including activation of sleeper licences) will be shared by all licence-holders through local management arrangements (see Policy 3.3, page 61). All water users are encouraged to make the most efficient use of their water.

Providing more security to section 51 take and use licence-holders

Holders of water shares on regulated river systems, such as the Murray, have a perpetual right to water.

Some submissions to the Draft Strategy argued that section 51 take and use licence-holders should also be granted a perpetual right, noting that the ability to access the water in any given year would still be subject to water availability. They also noted that the volume and conditions of the licence could still be changed through the preparation of a statutory management plan in a water supply protection area or as part of a long-term resource assessment every 15 years.

The *Water Act 1989* requires licences to be renewed unless there are good reasons not to do so. While this provides a relatively high degree of security and in practice most licences are renewed without any change to conditions, arguments for extending the licence term or making it perpetual include:

- *Providing greater confidence to invest* – For example, if there were only a few years remaining on the licence, a farmer may not be confident that the water will be available to support a significant investment (for example, to construct a deep bore).
- *Providing greater confidence to trade* – Some stakeholders argue that if the licence was perpetual, farmers would be more willing to trade on a permanent basis.
- *Potentially making section 51 take and use licences an asset that could be mortgaged* – If licences were perpetual with the same characteristics as a water share, this could make them an asset farmers might borrow money against to finance future investments.
- *Longer licence terms may reduce the risk of government intervention* – As governments change and introduce new policies, short-term licences may be exposed to more frequent government intervention compared to longer-term licences or water shares.
- *Reducing costs associated with licence renewals* – As licences must be renewed unless there are good reasons not to do so, the administration and costs associated with renewing them are considered a burden with limited benefits that could be reduced or avoided if the term was increased or made perpetual.

Some of these arguments have merit. However, it is important to note:

- Licence-holders can apply to have their licences renewed at any time, which means a licence-holder could apply and have the licence renewed for a period of up to 15 years before making an investment.
- Access to a section 51 take and use licence is likely to be incorporated in the value of a farm, which is able to be mortgaged.
- On ephemeral/unreliable streams or unreliable groundwater systems, the reliability of the system rather than the length of the licence term is likely to drive investment decisions.
- If the system was unreliable but supported high social, economic and environmental values, extending the licence terms may limit the ability to manage risks to those values by reviewing licence conditions on a more frequent basis (for example, every five years).

Policy 3.2 Sleeper licences

The rights of section 51 take and use licence-holders will continue to be recognised, independent of their current water use and, if activated, will be subject to the same management rules applied to active licence-holders (for example, restrictions or bans in times of scarcity).

These points suggest that the costs and benefits of extending the licence term are likely to be system-specific. Where a system is highly variable or unreliable, the arguments for extending the licence term are weaker. Where a system is reliable, which can often be the case in groundwater systems with significant storage, the arguments for extending the licence term or potentially establishing water shares may be stronger.

The Government accepts that there may be benefits in enabling licence terms to be extended for up to 20 years. However, before extending licence terms on a specific system, rural water corporations, in consultation with licence-holders and the relevant catchment management authority, would need to review and update the relevant local management plan to ensure they adequately consider the potential benefits and risks associated with extending the licence term.

In groundwater systems where there is significant storage and the rate of recharge is good, there may be an opportunity to provide greater certainty to users by establishing groundwater water shares. Groundwater water shares could be similar to unbundled water shares on regulated surface water systems, potentially providing the many benefits associated with the water share product, such as an asset that can be mortgaged, the ability to receive annual allocations and more streamlined processes for trading of allocations, long-term leases and carryover.

At this stage, there is likely to be only a few systems where it would be suitable to establish groundwater water shares. This is because there is likely to be only a few systems where there is significant storage and strong evidence that the benefits of establishing permanent water shares are likely to outweigh the administrative costs. From the experience of unbundling regulated water systems, these costs can be high.

3.1.2 Strengthening the entitlement framework

Victoria's water entitlement framework is designed to share water among uses in an equitable and orderly way. It does this by setting out the rights to water for a range of consumptive water uses and users, including the environment.

The current entitlement framework has evolved. As more has been learned about the State's water resources and the competing demands on them, the entitlement framework has been updated to ensure water rights are clear and protected.

For example, the *Water (Irrigation Farm Dams) Act 2002* strengthened the water management framework by bringing all irrigation and commercial use of water under the licensing regime, irrespective of whether the water was being diverted from a waterway or not.

Action 3.1 Providing more security to section 51 take and use licence-holders

Who: Minister for Water, rural water corporations, catchment management authorities **Timeframe:** 2013

The Minister for Water will propose changes to the *Water Act 1989* to enable section 51 take and use licences to be issued for up to 20 years.

Rural water corporations may renew and/or issue a licence for up to 20 years provided the proposed extension to the term of a licence on a particular system, including the potential benefits and risks associated with the proposed extension, has been discussed and determined as part of the process to prepare, review or amend a local management plan.

The Department of Sustainability and Environment, in consultation with rural water corporations and catchment management authorities, will investigate the potential to convert section 51 take and use licences into groundwater water shares where:

- resource assessments and management have shown that the groundwater system has significant storage and the rate of recharge is good; and
- the benefits of establishing groundwater water shares are likely to outweigh the administrative costs.

For the water entitlement framework to remain effective, all significant water uses must be recognised and managed. When uses are outside the water entitlement framework, their impact on water resources cannot be measured well or controlled effectively. The consequences of water scarcity may not be shared equally, and existing rights to water could be undermined.

The entitlement framework also needs to be updated to incorporate improvements in understanding, technology or the way water is delivered. For example, entitlements need to be amended after major water savings projects to ensure the savings are realised and allocated to the beneficiaries of the project. Mapping of groundwater has also provided new opportunities to manage whole aquifer systems (see Section 4.2.1, page 107).

This Strategy strengthens the entitlement framework by:

- ensuring the management of licensed groundwater use is better aligned with the characteristics of each groundwater system (Chapter 4);
- establishing arrangements for monitoring and managing the adverse impact of significant land use change on water availability (Chapter 5); and
- clarifying how water savings from the Wimmera-Mallee Pipeline will be shared between consumptive users and the environment (Chapter 6).

The Strategy also emphasises the need to continue to monitor water use outside the entitlement framework. This includes growth in domestic and stock water use in rural residential areas, where regulations have been introduced to ensure all new or enlarged domestic and stock dams are registered and comply with guidelines for reasonable domestic and stock use (see Box 3.1).

Farm dam filling Photo: Southern Rural Water

Box 3.1 Registering domestic and stock dams in rural residential areas

Domestic and stock water use continues to be an 'as of right' use if used for the purposes defined in the *Water Act 1989*.

However, in 2009, new state-wide policies were announced to improve the management of domestic and stock water use by:

- requiring the registration with the local rural water corporation of all new or altered domestic and stock dams within rural residential areas;
- promoting sustainable use in accordance with *Guidelines for reasonable domestic and stock use*; and
- committing to further review Victoria's approach to domestic and stock management after the release of the draft Murray-Darling Basin Plan.

New regulations

All new household dams in rural-urban fringe areas in Victoria need to be registered with rural water corporations.

The regulations came into effect on 1 January 2011. They require property owners in rural residential areas to register with their rural water corporation any new aesthetic dam, domestic and stock dam, or plans to significantly alter existing dams before beginning any works.

However, while property owners were encouraged to register their dams, the Minister for Water announced a two-month grace period before the water corporations put in place formal registration programs.

A rural residential area is any property located within the rural living zone, green wedge zones or any residential zone as defined by Victoria's Planning Schemes, or any property that is eight hectares (twenty acres) or smaller.

Under these policies, people with existing dams in rural residential areas do not need to register them unless they want to significantly enlarge them.

Property owners who live outside a rural residential area (with a property larger than eight hectares) do not need to register their new domestic and stock dams.

Defining 'reasonable' domestic and stock water use

The Department of Sustainability and Environment has prepared guidelines to promote the sustainable use of water for domestic and stock or aesthetic purposes. The guidelines help determine reasonable domestic and stock use, and suitable dam sizes.

Further review of Victoria's domestic and stock management arrangements

The release of the draft Murray-Darling Basin Plan was delayed from late 2010 to late 2011. At this stage, it appears that Victoria's current domestic and stock management arrangements will adequately meet the needs of the Basin Plan. Therefore, the proposed review can be postponed until the next review of sustainable water strategies in 10 years.

However, if detailed consideration of the draft and final Murray-Darling Basin Plan reveal the need for refinement to Victoria's domestic and stock management arrangements, any potential changes will be the subject of extensive public consultation as part of the process to implement and comply with the Murray-Darling Basin Plan by 2019.

Further information on the new regulations and contact details of all rural water corporations can be obtained from: http://www.water.vic.gov.au/resources/news_items/news_items_folder/new-regulations-domestic-stock-water-dams

Improving information about domestic and stock dams

In addition to the requirement to register new or substantially enlarged domestic and stock farm dams in rural residential areas (see Box 3.1), land holders in these areas will be required to register their domestic and stock dams following a change of ownership. A rural residential area includes any property:

- located within the rural living zone, green wedge zones or any residential zone as defined by Victoria's Planning Schemes; or
- that is 8 ha (20 acres) or smaller.

This requirement is intended to capture peri-urban areas where farming is not the primary long-term activity. It will provide better information to track potential increases in water interception by farm dams in areas being developed more densely for peri-urban purposes, without placing unnecessary demands on farmers. It will help water corporations assess potential impacts from domestic and stock use on water supplies.

Registering new active domestic and stock bores

There is currently no practical way for the Government to know whether a domestic and stock bore is in operation or not. This gap in information about the location of active bores makes it difficult to:

- assess the potential for any adverse impact on existing users when approving a new licence or the transfer of an existing licence; and
- accurately estimate domestic and stock groundwater use.

A person who wants to extract groundwater, even for domestic and stock purposes, must obtain a licence to 'construct' a bore under section 67 of the *Water Act 1989*. If the water is for commercial use, the person must also obtain a licence to 'operate' the bore under section 67. This 'operating' licence confirms the bore is in operation and ensures the bore is operated and maintained in a way that protects the integrity of the aquifer, such as ensuring an appropriate pumping rate. It does not provide conditions on the volume of water that is taken.

A bore used solely for domestic and stock purposes is currently exempted from the requirement to obtain an operating licence. This means that while the location of the bore is generally known, current arrangements do not confirm that the bore is in operation.

To help monitor and keep track of the growth in active domestic and stock groundwater bores, the Government will introduce a requirement for domestic and stock users who construct a new bore to register the bore as being active by obtaining an operating licence, once the bore has been sunk and is ready for use.

This requirement will apply to any new bores constructed from 1 September 2012. Existing property owners will not be required to obtain an operating licence for their existing bores. However, when a property changes hands, the new property owner will be required to obtain an operating licence for all active domestic and stock bores on their land.

Action 3.2 Improving information about domestic and stock dams

Who: Minister for Water, Department of Sustainability and Environment, rural water corporations **Timeframe:** 2013

The Minister for Water will require property owners in rural residential areas to register existing domestic and stock dams when a property changes ownership.

Action 3.3 Requiring property owners to register new domestic and stock bores

Who: Minister for Water, Department of Sustainability and Environment, rural water corporations **Timeframe:** End 2012

The Minister for Water will require property owners who construct a new bore to register the bore as being active by obtaining a section 67 operating licence once the bore has been sunk and is ready for use. This requirement will also apply to existing bores when a property changes ownership.

This requirement will provide better information about domestic and stock use over time. It will also help identify the number of constructed domestic and stock bores that are in use, which will help licensing authorities assess the potential for bore interference when approving a new take and use water licence or transfer of an existing licence. Better information about the location of active domestic and stock bores will help ensure the potential impact on supplies to the owners of those bores is adequately considered by rural water corporations when making licensing decisions in the area. It will also help improve the understanding and management of groundwater resources and extraction in the area.

The operating licence for domestic and stock bores will be issued under section 67 of the *Water Act 1989* for 20 years with a condition to notify the rural water corporation and cancel the licence if the bore fails or is decommissioned during that period. This licence term will ensure that information is updated at least every 20 years while minimising the costs associated with renewing the operating licence too frequently. The operating licence would attract a moderate upfront administration fee associated with issuing and renewing the licence, similar to the fee charged by rural water corporations for registering domestic and stock dams in rural residential areas.

Monitoring water use outside the entitlement framework

The Victorian Government recently received funding from the National Water Commission to undertake a project that aims to:

- estimate all significant water uses currently outside the water entitlement regime;
- record these estimates on the Victorian Water Register and Victorian Water Accounts; and
- track this use over time.

This project will consolidate the various tools available for estimating unaccounted water use to gain cost-effective, point-in-time estimates, and develop a framework for adopting emerging technologies to achieve more accurate estimates over time. These estimates will establish an information base from which more active management of unaccounted water use can evolve.

3.1.3 More responsive local management for licensed water extractions

The Victorian Government allocates water from groundwater systems and unregulated river systems (rivers with no large dams or weirs) by issuing individuals with licences to take and use water under section 51 of the *Water Act 1989*, and water corporations with bulk entitlements under section 34A of the Act. If water is available, it can be taken and used in accordance with the licence conditions. If there is not enough for all needs, conditions on the licence provide for water use to be restricted to:

- ensure available water is shared equitably between users; and
- protect the environment and the long-term condition of the resource.

Under the Act, the main mechanism for establishing management arrangements for section 51 take and use licences on unregulated surface water and groundwater systems is the process of declaring a water supply protection area (WSPA) and preparing a statutory management plan. This process, which was introduced in 1969, was originally used to tighten controls on licensed water use, such as caps on extractions, increased monitoring, the requirement to meter use and the ability to levy charges to recover management costs.

Action 3.4 Monitoring and tracking water use outside the entitlement framework

Who: Department of Sustainability and Environment **Timeframe:** Annually

The Department of Sustainability and Environment will monitor, track and report on water use outside the entitlement framework annually using:

- registrations of domestic and stock dams in peri-urban areas;
- records of construction licences for domestic and stock bores;
- estimates of domestic and stock water use reported on the Victorian Water Register and Victorian Water Accounts; and
- estimates of water intercepted by current land use throughout the State (see also Action 5.1 and 5.2).

This information will be used to inform the review of this Strategy in 10 years, which will assess the need for more active management of water use outside the entitlement framework.

Since 1969, several reforms have improved management without the need to develop a statutory management plan. These reforms include:

- The Minister for Water now has the ability to set permissible consumptive volumes (PCVs) to cap licensed water extractions.
- Since 2004, rural water corporations have rolled out an extensive metering program, which has resulted in all surface water extraction over 10 ML and groundwater extraction over 20 ML (over 10 ML in Southern Rural Water's area) being metered.
- Water corporations now recover the costs of managing the licensing regime through charges approved by Victoria's independent economic regulator, the Essential Services Commission.

For some stressed systems, statutory management plans may not have the power to address the main causes of that stress, such as water use under a bulk entitlement, land use changes or the proliferation of domestic and stock farm dams. Also, many of the original management outcomes that statutory management plans aimed to achieve are now in place. In addition, the process for developing a statutory plan is resource-intensive and time-consuming, and is most relevant in areas where licensed extraction is the main cause of stress.

This suggests that statutory management plans are now not required for all systems, and developing new statutory management plans is likely to be costly and time-consuming with limited additional benefits for users and the environment.

In the absence of a statutory management plan, rural water corporations will continue to use licence conditions to manage supplies in times of shortage. However, with the potential for more variable water supplies in the future, there is a greater need for water users and environmental managers to know how the licence conditions will be applied to manage periodic changes in water availability.

While rural water corporations have developed local management rules on some systems to explain to users how the licence conditions will be invoked (for example, roster or restriction rules), the Government believes these rules should be formally documented in local management plans to improve transparency and provide greater certainty to users about the processes for reviewing and changing these rules over time.

Local management plans will be developed for all systems. They will improve management by providing a more flexible way to clarify water-sharing arrangements in most systems.

Policy 3.3 Establishing local management plans for unregulated surface water and groundwater systems

Local management plans will:

- document the management objectives for the system;
- explain to licence-holders (and the broader community) the specific management objectives and arrangements for their water resource and the rules that apply to them as users of that resource;
- clarify water-sharing arrangements for all users and the environment, including environmental flow requirements;
- consider the environmental values documented in regional river health strategies;
- document any limits, including water use caps, permissible consumptive volumes or extraction limits that apply to the area/system;
- document rules for applying temporary qualifications;
- include trading zones and rules;
- be based on existing operational rules, recognising the rights of existing licence-holders;
- if applicable, document groundwater carryover provisions;
- document monitoring and reporting requirements;
- be periodically reviewed to incorporate new knowledge;
- be consistent with the *Policies for Managing (section 51) Take and Use Licences*; and
- be publicly available on water corporation websites.

Local management plans will be responsive and adaptable to local conditions and the characteristics of each groundwater or unregulated river system. They will specify rules for applying and removing rosters or restrictions on water use that:

- closely match the characteristics of each system, with every opportunity explored to apply them in a way that best meets the needs of users and the environment; and
- are clearly documented and well understood by users, with any proposed changes to these rules subject to appropriate consultation with users and environmental managers.

Local management plans will also document the water trading rules for each system, with appropriate links to the relevant state-wide water trading regulations and policies (see also Box 3.2).

"We believe formal local management rules (plans) are an important management strategy as they allow for a more tailored approach to the management of groundwater and unregulated river systems." – submission to the Draft Strategy DS262

Local management plans will conform to state-wide policies for managing licensed water use (see Box 3.2). Further guidelines will be prepared to facilitate the development of these plans as a more efficient streamlined water planning process to address the circumstances in specific areas. In some cases, existing rules will be documented in local management plans.

Box 3.2 State-wide guidelines for licensed water use

The Minister for Water delegates powers under the *Water Act 1989* to rural water corporations to manage water use throughout the State. The Department of Sustainability and Environment prepares and updates Ministerial guidelines (*Policies for managing section 51 take and use licences*) to reflect current government policy and best management practice to ensure rural water corporations have appropriate processes in place to make good licensing decisions, which protect downstream users and the environment (see http://waterregister.vic.gov.au/Public/TakeAndUseLicences.aspx).

In particular, the guidelines require a licensing authority, when issuing, renewing or approving the transfer of a licence, to consider the need to include conditions to protect the environment and other water users. This can include consultation with the relevant catchment management authority and the Department about allocation and restriction arrangements.

These policies have been consolidated in recent years by updating and developing Ministerial guidelines for:

- Basic standards for section 51 take and use licences and how they can be issued and traded, including trading rules, caps on new licences, metering requirements, standard licensing conditions (such as pumping rates, passing flows and roster and ban arrangements), the use of the Victorian Water Register to record all licences in the State, and the implementation of new policies, such as the dairy shed transition program and licensing for crown frontage fencing.
- Minimum standards for the construction, alteration, decommissioning or operation of works licensed under section 67, including groundwater bores, works on a waterway (such as a pump) and potentially hazardous dams.
- Rural water corporations assessing and recording domestic and stock dams in a rural residential area.
- Standards to permit underground disposal of drainage water and other waste, and also increasingly Managed Aquifer Recharge projects (see Section 4.3.1, page 113).
- Licensing requirements to harvest stormwater under a section 51 take and use licence from the works of an authority or from a waterway.

Action 3.5: Developing local management plans for unregulated surface water and groundwater systems

Who:	Rural water corporations, Department of Sustainability and Environment
Timeframe:	Plans for all areas with existing rules – Mid 2012 Work schedule for developing other plans – End 2012

Rural water corporations will develop local management plans in accordance with guidance prepared by the Department of Sustainability and Environment. All existing operating arrangements for the region's surface water and groundwater systems will be formalised as local management plans by:

- converting existing rules into local management plans on systems where rural water corporations are of the view that the existing rules are sufficient and working effectively, and there are no immediate concerns about the reliability of supply; and
- publishing a work schedule for developing local management plans on systems where rural water corporations believe that existing rules are not sufficient and need to be reviewed/revised.

Local management plans will be prepared for the surface water systems listed in Table 3.1 over the page and the groundwater systems listed in Table 4.1 (page 111).

Table 3.1 outlines the timeframe for developing local management plans on each river basin and, where needed, for specific unregulated surface water systems. Most of these specific systems have local management rules in place that will be converted into local management plans by mid 2012. The development of local management plans for each groundwater management unit is discussed in Chapter 4 (see Table 4.1). Chapters 7 to 10 list the local management plans required for surface water and groundwater systems in the sub-regions (see Tables 7.2, 8.2, 9.2 and 10.3).

Photo: SRW

Travelling irrigation system

Table 3.1 Local management plans for surface water in the Western Region

	River basin	Unregulated river system	Timeframe
Areas where existing rules will be documented as local management plans	Otway Coast	Otways (Aire River – Anglesea River) Gellibrand River[a] Curdies River Lake Purrumbete	Mid 2012
	Glenelg	Glenelg River Crawford River Stokes River Wannon River Grange Burn	
	Hopkins	Hopkins River/Mt Emu Creek/Brucknell Creek Cudgee Creek	
	Portland Coast	Condah Drain Fitzroy River Moyne River Shaw River Surrey River Eumeralla Creek	
	Lake Corangamite	All relevant river systems in basin	
	Avoca River	Avoca River	
	Wimmera-Avon	Avon-Richardson River Upper Wimmera River[b]	
	Mallee	As needed	
	Millicent Coast	Mosquito Creek	
Areas where existing rules will be reviewed or improved[d]	Hopkins	Merri River[c]	End 2012

Notes: A local management plan will be developed for each river basin. Where needed, plans for specific unregulated rivers within each basin will be developed and attached as a schedule to the local management plan for the basin.

[a] The Gellibrand River will be managed based on a local management plan. A statutory streamflow management plan will not be prepared (see Section 7.3.1).

[b] The Upper Wimmera River will be managed based on a local management plan. A statutory streamflow management plan will not be prepared (see Section 10.3.1).

[c] The Merri River will be managed based on a local management plan that will include changes to rules outlined in Section 8.3.1. A statutory streamflow management plan will not be prepared.

[d] Existing rules will continue to apply in these areas until they are reviewed/revised and incorporated in a new local management plan.

Water supply protection areas

Local management plans will provide adequate management for most unregulated rivers and groundwater systems. However in highly stressed systems, the water-sharing arrangements or the total volumes licensed for use may need to be revised to restore water for the environment or to address reliability problems. In these cases, a WSPA will be declared under section 32 of the *Water Act 1989* and a statutory management plan prepared. This formal process allows competing demands to be negotiated and resolved.

In areas where a WSPA has already been declared but the statutory management plan has not been finalised or is due to be reviewed or updated, consideration needs to be given to whether a statutory management plan is still required. If not required, the rural water corporation will initiate the process for un-declaring the area and preparing a local management plan. Chapter 4 provides details of areas where WSPAs have been declared for groundwater management purposes but there is no longer a need for the statutory management plan to be completed (see page 112).

The development of a statutory management plan for a WSPA can take 18 months or longer and requires the Minister for Water to appoint an overseeing consultative committee and extensive consultation with licensees and the broader community. This process will be reviewed to ensure it operates as efficiently as possible to meet the needs of water users and the environment.

3.1.4 Reviewing entitlements to account for any long-term changes in water availability

A key strength of Victoria's entitlement framework is that permanent changes cannot be arbitrarily made to existing entitlements.

Section 51 take and use licences, which are issued for a defined period, can be amended only:

- when a licence is renewed, however the Minister for Water must have regard to several matters and must renew the licence unless there are good reasons not to do so;
- through the declaration of a WSPA and development of a statutory management plan (discussed above); or
- following a 15-year review of water resources (discussed below).

Bulk entitlements, environmental entitlements and water shares, which are all permanent rather than renewable rights, can be amended only:

- at the request of the entitlement-holder, for example following the completion of water savings projects; and/or
- following a 15-year review of water resources.

The fact that entitlements are not subject to arbitrary changes gives water users, water corporations and environmental managers confidence to invest in their water future. Under the *Water Act 1989*, the Minister for Water is required to undertake a 15-year review of

Policy 3.4 Developing statutory management plans for water supply protection areas

In the event that new information identifies an unregulated surface water or groundwater system as highly stressed, the Minister for Water will declare a water supply protection area and rural water corporations will develop a statutory management plan if:

- licensed extraction is the primary cause of the stress on the system;
- there is a need to amend licence conditions before renewal of licences;
- permanent or ongoing restrictions on licensed extraction are required to protect consumptive licences, domestic and stock use or the environment; and/or
- the overall licensed volume needs to be reduced.

Action 3.6 Reviewing the process for declaring water supply protection areas and developing statutory management plans

Who: Minister For Water, Department of Sustainability and Environment, rural water corporations **Timeframe:** End 2012

The process for declaring WSPAs and developing statutory management plans will be reviewed to identify options for improvements, such as developing the criteria against which WSPAs are declared and options to streamline the process.

water resources, with the first review due to be completed by 2019. The Act sets out the formal process for assessing the resource availability and if needed, rebalancing water for consumptive and environmental purposes.

Recent experience of the process to develop the Murray-Darling Basin Plan highlights the difficulties and potential uncertainty associated with undertaking centralised, periodic resource assessments across a huge region, with the expectation of rebalancing water for consumptive and environmental purposes.

While the *Water Act 1989* requires the Minister for Water to undertake a 15-year review, the Victorian Government will continue to use sustainable water strategies to establish more flexible and adaptive processes, which allow water managers to work with the community to manage water resources sustainably, responding at a local level when problems arise and potentially avoiding the need for once-off, centralised rebalancing in the future.

These processes and the decisions that come from them will aim to protect existing entitlement-holders and the environment, and avoid irreversible impacts or the need to reduce consumptive use in the future.

Policy 3.5 Reviewing entitlements

Through actions and policies developed in sustainable water strategies, the Victorian Government will promote more flexible and adaptive management arrangements which allow water managers to:

- work with the community to manage water resources sustainably;
- respond at a local level when problems arise; and
- potentially avoid the need for once-off, centralised rebalancing as part of the 15-year long-term review.

3.2 Promoting the sustainable use of the region's water resources

The long-term sustainable use of the region's water resources depends on understanding the risks to those resources and to supply reliability. With greater demand for water likely in the future (see Box 3.3), current water supplies need to be used as efficiently and as profitably as possible. New water (where it is available, see Technical Report 4 found online) can then be allocated to improve reliability or for new uses.

3.2.1 Improving our understanding of climate risks

Regional sustainable water strategies play a key role in providing water users, water managers and the community with the most up-to-date information about the threats to water availability. The latest information about the risks from climate variability (see Section 2.2 and Appendix 3) gives water users and managers an understanding of what the future might hold and how they may need to manage risks of water scarcity. As more research or modelling is completed, the findings will be made available to water users and water managers as soon as possible so their management decisions can be informed by the latest science.

Box 3.3 Future demand for water in the Western Region

Urban water use

Predicted urban population changes vary throughout the region (see Section 2.3.1). Growing populations along the coast will increase household and industry demands. Larger centres in inland areas are also likely to grow. These increased demands will be managed through each urban water corporation's water supply-demand strategy (see Section 3.3.1).

Water use by large industry

Large industrial water users include food processing, energy generation and mining (see Section 2.3.2). New industries will come to parts of the region bringing benefits but also significant demands for reliable water. In some cases, these demands can be managed with innovative approaches, such as the use of town effluent for the Mortlake power station. A recent study of potential demand undertaken for this Strategy (see Technical Report 3 found online, *Water demands in unregulated catchments – Southern Victoria*) found that mining and electricity generation are unlikely to drive significant changes in demand in the south of the region over the next 10 years. Demand from the geothermal generation industry may grow in the next 10 to 20 years, and coal seam methane gas extraction could use large volumes in the future. In the north of the region, the mineral sands industry is likely to expand, and the Wimmera-Mallee Pipeline will allow growth with 18 GL remaining for new development.

Rural water use

Water demand of some agricultural industries is expected to grow in the next 10 years. The recent demand study found that:

- A range of factors will influence what and where new water demands will occur, including commodity prices, the cost of land, access to markets, as well as the reliability of water supplies.
- Growth in demand is generally likely to come from the predominant industry already present in each area.
- Some new water demands may be created as industries relocate from peri-urban growth areas.

Dairying has the greatest potential for growth in the south-west under current market conditions. This growth will rely on access to water for dairy wash down – typically less than 20 ML per year for each new enterprise. Intensive animal-raising may expand in areas within two hours of Melbourne and Geelong. These industries require and are willing to pay for 100 per cent reliable and high quality water supply. In the north of the region, the 18 GL from the Wimmera-Mallee Pipeline will also support new rural businesses. Population growth near regional centres will increase demand for domestic and stock supplies in rural-residential areas.

The following general conclusions from the water demand study were considered in developing policies and actions for rural water use for this Strategy:

- The cost of constructing off-stream storages (in the order of $400 per ML per year) or accessing deeper groundwater sources is too expensive for all but the higher value rural industries such as horticulture, intensive animal-raising, and dairy stock watering and wash down. These costs are likely to limit the demand for significant irrigated agriculture in the region.
- There is likely to be demand for smaller volumes, such as water for dairy wash down, to support growth in largely rain-fed industries with the ability to substitute feed for grass.
- There is likely to be demand for smaller volumes to support high value industries such as intensive animal-raising.
- Facilitating access to smaller volumes through new allocations or trade will be critical to support economic growth.
- All-year licences and shallower, reliable groundwater supplies are the lowest cost options for rural and agricultural users – the ability to trade these options where possible could help move water to its highest value use.
- Because only smaller volumes are likely to be sought, there is the potential for agricultural growth without significant adverse impact or risks to the health of the region's waterways.

Action 3.7 Improving information sharing about climate variability and risks

Who: Department of Sustainability and Environment **Timeframe:** 2011 and ongoing

The Department of Sustainability and Environment will:

- make available on its website links to the latest research on climate variability and climate change undertaken by the South Eastern Australian Climate Initiative (SEACI); and
- regularly review and update streamflow projections to incorporate the latest advances in government understanding of climate projections and scenarios.

3.2.2 Monitoring the condition of water resources

Adequate monitoring of the State's water resources is the basis for ensuring appropriate management and the most valuable water use while protecting the environmental, social and cultural values those resources support, now and in the future. This monitoring is required under section 22.1(a) and (b) of the *Water Act 1989*.

The monitoring of surface water at 768 sites throughout the State is undertaken through regional water monitoring partnerships. These partnerships involve collaboration between the Department of Sustainability and Environment, water corporations, catchment management authorities, coastal boards, local councils, the Bureau of Meteorology and other organisation with an interest in water, such as energy companies. These partnerships coordinate activities by management agencies so that monitoring is cost-effective and provides the information needed to manage surface water resources, and the data can be used effectively by a wide range of stakeholders.

Section 4.4.1 (page 118) describes the arrangements for monitoring groundwater. This is undertaken through the State Observation Bore Network – a collection of about 2,500 bores managed by the Department of Sustainability and Environment in cooperation with water corporations and catchment management authorities.

Photo courtesy of DSE

State observation bore

3.2.3 Making the best use of existing supplies

This Strategy aims to make the best use of existing supplies by:

- continuing to promote water conservation and efficiency;
- exploring opportunities to improve storage capacity by, for example, using off-stream storages or aquifers, or extend the supply network; and
- encouraging water users to trade water with other users or carryover water from year to year.

Managing demand – promoting water conservation and efficiency

Recent drought conditions have highlighted the important role water efficiency and demand management measures can play in ensuring reliable supplies.

The community embraced extensive water efficiency and demand management campaigns throughout the State during the past 14 years. Homes and businesses changed their habits and actively sought to reduce the amount of water they used. Large-scale water efficiency projects, such as the Wimmera-Mallee Pipeline (see Chapter 6), also reduced the demand on the region's rivers.

The Victorian Government will continue to support urban water corporations pursuing water efficiency initiatives as part of their strategies for balancing supply and demand. The sub-region chapters (7 to 10) discuss water efficiency initiatives urban water corporations have in place or are developing as part of their water supply-demand strategies, which are due to be reviewed and updated by March 2012 (see Action 3.16, page 84).

In July 2011, the Government announced it would extend the water efficiency rebate program to include all Victorian households and small businesses and to encourage them to invest in water-efficient appliances.

The Government is continuing to encourage water efficiency in homes and businesses, and water corporations work with their communities and business customers to help them implement water-efficient practices. In particular, water advisers are working with business customers to reduce their water use and wastewater.

To help promote efficient water use, the Government has initiated a review of permanent water saving rules as part of a broader review of the *Victorian Uniform Drought Water Restriction Guidelines* (see Action 3.17, page 85). This review will develop permanent water saving rules that reflect community expectations about environmentally, socially and economically responsible water use.

In rural areas, the Government will continue to promote efficient use of water for irrigation and domestic and stock purposes. Best practice *Irrigation Development Guidelines* will continue to be applied in areas where new section 51 take and use licences are issued and irrigation is developing.

The *Guidelines for Reasonable Domestic and Stock Use* will be promoted to help domestic and stock users plan for and meet their efficient water needs. The Government will also promote efficient use of domestic and stock water as part of a new initiative to encourage sustainable water management on dryland farms (see Action 3.19, page 88).

In terms of water efficiency, another key issue for the region will be ensuring that water use stemming from the activation of sleeper licences is as efficient as possible. About 22 per cent of unregulated surface water licences in the Western Region are sleeper licences. However, this proportion differs dramatically between river systems – from about 2 per cent in the Merri River to 43 per cent in the Gellibrand River. Only 42 per cent of licensed groundwater entitlements is currently extracted, and a large proportion of the unused resource is expected to be from sleeper and under-utilised licences. When sleeper licences are activated, users will be encouraged to comply with best practice irrigation development guidelines.

Action 3.8 Promoting water conservation and efficiency

Who: Department of Sustainability and Environment, water corporations **Timeframe:** Ongoing

The Government will promote water efficiency by:

- requiring water corporations to evaluate cost-effective water efficiency options as part of their water supply-demand strategies;
- continuing to support rebate programs for water-efficient appliances for homes and small business;
- continuing to encourage water-efficient practices in homes and businesses;
- reviewing permanent water saving rules as part of a broader evaluation of the *Victorian Uniform Drought Water Restriction Guidelines*;
- requiring best practice *Irrigation Development Guidelines* to be applied for new irrigation developments and encouraging the use of these guidelines when sleeper licences are activated;
- continuing to support whole-of-farm planning through the Sustainable Irrigation Program, helping irrigators plan for and manage their water needs efficiently; and
- promoting efficient domestic and stock water use through the *Guidelines for Reasonable Domestic and Stock Use* and dryland sustainable water management program.

Exploring opportunities to improve storage capacity or extend the supply network

In some areas, the region's existing water could be put to better use if it could be stored and used in dry periods without adversely affecting existing users and the environment.

Private storages

Off-stream storages can be used by individual licence-holders to capture water from rivers during wet periods for use in drier months. Although more expensive than direct pumping and use of water, these storages reduce the impact of water extraction on the river by taking water when environmental stress is low, generally in winter. This can reduce demands in dry periods when environmental stress is highest. The total amount of water able to be taken over the year is unchanged.

This option may need flexibility to allow increased pumping rates during wet periods, for example by revising licence conditions or local management plans. It would be allowed only where there is a demonstrable need and where there are no unacceptable impacts on other consumptive users in the system and the environment.

Rural water corporations approve the construction of off-stream storages by issuing a licence under section 67 of the Water Act. The process of obtaining a section 67 licence can be time-consuming because it often requires a determination to be made that the storage is not on a waterway before the application is referred to the relevant catchment management authority, which may require the applicant to commission a study to assess the potential risks to the environment. The scope of these studies may differ in different parts of the State because there is limited guidance to catchment management authorities about how to assess the needs of the environment, including how to consider the potential benefits of converting an all-year licence to a winter-fill licence.

In some instances, it may not be possible to construct an off-stream storage and the applicant may seek approval to construct a storage on a waterway. Before this can occur, the rural water corporation must be satisfied that:

- the applicant has thoroughly investigated alternative sites for the storage and alternative sources of water supply;
- an environmental assessment report commissioned by the applicant demonstrates that the proposed works will not have an unacceptable impact on downstream ecological or riparian values at or near the site; and
- the section 67 construction licence includes appropriate environmental conditions, such as requirements to provide passing flows or appropriate fish passage.

Satisfying these requirements can be time-consuming because of limited information and guidance on how to identify waterways of high ecological value and how to determine appropriate environmental requirements.

There is a need for guidance to help applicants understand the risks to third parties and the environment associated with constructing water storages and the process they will need to follow to obtain the relevant approvals.

Action 3.9 Streamlining the approval of section 67 storage construction licences

Who: Minister for Water, Department of Sustainability and Environment, rural water corporations, catchment management authorities **Timeframe:** Mid 2012

The Department of Sustainability and Environment, in consultation with rural water corporations and catchment management authorities, will develop Ministerial guidance for assessing applications for section 67 licences to construct private storages, which will include guidance on:

- determining appropriate timelines for the application process;
- identifying waterways of high ecological value;
- assessing the needs of the environment, including how to assess the potential net environmental benefits of converting all-year licences to winter-fill licences; and
- determining appropriate environmental requirements and licence conditions.

Large public storages

Large public on-stream dams are a more traditional form of water storage. In the right situations, these storages may be the best option to provide water when it is needed. However, on-stream dams have major impacts on aquatic environments by changing the seasonal pattern of flow and obstructing the movement of fish and other animals that need to migrate along the waterway.

The assessment of any future large public storages should be based on a thorough investigation of the economic, environmental and social benefits and costs of each proposal. It should consider the risks of long-term climate variability and be consistent with State and Federal legislation.

Using aquifers to store additional water

In the right situations, managed aquifer recharge (MAR) could be used to store raw water, recycled water and treated stormwater for later reuse. For example, water could be stored in an aquifer over winter and extracted in summer to improve supply reliability and ease pressure on other water users or the environment over the summer months. The use of MAR could also avoid building expensive off-stream storages. Section 4.3.1 outlines the opportunities for using MAR and the precautions needed to protect groundwater resources, other groundwater users and the environment.

Harvesting high flows

The prospect of a more variable climate, with extended dry periods and floods, requires water harvesting rules to make the best use of storages while protecting the interests of all water users and the environment. The challenge is to find the right balance between providing flexible management options to entitlement-holders without adversely impacting on the needs of the environment and downstream users.

Most water entitlements provide for storages (on and off-stream) to be filled only from 1 July to 31 October. Winter-fill rules were established to minimise the impact on the environment by filling storages in winter and reducing diversions over the summer months, where inflows have historically been low.

During the recent drought (1997 to 2009), there was a noticeable shift in rainfall seasonality, with a clear reduction in Victoria's autumn/winter rainfall. Reductions in overall spring/summer rainfall was less significant and was coupled with an increase in the number and intensity of 'summer storms'.

It is not certain which weather patterns will influence Victoria's climate in the future. However, opportunities exist to amend the licensing framework to make it more flexible under a range of rainfall and climate patterns by allowing diverters to access high flows outside the winter-fill period.

Natural freshes and floods are vital for the health of a river system, by improving water quality, regenerating floodplains and wetlands, including agricultural soil and replenishing river channels (see Box 3.4). There is a risk that allowing diverters to access high flows outside the winter-fill period could reduce freshes or floods and harm the environment. Therefore, measures would need to be taken to ensure the harvesting of high flows does not materially reduce the benefits of freshes and floods, such as setting triggers for allowing harvesting based on a river height or flow capacity that will not erode the environmental benefits of high flow events.

There may be some benefits to reliability from enabling the harvesting of high flows, but these should not be overstated. High flow diversions linked to floods will be of an opportunistic nature and should not be seen as the panacea to extended dry periods, or the basis for significant new investment.

Policy 3.6 Assessing proposals for new large public storages

Proposals for new on-stream storages will be considered on a case-by-case basis as part of the assessment of all water harvesting options through existing water planning processes such as urban water corporations' water supply-demand strategies.

New public storages will be built and existing storages expanded only after a thorough investigation into the economic, environmental and social benefits and costs of each proposal. The cumulative environmental impact of on-stream storages will need to be assessed on a basin-wide context.

Controlled access to high flows will add to the options available to adaptively manage water-sharing arrangements for Victorian waterways. A decision to access high flows in a given waterway system will be made locally and will consider allowing access on river systems where:

- high flows are more likely to be sustained over a number of days;
- flow capacity may be considerably higher than total licensed demand;
- the proportion of water harvested is small compared to the stream flows; and
- customers are willing to pay the additional costs of managing access to high flows.

Water corporations would need to consider granting access to high flows as part of a system-specific planning process to assess relevant local issues, consult with stakeholders and be guided by the principles in Action 3.10. In some instances, it may be better to promote trade to provide the increase in management flexibility and/or reliability needed (see Action 3.12).

Extending the supply network

Extending the water supply network may be a useful and cost-effective way of making the best use of existing supplies in some situations and areas. It spreads the risks from dry conditions and can give greater supply flexibility. The benefits of this option need to be weighed against significant construction and operation costs.

The Government will continue to support water users and water corporations exploring the potential to extend the supply network to provide sustainable water supplies to existing and new users. The main opportunity for this in the region is likely to be extending the Wimmera-Mallee Pipeline to service more towns (see Chapter 6).

Box 3.4 The importance of summer and spring flows for the environment

Unregulated streams can receive short flows in the drier late spring and summer months. These pulses of water often come from local rainfall and usually last only a few days. They are greater than the usual low summer flows, and bring important ecological benefits to the stream by:

- providing breeding triggers for native fish and other biological triggers;
- increasing the release and distribution of food by creating short-term connections between the main channel and terraces along the river bank;
- helping to maintain a range of habitats by watering stream-side vegetation; and
- sustaining populations of some plants and animals.

Action 3.10 Harvesting high flows

Who: Department of Sustainability and Environment, rural water corporations, catchment management authorities **Timeframe:** End 2012

The Department of Sustainability and Environment in consultation with rural water corporations and catchment management authorities will investigate the option of providing access to high flows (outside the winter-fill period) based on the following principles:

a) the total volume of entitlements for a given system is not increased, although the reliability of entitlements may consequently increase;
b) harvesting high flows will be available on river systems and for flows only where the risk of adverse impacts to downstream users, and the immediate and downstream environments, is low;
c) appropriate constraints/rules on extraction, such as limiting individual pumps and pumping rates, are in place to ensure equitable access to high flow events; and
d) the licensee meets administration costs of managing and monitoring the harvesting of high flows.

The *Policies for Managing (section 51) Take and Use Licences* will be amended to formalise principles for licensing access to high flows and processes to be followed to determine implementation arrangements.

Action 3.11 Extending the reticulated supply network

Who: Department of Sustainability and Environment, water corporations **Timeframe:** End 2012

The Government will encourage water users and water corporations to explore the potential for extending reticulated supply systems to provide sustainable water services to users near existing pipelines. The potential benefits of extending the network will be weighed against significant construction and operation costs.

A consistent approach will be developed to manage the expansion of reticulated supply systems, considering:

- cost-effectiveness and risk management;
- who will provide the service (an urban or rural water corporation or community cooperative);
- whether the service is required for one customer or a group of customers;
- required level of service (for example, timing of supply and water quality needs);
- proximity to existing supply systems;
- terms and conditions for customers and how to determine a fair and reasonable price; and
- protection of both existing and prospective customers' interests.

Pricing arrangements will need to be consistent with the Essential Service Commission's existing pricing principles and any future principles developed as part of a state-based third party access regime.

Lake Fyans Photo: Click Zoom

What is needed for a water market to work well?

Water markets can work effectively when:

- the amount of water available is capped and fully allocated, so people wanting water will look to the water market to buy it;
- the ownership rights to that water are secure and clear, for example through a register of entitlements;
- there are many potential sellers and buyers, and simple and effective ways for them to find each other;
- sellers and buyers are connected to the same surface or groundwater system so that water can be transferred between them;
- potential sellers and buyers are well informed and there is clear, readily available information about the available water so they can make their own business decisions about the value of water and possible sales or purchases;
- any limitations for water trading are made clear in trading rules that are understood by potential sellers and buyers; and
- there is a good understanding of the trading process, for example the volumes traded, the prices paid and the time required to sell or buy water.

Types of water trading

Temporary trade

Water users with a water entitlement, or a tradeable water allowance, can trade part of that entitlement in a given year (known as a temporary trade), and still keep the entitlement. They will have their full entitlement the following year, unless they decide to sell some of it again.

Limited-term transfers or leases

Water users also have the ability to trade or 'lease' water for a multi-year period. However, the option of leasing water is currently available only for:

- up to 20 years on regulated systems; and
- up to five years if permanent transfers have been banned for more than 12 months due to the declaration of a water supply protection area, or the water corporation, after consultation with the Department of Sustainability and Environment, believes other circumstances warrant a temporary transfer for longer than one season.

Permanent trade

Water users may want to sell all or part of their water entitlement or tradeable water allowance permanently. They may have less need for water because of more efficient operations or because they have reduced the water-using parts of their business.

Water trade in Victoria

A water market has existed in Victoria since the early 1990s. In areas where new water entitlements are not available, water trading is the main way for individuals to access additional supplies. It enables rural water users, industries, urban water corporations and environmental managers to sell and buy water shares, seasonal allocations and section 51 take and use licences. Trading can encourage more efficient use of water resources without leading to an overall increase in water entitlements in an area.

The water market is a fair and effective way to reallocate water to meet changing needs of individuals and the community in the short and the long term. In times of water scarcity, it is a voluntary way to move water between uses. Without trade, irrigators could not buy additional water when allocations are too low to support their crops and pasture. Likewise, other irrigators could not sell their allocations to generate revenue.

If the market did not exist, other compulsory and more bureaucratic methods would need to be found to reallocate water. This type of government intervention would reduce water user's confidence in their entitlement and make it harder for them to plan ahead. It is therefore important to ensure Victoria maintains the integrity of its entitlement system, so the community has confidence to invest.

Trade and carryover

Water trading and the ability to carryover unused water entitlements can let water users manage the risk of changing water availability to meet their individual needs.

Improving opportunities for water trading

In parts of the region, where water resources are fully allocated or close to full allocation, the only way to obtain more water is to buy it from another water user or find alternative sources.

Effective water markets promote productive water use. They allow water to move from lower value to higher value uses as demands change over time, boosting the regional economic returns that can be made from the available water. Additionally, trading can help new water-dependent developments become established.

Potential water markets in the region

Water markets are well developed in regulated supply systems such as the Werribee Irrigation District. However, they are not nearly as well developed in the unregulated surface water and groundwater systems in the Western Region. Generally, this is because there are not enough active sellers and buyers drawing on the waterway or aquifer to create the market. However, opportunities exist to develop water markets where trade is already occurring and to facilitate trade in areas where there has been limited or no trade to date (see Section 4.3.2 for groundwater trading and Section 6.3.1 for water trading in the Wimmera-Mallee supply system).

The Minister for Water's *Policies for Managing (section 51) Take and Use Licences* (see Box 3.2, page 62) specify the current trading rules for unregulated surface water systems.

Under current arrangements, the trade of all-year licences is permitted to downstream areas (subject to a 20 per cent reduction in volume in northern Victoria unless the resulting licence is winter-fill) and to upstream areas if the all-year licence is changed to a winter-fill licence. In special circumstances, a licensing authority can apply to the Secretary of the Department of Sustainability and Environment to allow upstream trade to summer direct pumping licences if there is sufficient summer flow and there are no alternative supplies. The assessment of such applications is based on a precautionary approach to protect exiting water users and the environment.

In addition, Victoria's sustainable diversion limits (SDLs, see Reference Guide 2) are used as a tool to assess the capacity to trade or transfer winter-fill licences between unregulated sub-catchments. Under the current trading rules, if the sub-catchment to where the water is being traded has licensed volumes greater than the SDL, the trade would not be approved without a detailed assessment of the potential risks to existing users and the environment.

The *Policies for Managing (section 51) Take and Use Licences* do not specify trading rules for groundwater systems. This means rural water corporations generally assess applications to trade groundwater on a case-by-case basis in accordance with section 40 of the *Water Act 1989*, which requires several matters to be considered, such as the impact on other users and the environment, before approving the trade. In some instances, rural water corporations have developed and documented trading rules for particular groundwater systems in statutory management plans or local management rules.

The actions below aim to encourage and potentially free up water trading in the Western Region, while maintaining the benefits of the 'black and white' approach described above. The *Policies for Managing (section 51) Take and Use Licences* will continue to specify generic, 'black and white' rules for water trading.

Action 3.12 Improving opportunities for water trading in groundwater and unregulated river systems

Who: Department of Sustainability and Environment, rural water corporations, Department of Primary Industries, catchment management authorities **Timeframe:** End 2012

Trading opportunities and flexibility in groundwater and unregulated river systems in the region will be improved for entitlement-holders while minimising third-party impacts (see Table 3.2 for the specific actions to be taken).

Table 3.2 Improving water trading opportunities

Issue and context	Action	Who	Timeframe
Better information about water markets and trading • Government and water corporations can assist development of water markets by providing information to help potential participants understand how trading works and value their water entitlements each year.	**Action 3.12 (a):** A market development and education program will be implemented to inform water users and the wider community about trade, its benefits and how it works, including: • more detailed market information on the Victorian Water Register (www.waterregister.vic.gov.au); • information about trade concepts, rules, processes and applications, and sources for trade data; • requiring trading applications to disclose market prices; • information from other areas where trade occurs to allow people to infer market prices; • how potential sellers and buyers can use the Victorian Water Register to search for and view water licences held in an area; and • how to go about and complete a groundwater transfer.	DSE, SRW, GWMWater	December 2012
Increasing the potential for trade in unregulated surface water and groundwater systems • In some systems, the current trading rules or approval processes may limit trade despite the risks to existing users and the environment being low. It may be possible to develop system-specific trading rules that increase the potential for trade while ensuring the risks to existing users and the environment are low.	**Action 3.12 (b):** In developing or amending a local management plan, rural water corporations may develop system-specific trading rules that provide greater potential for trade while minimising risks to existing users and the environment. For example: • establishing trading zones to allow upstream and downstream trades in reaches of larger waterways; • providing exemptions to Victoria's sustainable diversion limits in sub-catchments where the risks to third parties are low; • establishing rules or arrangements that facilitate trades of small volumes where the risks are low; • identifying areas where trades could proceed without the need for a detailed, technical assessment of the potential risks to third parties; • identifying buffer zones where trades could not proceed without a detailed, technical assessment of risks. Any system-specific water trading rules in a local management plan must be reviewed and approved by the Secretary of the Department of Sustainability and Environment (on behalf of the Minister for Water) before being implemented. The *Policies for Managing (section 51) Take and Use Licences* will be amended to include this requirement.	DSE, SRW, GWMWater	As needed
Risk-based approach to approving water trades • Applications to trade water are assessed to identify potential impacts of the trade on third parties. However, the time and cost of these assessments can preclude the trade of small volumes such as for dairy wash down. The costs can be significant for groundwater trading, which must be supported by a hydrogeological assessment.	**Action 3.12 (c):** In applying section 40 of the *Water Act 1989*, rural water corporations will use a risk-based approach to determine the level of assessment required before approving a trade. Low risk trade applications could include those with low transfer volumes and low likelihood of impacts. Trades with little likelihood of affecting third parties might require only a desktop assessment. The Department of Sustainability and Environment will work with rural water corporations and catchment management authorities to identify best practice in using a risk-based approach to assess transfer applications. Temporary groundwater transfers of 20 ML or less will not require advertising or a detailed groundwater assessment unless there is likely to be a third party impact. These transfers will still be subject to trading rules for each management area or trading zone.	DSE, SRW, GWMWater	End 2012
Facilitating limited-term transfers or leases in unregulated surface water and groundwater systems • Under the *Policies for Managing (section 51) Take and Use Licences*, limited-term transfers or leases are currently permitted for up to five years in certain circumstances (see Box 3.2, page 62). Comments on the Draft Strategy suggested that providing greater ability for limited-term transfers or leases could help stimulate trading of section 51 take and use licences.	**Action 3.12 (d):** The *Policies for Managing (section 51) Take and Use Licences* will be amended to allow limited-term transfers or leases of section 51 take and use licences for: • a period of up to five years if the water corporation believes the risks to third parties are low; or • the licence term if the rural water corporation, as part of the process of developing a local management plan, has demonstrated that the benefits of enabling leases for the term of a licence outweigh the potential costs and risks to third parties.	DSE in consultation with SRW, GWMWater	Mid 2012

Carrying over water

Carryover allows individuals to keep their unused water allocation for use in the following season. This lets them manage their own reserves – and their own risks.

It encourages water users to use water efficiently because what water they save they can use next year. Together with trading, carryover gives individuals greater control over their own water supplies. Urban water corporations already carry over water from year to year to help avoid severe water restrictions and can make this more effective by using their own storages.

Carryover is possible only when water can be stored until it is needed, such as in the storages of the Wimmera-Mallee supply system (see Section 6.3.1) and in some large aquifers.

Legislation permits groundwater carryover in a groundwater system if the Minister for Water makes a declaration allowing carryover. For more information about carryover of groundwater entitlements see Section 4.3.2.

3.2.4 Promoting the use of alternative supplies such as recycled water and stormwater

Use of alternative water sources can provide many social and environmental benefits. If implemented well, they can replace potable water use, reduce pressure on existing stressed supply systems and the environment, and improve local amenity for communities. Alternative supply options can be developed to be 'fit-for-purpose' (that is, of a quality appropriate for its intended use).

Some examples of alternative supplies include:

- Urban stormwater is the extra run-off created by the large areas of pavement and other hard, impervious surfaces in towns and cities. With planning, particularly at the start of new developments, stormwater can be captured to supplement water supply.
- Rainwater (water run-off from rooftops) can also be captured and stored on-site in rainwater tanks for use.
- Use of recycled water (treated wastewater from sewage treatment plants) is common throughout the Western Region, especially in the drier north.
- Individuals actively use greywater (recycled water from showers, baths and hand basins in the home) to maintain their gardens during prolonged dry periods. To protect public health, permanent greywater treatment and reuse systems must be approved by EPA Victoria and a permit obtained from the relevant council.
- Desalination of brackish groundwater could provide greater reliability of supply for higher value uses in dry conditions.

Alternative supply options for urban uses will be considered through each urban water corporation's water supply-demand strategy (see Action 3.16, page 84) where they provide net community benefit. This includes reducing demand on potable supply systems, deferring major supply augmentation, and environmental, amenity and energy consumption benefits.

Warrnambool roof top harvesting project Photo: Wannon Water

The Government will continue to promote the use of alternative sources to meet future water needs. It recently established a Ministerial Advisory Council to, among other things, provide advice on how Melbourne could make better use of alternative supplies. The Ministerial Advisory Council has developed a Roadmap (see Section 3.3.1). This identifies priority reform areas to improve urban water management, including the need to optimise use of all available water sources and fit-for-purpose alternative water supplies. The Ministerial Advisory Council will also produce an implementation plan for these reforms. The Government's response, expected to be released in 2012, will consider the relevance of the council's advice to regional Victoria and highlight opportunities to facilitate increased use of alternative supplies.

Action 3.13 Encouraging fit-for-purpose use of alternative water supplies

Who: Department of Sustainability and Environment, water corporations **Timeframe:** End 2012

Increased fit-for-purpose use of alternative water sources will be encouraged where there are overall benefits to the community and in accordance with State and National guidelines (see Table 3.3 for specific actions to be taken).

Table 3.3 Encouraging efficient and fit-for-purpose use of alternative water supplies

Issue	Action	Who	Timeframe
Encouraging water corporations to use alternative supplies	**Action 3.13(a) Identifying alternative supply options in urban water corporations' water supply-demand strategies** Requiring water corporations to identify and evaluate potential alternative supply options as part of their water supply-demand strategies, including preparing an atlas of alternative supplies in their operating areas (see Action 3.16).	DSE, urban water corporations	End 2012
Urban stormwater	**Action 3.13(b) Allocating stormwater** Rural water corporations will continue to issue licences to harvest stormwater from their works and infrastructure or waterways, in accordance with Take and Use Policies. The Department of Sustainability and Environment will also continue to work with local councils and water corporations to consider the need to establish mechanisms for licensing stormwater from council works and infrastructure to ensure stormwater is allocated efficiently with due consideration of downstream users and the environment.	DSE, water corporations and local councils	End 2012
Managing desalination systems – *In-situ* systems leave salt in or around the bore. This may lead to localised salinity increases.	**Action 3.13(c) Guidelines for local desalination systems** Guidelines and licensing arrangements will be developed and applied for desalination systems, including disposal of brine in accordance with the *Environment Protection Act 1970* and *State Environment Protection Policy (Groundwaters of Victoria).*	DSE, EPA Victoria, water corporations	End 2012

3.2.5 Balanced approach to releasing unallocated water for consumptive use

While this Strategy promotes the sustainable use of existing and alternative supplies, there are unallocated water resources in the region that could be used to meet current and future water needs. A key issue for the Strategy is determining how these unallocated resources should be shared to ensure an appropriate balance between consumptive and environmental water use.

The key parcels of unallocated water in the Western Region include:

- 18 GL available for new growth in the Wimmera-Mallee supply system from water savings achieved by the construction of the Wimmera-Mallee Pipeline (see Section 6.3.2);
- unallocated surface water on unregulated streams for the winter-fill period under existing sustainable diversion limits (see Reference Guide 2), which includes:
  - 34.6 GL in parts of the Otway Coast Basin – see Section 7.2.1, page 174
  - 28.8 GL in parts of the Portland Coast Basin – see Section 8.2.1, page 192
  - 2.6 GL in parts of the Lake Corangamite Basin – see Section 9.2.1, page 209
  - 1.3 GL in parts of the Hopkins Basin – see Section 8.2.1 page 192;
- groundwater in areas where water is available under permissible consumptive volumes (PCV) or a resource appraisal has confirmed additional groundwater supplies could be made available (for example, the Dilwyn System – see Section 8.2.3); and
- saline or brackish groundwater in certain areas.

When examining the balance between environmental and consumptive uses of this unallocated water, there is a need to consider:

- potential benefits of making more water available for consumptive use;
- whether consumptive water demands are likely to increase;
- risks to the environment and existing water users; and
- uncertainty about future water availability.

How much unallocated water should be made available for consumptive use?

The nature of each system must be carefully considered before determining how much unallocated water should be made available for consumptive use.

On the Wimmera-Mallee system, the Government supports making available the full remaining 18 GL of growth water through a competitive process. Chapter 6 provides more detail of the growth opportunities this water could create and the process for making the water available (see page 152).

On unregulated streams where water is currently available under sustainable diversion limits, the Government supports a balanced approach to making new water available having regard to the principles in Policy 3.7.

The current sustainable diversion limits are based on historical streamflows. The methodology for setting these limits, which has been consistently applied for all unregulated streams and reaches in the State (other than the ephemeral streams in the Millicent Coast Basin), was designed to provide a precautionary estimate of how much water could be diverted through the issue of new licences or trades of existing licences at low risk to the environment.

Policy 3.7 Principles for managing unallocated water

For Western Region rivers and aquifers that are not yet fully allocated under existing caps, the balance between water for consumptive use and the environment should be set considering:

- the environmental, economic and social values supported by the river basin or aquifer and the costs associated with maintaining and improving those values;
- the existing and projected availability of water in the river basin or aquifer;
- the need to protect the reliability of supply to existing water users and the health of the environment; and
- the ability to meet the needs of consumptive users or the environment through other measures such as alternative supplies.

However, it is probable that the calculated sustainable diversion limits do not provide an accurate estimate of the amount of additional water that could be allocated. Given the recent climate experience, it makes sense to be cautious about allocating water available under the current sustainable diversion limits. It would be risky to allocate all available water if:

- the reliability of the full amount was uncertain;
- the use of the unallocated resource could impact adversely on existing users or the environment; or
- there was limited demand.

A more sustainable, 'no regrets' approach would be to make some of the water available now and reassess whether more should be made available as part of the review of this Strategy in 10 years.

The precautionary caps for each unregulated river with water available under the sustainable diversion limits are discussed in each sub-region chapter.

For groundwater, the Government supports additional water being made available where a resource appraisal shows this can be done sustainably. Chapter 4 includes an action to undertake strategic resource appraisals on certain groundwater systems with a view to making more water available to existing and new users (see Section 4.3.3).

In areas where groundwater is already available under the PCV (see Reference Guide 2 and Appendix 2), groundwater will continue to be allocated on a case-by-case basis consistent with the *Water Act 1989*, which specifies the matters that must be considered before the water is allocated, including the impact on existing users and the environment. Consideration of these matters sometimes means water cannot be allocated even though it is available within the PCV.

What if the groundwater is brackish?

The use of saline or brackish groundwater has been rare in the past. However, some industries can use brackish water, and new technology may make it an option for high value industries. In most cases, use of saline groundwater should be encouraged because of the potential benefits for mitigating land salinisation and mobilisation of salts to streams. Most saline groundwater reserves are in unincorporated areas, which do not have formal management arrangements. Any extraction of saline groundwater, other than for domestic and stock use, will require a licence under section 51 of the *Water Act 1989* to take and use water and be subject to the same requirements as other extractions.

How will the unallocated water be made available?

Major sources of unallocated water in the region will be released in stages based on the latest assessment of the sustainable yield of each system. As better understanding of each system develops, the potential for further allocations will be reconsidered.

Action 3.14 Balanced approach to managing unallocated water on unregulated rivers

Who: Department of Sustainability and Environment, rural water corporations **Timeframe:** Precautionary caps – End 2012

The Government will:

- impose precautionary caps on the issue of new licences taking into account the likely demand for additional water, potential impact on existing users and the environment, and climate uncertainty; and
- review the precautionary caps taking into account an assessment of demand when this Strategy is reviewed in 10 years.

If demand exceeds a cap before this review, a change in the cap would be considered where detailed assessment of the resource demonstrates a low risk to existing users and the environment.

Policy 3.8 Managing saline groundwater resources

Applications to use saline groundwater will be considered in two ways:

- Where there is no scarcity of the groundwater resource, applications will be assessed against the considerations under section 40 of the Water Act (like other applications).
- If there is significant demand for the resource, a local management plan will be developed for the area.

Action 3.15 Staged release of unallocated water

Who: Rural water corporations **Timeframe:** Progressive

Where unallocated water can be made available for consumptive use, within sustainable diversion limits for unregulated rivers and permissible consumptive volumes for groundwater systems, auctions and tenders will be used to ensure the price is based on the value of the resources.

The following water will be made available through auction or other competitive processes:

- the remaining 18 GL of water entitlement from the savings generated by the Wimmera-Mallee Pipeline ear-marked for development (see Section 6.3.2);
- future allocations from the Dilwyn Aquifer (see Section 8.2.3); and
- water available under the permissable consumptive volume for the West Wimmera Groundwater Management Area (see Section 10.1.2).

These and other auctions or tenders between 2011 and 2013 will provide an estimate of the market value of water in different parts of the region.

Rural water corporations will use the results of these auctions to inform the setting of a reserve price for unallocated water in areas where there is insufficient demand to hold an effective auction. However, the setting of a reserve price would be waived in circumstances where application fees and the costs of resource appraisals required to access the water already provide a strong signal about the value of the resource.

Any revenue raised through these auctions would be used by rural water corporations to cover the cost of the auctions and to undertake future resource appraisals.

Port of Portland - aerial view Photo: Wannon Water

3.3 Improving water supply reliability

3.3.1 Improving the reliability of supply for urban and industrial users

A secure water supply is critical to the future prosperity of the region's towns and regional centres (see Section 2.3.1).

Water supply-demand strategies

The region is well placed to meet its urban supply needs through the development and implementation of each urban water corporation's water supply-demand strategy (see Appendix 4 and Chapters 7 to 10). First prepared in 2007, these strategies set out actions to ensure water supplies are sufficient to meet the needs of cities and towns. As part of an adaptive management framework, these strategies must be reviewed and updated every five years so that decisions about managing the supply-demand balance are based on up-to-date information and benefit from recent experience. Each water corporation must review and update its water supply-demand strategy by March 2012.

As noted above, as part of the Government's *Living Melbourne, Living Victoria* initiative, the Minister for Water established a Ministerial Advisory Council to develop a roadmap and implementation plan for identifying and progressing priority areas in urban water reform (see Box 3.5). The roadmap and implementation plan will deal specifically with Melbourne, but its recommendations will guide reform across Victoria's cities and towns.

The roadmap emphasises the importance of a water planning framework that considers all options – water efficiency, centralised and decentralised approaches – with a particular focus on encouraging fit-for-purpose use of all available water sources. While the Government's formal response to the Ministerial Advisory Council's Roadmap and Implementation Plan is not expected to be released until early 2012, the Government will encourage urban water corporations to develop their water supply-demand strategies having regard to the Ministerial Advisory Council's high level objectives and directions.

The Department of Sustainability and Environment has prepared and issued guidelines that will help water corporations prepare, update and implement water supply-demand strategies consistent with the objectives of the *Living Melbourne, Living Victoria* initiative.

These guidelines confirm the responsibilities of water corporations in balancing water supply and demand. They aim to ensure that water supply-demand strategies are developed on a consistent basis across the State, adopting best practice in urban water planning.

Best practice planning involves consulting with the community and customers to ensure they understand and comment on the expected level of service provided by their water corporation, and the actions required to maintain or improve that level of service over time. In this regard, the guidelines require water corporations to consult their customers and community to set:

- agreed service levels that reflect community expectations about the environmentally, socially and economically responsible use of water; and
- minimum service levels that reflect community expectations about the appropriate use of water in times of drought or other water shortage.

The guidelines introduce a new requirement for each water corporations to prepare an alternative water atlas that provides information on specific opportunities for increasing the alternative water supplies within their service area. In developing an Alternative Water Atlas as part of the process of updating their water supply-demand strategies, water corporations will be able to assess the cost-effectiveness of these options compared to more traditional supply and demand measures.

The guidelines also introduce a requirement for water corporations to prepare an annual Water Supply Outlook, which will present projections each year, on a scenario basis, to help identify and prioritise when particular actions need to be implemented to ensure water security. This annual outlook will improve local communities' understanding of the likely risks to their water supply in forthcoming years and the actions being taken by water corporations to manage those risks.

Action 3.16 Updating water supply-demand strategies

Who: Water corporations, Department of Sustainability and Environment **Timeframe:** Mid 2012

Water corporations, in consultation with their customers and communities, will review and update their water supply-demand strategy based on guidelines issued by the Department of Sustainability and Environment that include new requirements to:

- set agreed standard and minimum service levels that reflect community expectations about the environmentally, socially and economically responsible use of water;
- prepare an Alternative Water Atlas that provides information on specific opportunities for increasing alternative water supplies within their service areas; and
- prepare an annual Water Supply Outlook, which will present projections each year, on a scenario basis, to help identify and prioritise when particular actions need to be implemented to ensure water security.

Box 3.5 Developing state-wide policies for urban water - Directions developed by the Ministerial Advisory Council

The process of improving urban water supply reliability will be guided by the Government's Living Victoria roadmap which outlines priority reform areas for Victoria's cities and towns. The roadmap recommends eight key directions:

- An agreed vision for the contribution of water to urban liveability, through protection from flooding, improving the health of urban waterways and supporting green landscapes
- Greater customer choice and innovation in water products on offer, the water charges they pay and their level of service
- Improved integration of urban and water planning through planning and building regulations that facilitate integrated water cycle management
- Optimised use of all available water sources, including fit-for-purpose alternative water supplies
- Improved environmental and public health outcomes supported by clear regulations to ensure customers and the environment are protected
- A common approach to the economic evaluation of water projects to ensure broader benefits, such as downstream water quality and reduced risk of flooding, are recognised
- Approaches to pricing that recognise the value of water and reward customers for conserving water
- Strengthened institutional and governance arrangements to hold service providers to account for their performance.

The roadmap was released on 11 March 2011 and is available on the Department of Sustainability and Environment's water website: http://www.water.vic.gov.au.

Drought response plans

Urban water corporations develop drought response plans to manage temporary water shortages due to prolonged periods of below average rainfall or other causes such as water quality issues. As required after any period of drought, urban water corporations throughout the State are updating their plans to take account of lessons from recent experience. These reviews are undertaken in parallel with the review of the water supply-demand strategies.

Drought response plans outline a range of options to balance supply and demand, which may include imposing water restrictions. The prolonged dry period from 1997 to 2009 resulted in a greater frequency of water restrictions than planned in many areas of the State, as these dry conditions were worse than those previously assumed for planning. The experience in many cities and towns during this time also showed the impact of moving from Stage 3 to Stage 4 restrictions was significant, with unreasonable impacts on public facilities, open space and urban amenity.

Urban water corporations will remain responsible for deciding if and when to impose water restrictions as part of their drought response plans. However, to build on the lessons from imposing restrictions in recent years, the Minister for Water initiated a review of the water restriction framework to ensure:

- permanent water saving rules reflect community expectations about the environmentally, socially and economically responsible use of water; and
- consistency in the rules under each of the four stages of water restrictions throughout the State in times of drought or water shortage.

Integrating urban land use planning and water planning

Integrated water management creates incentives for adaptive, innovative and productive water management and puts under-utilised stormwater and recycled water resources to better use. This can contribute to a more resilient and adaptable water supply system, as well as more liveable, sustainable and productive urban environments.

The most effective way to achieve this is to integrate the urban land use planning process of local government and the water planning processes of water corporations, and using planning and building regulations that boost integrated water cycle management. Better environmental and water supply-demand outcomes for new developments can be achieved by:

- integrating more water-efficient measures into new residential, commercial and industrial developments;
- reducing the impact of stormwater discharges on local waterways;
- allowing for infrastructure to cost-effectively capture, treat and store stormwater for later use as an alternative water source, where this generates a net community benefit; and
- designing sports fields, parks and other open spaces that have access to fit-for-purpose water sources such that they remain viable community assets.

Action 3.17 Review of the Victorian Uniform Drought Water Restriction Guidelines and Permanent Water Saving Rules

Who: VicWater, Department of Sustainability and Environment **Timeframe:** 2011

The Department of Sustainability and Environment, in conjunction with VicWater, the Victorian water industry and the community, will review the *Victorian Uniform Drought Water Restriction Guidelines* and Permanent Water Saving Rules in the light of recent experience and determine an appropriate process for implementing permanent water saving rules and a revised restriction schedule, if appropriate.

Action 3.18 Facilitating integrated water planning

Who: Water corporations, local councils, Department of Planning and Community Development, Department of Sustainability and Environment **Timeframe:** Ongoing

Local councils and water corporations will be encouraged to work together to ensure that cost-effective opportunities for more efficient water supply and demand options are considered in the urban planning process as early as possible.

Findings from the Ministerial Advisory Council roadmap and implementation plan will be considered by Government to help facilitate and guide better integrated water management.

The Department of Planning and Community Development will continue to develop regional growth plans for eight regions over the next four years. Strategic direction for growth and planning will be facilitated through the development of these plans.

Large industrial users

"To ensure the future prosperity of our region, industries such as agriculture and mining require a reliable water source." – submission on the Draft Strategy DS089

In most cases, large industrial water users approach urban water corporations to secure a water supply. Water corporations then consider what actions are required to meet the demands of large users when developing their water supply-demand strategies. In some instances, a large industrial user may prefer to source its own supply, for example, by applying for a section 51 licence to take and use water from an unregulated surface water or groundwater system.

The key opportunities in this Strategy for large industrial users include:

- working with water corporations as they review and update their water supply-demand strategies (Action 3.16)
- continuing to pursue water efficiency measures and alternative supplies (see Actions 3.8 and 3.13);
- participating in auctions and other sales of unallocated water in certain parts of the region (see Section 3.2.5, page 80), including from the Wimmera-Mallee Pipeline (see Section 6.3.2 page 152); and
- exploring the potential to trade water to supply new and expanding industries (see Action 3.12, page 75).

3.3.2 Improving the reliability of supply for rural and agricultural users

"Many of the region's communities entirely rely on agricultural activities and supporting services that essentially require a reliable supply of water." – submission to the Draft Strategy DS200

Opportunities for rural and agricultural water users

Additional water for expanding and new industries is available in some parts of the region (see Section 3.2.5, page 80). However, in large areas new water can be obtained only through trading, and this is restricted by the characteristics of the waterway or aquifer and management arrangements in place to protect existing water users and the environment. In addition, buying water may only be possible by constructing an on-farm dam to store water from a winter-fill licence on an unregulated stream or by constructing a bore and pumping groundwater. This may only be viable for higher value water uses such as horticulture, intensive animal-raising and dairy stock watering and wash down (see Box 3.3, page 67).

The key opportunities for agricultural and rural users (see Box 3.6) in this Strategy include:

- participating in auctions and other sales processes for unallocated water in certain parts of the region (see Section 3.2.5, page 80), including from the Wimmera-Mallee Pipeline (see Section 6.3.2, page 152);
- exploring the potential to trade water to supply new and expanding industries (see Action 3.12, page 75);
- exploring the potential to carryover water in certain groundwater systems (see Section 4.3.2, page 116);
- more responsive local management of licensed water use (see Section 3.1.3, page 60);
- exploring the potential for managed aquifer recharge and off-stream storages (see Section 3.2.3, page 71); and
- continuing to promote efficient irrigation practices (see Action 3.8, page 69).

Box 3.6 Agricultural industries in the region (see also Technical Report 3 found online)

Dairying in the south-west is largely dryland, supported by relatively reliable rainfall. This has seen some dairy farmers from the north of the State shift to the area. Given the proximity to extensive grain-growing areas, irrigated pasture can be substituted by feed where economic. Most farmers have become highly water efficient during the recent prolonged dry period.

The dairy industry is relatively buoyant, and production is expected to grow substantially in the south-west. This growth is expected to be within and next to existing dairying areas. To the west of these areas, growth has been constrained by competition with forestry and to the north (around Penshurst) by soils more prone to water-logging. Suitability for dairying declines further north as rainfall decreases, with businesses becoming marginal with less than 600 mm annual rainfall. The Portland Coast and Hopkins basins have the best growth potential due to access to labour and services, and suitable soil types and rainfall. The Glenelg catchment also has some potential.

Grain production is predominantly in the west and north-west of the State, especially the Wimmera and Mallee. It is continuing to expand into the high rainfall zones on land previously used exclusively for pasture production. Grain is becoming more available in western Victoria, and this will help dairy and intensive animal-raising expand in this area. It is unlikely to compete with dairy significantly as the grains industry tends to be in lower rainfall areas.

Beef and sheep irrigated grazing occurs mainly in the south of the region. The industry is generally stable, supported by recent improvements in sheep profitability. Conversion to dairying in the south-west may cause a decline over time. Dryland grazing occurs throughout the region.

Intensive animal-raising industries are most likely to grow in areas less than two hours from Melbourne/Geelong due to growth of existing businesses and relocation from former urban fringes. Some growth may occur in the near west, such as poultry production around Colac. However, other areas of the region are too far from markets and processing facilities.

Horticulture is not a major industry in the region. There is some wine grape production near Heywood and in the Pyrenees, and vegetable production along the border with South Australia irrigated with groundwater. The key barriers to increased production in the region are the lack of infrastructure, unsuitable soils in some areas and a perceived lack of secure water.

Domestic and stock water users

People use domestic and stock water throughout the region. Reliable supplies are critical for maintaining rural homes and supporting a wide range of livestock industries, including the region's high value dryland dairy enterprises.

In dry periods, domestic and stock dams can fail, waterway diversions may be less reliable and shallow groundwater aquifers, with close links to surface water, cannot receive adequate recharge and become unproductive. In such times, rural landowners look to increase their domestic and stock supply sources. They might build more domestic and stock dams or seek approval to construct more bores in different locations. The cost to build and maintain domestic and stock water supplies is paid for by the individual rural landowner.

The key opportunities in this Strategy for domestic and stock water users include:

- exploring the potential to connect to reticulated supply networks (Action 3.11);
- improving supply reliability with off-stream storages (see Section 3.2.3);
- developing an improved understanding of climate risks to water availability (Action 3.7);
- developing an improved understanding of the condition of groundwater resources on which many domestic and stock users rely as their only supply (see Section 4.4.1); and
- exploring the potential benefits of trade to improve water security, particularly on the Wimmera-Mallee supply system (see Chapter 6).

The Strategy also includes actions to provide certainty to existing users and the environment, which will also provide a greater level of protection of domestic and stock users, such as the development of local management plans (see Policy 3.3 and Action 3.5) and policies for managing the adverse impacts of significant land use change on water availability (see Chapter 5).

In addition to these general opportunities, the Government supports improving the level of information available to dryland farmers about sustainable water management in a variable climate. Because dryland farmers manage their own water needs, less information has historically been provided to them than irrigators about the efficient and sustainable use of water. For example, sustainable irrigation programs are well established to help irrigators adopt best practice in water management.

The Department of Primary Industries provides general extension services and advice on the water needs of dryland farmers, but if the region faces the prospect of less, or more variable, water supplies, there may be a need to provide more advice to dryland farmers about how to sustainably manage their future water needs (for example, the latest climate research or opportunities to diversify supply sources).

Action 3.19 Promoting sustainable water management on dryland farms

Who: Department of Sustainability and Environment, Department of Primary Industries **Timeframe:** Ongoing

Drawing on experience from delivering the Sustainable Irrigation Program, the Department of Sustainability and Environment and the Department of Primary Industries will work together to promote sustainable water management on dryland farms, including advising farmers on the best options for managing the risks associated with low or more variable water supplies.

3.4 Protecting waterways, aquifers, wetlands and estuaries

Communities in the region rely on healthy rivers, floodplains, wetlands and estuaries to provide reliable, high quality water for households, farms and industry, to maintain social, cultural and heritage assets and for recreational and tourism opportunities. The community derives considerable economic benefits from waterways and wetlands – and pays a considerable cost when their condition declines.

For many, waterways and wetlands are deeply associated with their 'sense of place' and 'belonging'. This is particularly true for Indigenous Victorians, for whom rivers are spiritual and living entities.

The *Water Act 1989* requires this Strategy to identify ways to increase the environment's share of water. The environmental water reserve (the water set aside by law to protect environmental values) can include:

- formal environmental entitlements (such as a volume of water held in storage);
- conditions on other water users entitlements, licences and permits (such as passing flows below a storage); and
- limits on diversions such as permissible consumptive volumes and sustainable diversion limits (see Reference Guide 2).

Aquatic ecosystems in the Western Region suffered heavily during the exceptionally dry conditions from 1997 to 2009. Even though the 2010 and 2011 floods rejuvenated these ecosystems, they may have to cope with prolonged dry periods in the future.

Drought and climate variability mean that a stronger approach is required for managing rivers, wetlands and estuaries. This Strategy aims to do this by:

- increasing and protecting the environment's share of water;
- making the best use of environmental water;
- undertaking complementary river restoration works and measures to improve waterways and wetland condition; and
- adapting and integrating the management of environmental water and works.

Lake Pertobe Foreshore Park Photo: Robert Mason

Box 3.7 A Victorian strategy for healthy rivers, estuaries and wetlands

The Government is developing a Victorian strategy for healthy rivers, estuaries and wetlands for release in late 2012. The Strategy will replace the Victorian River Health Strategy (2002) and present the Government's overarching policy framework for managing Victoria's rivers.

In the ten years since the Victorian River Health Strategy was released, a more integrated approach to planning has developed to consider the broader landscape and climate variability. The new strategy will integrate the management of rivers, estuaries and wetlands and incorporate the directions of recent Government legislation and policies, including those developed through successive sustainable water strategies.

The current regional river health strategies (see Appendix 5) will be replaced by the regional strategies for healthy rivers and wetlands (SHRWs) by late 2013. The regional SHRWs will use a priority setting process to identify the waterways of highest community value and outline a holistic program of management actions (including management of environmental water, riparian areas, in-stream habitat and water quality, bed and bank erosion control and provision of fish passage).

The Regional Catchment Strategies (RCSs) are an important link between waterway management and the broader catchment management. They are the primary framework for managing land, water and biodiversity in each catchment. The long-term waterway objectives and priorities for action in the updated RCSs will be reflected in the regional SHRWs.

3.4.1 Environmental water

Increasing and protecting the environment's share of water

The key actions in this Strategy to increase and protect the environment's share of water include:

- Confirming the arrangements for sharing water savings from the Wimmera-Mallee Pipeline (see Chapter 6). Under historic inflows, the environment will receive on average an additional 83 GL of water each year. This 83 GL comprises high reliability entitlement held in storage, passing flows, unregulated spills and a wetland wildlife entitlement (see Section 6.4.1).
- Supporting-in-principle a purchase by the Commonwealth Government of the Wimmera irrigation entitlements (totalling 28 GL).
- Establishing precautionary caps on unregulated rivers that have unallocated water available for consumptive use (see Action 3.14 and Chapters 7 to 10).
- Capping surface water extractions from waterways in the Millicent Coast River Basin at their current levels (subject to South Australia implementing comparable caps) (see Section 10.4.3).
- Restoring flows to Lake Corangamite while maintaining drainage infrastructure for wetter years (see Action 9.2).
- Investigating the potential to protect critical flows in the Gellibrand River through the summer low flow period by augmenting supplies and reducing the need for summer extractions (see Action 7.3).

This Strategy promotes improved documentation of rules for managing section 51 take and use licences through the development of local management plans. These plans will provide greater transparency and understanding of the rules in place to protect existing users and the environment in times of low inflows. The sub-region chapters discuss where local management plans will be developed, with priority areas including the documentation of flow-sharing arrangements on the Merri River (see Section 8.3.1) and the development of a local management plan for the Upper Wimmera River (see Section 10.3.1).

The Strategy also aims to improve the way groundwater dependent ecosystems are considered in licensing decisions (see Section 4.4.2) and includes actions to protect the rights of existing users and the environment, such as actions to manage adverse impacts of significant land use change on water availability (see Chapter 5).

Most rivers in the region are unregulated, so applying precautionary caps on consumptive use is the preferred approach to managing the environment's needs. Unlike regulated rivers, where an environmental entitlement could be held and actively managed to reproduce natural flows and protect the health of the river, few options exist for actively managing or increasing flows on unregulated streams. Therefore, precautionary caps, minimum passing flows and other environmental measures, such as complementary river health works, are the main tools for protecting river health in most parts of the region.

In catchments where water interceptions use most surface run-off during dry periods, such as in the Corangamite and Avon-Richardson, it is difficult to recover water for the environment.

Over time, other opportunities may arise to provide greater flows to the region's waterways. Reuse of recycled water if treated to an appropriate standard can contribute beneficial environmental flows on some systems. For example, Central Highlands Water's Ballarat North treatment plant discharges into Burrumbeet Creek.

Better management of rural drains may also provide local opportunities to redirect water into important wetlands.

Making the best use of environmental water

Environmental water managers are like other water users – they want the greatest benefits from their water.

The Government recently established the Victorian Environmental Water Holder (VEWH) to hold and manage environmental entitlements across the State (see Box 3.8). The VEWH is responsible for managing environmental entitlements efficiently to deliver the highest value environmental outcomes.

Box 3.8 Victorian Environmental Water Holder

The Victorian Environmental Water Holder (VEWH) was established in 2011 as an independent statutory body to hold and manage environmental water entitlements and allocations across the State. It decides the best use of that water, including trade and carryover, to achieve the highest environmental value.

VEWH will make transparent, accountable and timely decisions about where and when environmental water is delivered. It will do this by drawing on the priorities identified by catchment management authorities, in consultation with local communities, to identify state-wide priorities.

The VEWH will make decisions independently from, but accountable to, the Government in accordance with high-level rules established by the Minister for Environment. It must have regard for catchment management authority seasonal watering proposals.

The VEWH makes decisions about the parts of the environment's water that can be actively managed (the formal environmental water entitlements), with discretion over when and how water is released or diverted. It does not have any influence over conditions on other users' bulk entitlements or section 51 take and use licences. In the Western Region, it will oversee the environmental entitlement on the Wimmera-Glenelg system.

Structural works to deliver environmental water

In some instances, structural works, such as in-stream structures and flow control regulators, can be used to deliver environmental water and achieve environmental outcomes with much less water. This is particularly true for wetland and floodplain anabranches, which have become disconnected from the main river channel or where overbank flow frequency is inadequate to meet environmental flow objectives. Targeted structural works give the greatest environmental benefits for a given amount of water.

The ability to manage formal environmental entitlements in the regulated Wimmera-Glenelg system makes structural works particularly useful for optimising environmental outcomes. Works could also be used where environmental priorities have been identified on unregulated waterways and drainage systems to achieve better environmental outcomes with less water. Two examples are the planned works to flood Lake Condah for heritage purposes (see Section 8.2.4, page 198), and those for the Woady Yaloak Diversion Scheme and Lake Corangamite (see Section 9.3.1, page 214). The latter aims to:

- improve flows to the internationally significant Lake Corangamite;
- minimise flooding impacts on surrounding private land; and
- reduce the considerable financial cost of maintaining the existing diversion system.

Carryover of environmental entitlements

Environmental water managers with formal entitlements on regulated systems, such as the Wimmera-Glenelg system, can carryover their unused entitlement from one year to the next. This gives them more flexibility to achieve the best environmental outcomes possible under the flow conditions each year.

Using consumptive water *en route*

An innovative way to achieve environmental or social benefits without requiring additional water is to make use of consumptive water on its way to water users. However this is only possible where it can be done without impacting adversely on the reliability of supply to primary entitlement-holders.

The release of water from storages can be timed to meet ecological objectives and broader public benefits, provided that this is not detrimental to water users. The extent of the benefit will depend on how well the release meets the timing, duration and frequency of flows needed for priority ecological outcomes. This option may be useful on the regulated Wimmera-Glenelg system.

Management of environmental water downstream of consumptive users

In locations on river systems where there are no downstream consumptive users, there may be opportunities to use some of the water in the river to improve the condition of adjacent wetlands, depending on the priority of environmental objectives at the time. Enshrining these unregulated flows in environmental water entitlements would give more flexibility to achieve environmental benefits, while still ensuring no impact to existing users.

Policy 3.9 Structural works to maximise the benefits of environmental watering

The use of structural works to maximise the benefits of environmental watering will be explored, with each option being assessed on its potential benefits, feasibility and cost-effectiveness to meet environmental objectives.

Action 3.20 Using consumptive water *en route*

Who: Department of Sustainability and Environment, water corporations, catchment management authorities **Timeframe:** Ongoing

The Department of Sustainability and Environment, water corporations and catchment management authorities will work together to explore opportunities to use water *en route* for environmental and social benefits. Use of consumptive water *en route* will only be permitted if the rights of entitlement-holders are protected. Potential opportunities will be identified through existing planning processes.

Box 3.9 Possible opportunities to use consumptive water *en route* for multiple benefits in the Wimmera-Mallee

MacKenzie River – Wartook Reservoir to Horsham and Supply System 6

The MacKenzie River is the most flow-stressed river in Victoria due to town and rural water supply demands. Since 1887, it has been used to transfer water from Wartook Reservoir to Horsham and domestic and stock users. These transfers have some environmental benefits in providing flows to sustain the region's only platypus population as well as a highly valued native fish community.

Periodic flows along the MacKenzie River to supply the Wimmera-Mallee Pipeline mean regulated environmental water allocations can be utilised in other ways instead of watering this reach. Conversely environmental water releases help to improve efficiency when these transfers take place by ensuring that the waterway is not completely dry before transfers take place. GWMWater is also looking at possible ecological benefits of consumptive water transfers.

Mount William Creek – transfers from Lake Lonsdale

Lake Lonsdale, on Mount William Creek, can hold 53,300 ML and receives on average 52,000 ML each year. It is an inefficient storage because of its high evaporation losses. Water released from Lake Lonsdale can be used to supply the more efficient Taylors Lake, which in turn supplies parts of the Wimmera-Mallee supply system, irrigation areas and environmental flows for the Wimmera River. Water sent to Taylors Lake from Lake Lonsdale provides much-needed flows to Mount William Creek, the third most flow-stressed waterway in Victoria. It also means environmental water releases do not need to take place when transfers are taking place, allowing them to be utilised in other ways.

Harvesting, releases and transfers of water in these storages could be managed to mitigate some of their impacts and provide greater ecological benefits if integrated more effectively with the environmental objectives for the Wimmera River and Mount William Creek.

GWMWater, as the storage manager (see Section 6.2.2), is consulting with entitlement-holders and the Department of Sustainability and Environment to provide additional environmental benefits while protecting the rights of entitlement-holders.

Policy 3.10 Environmental decisions downstream of all consumptive uses

Entitlements will be created where unregulated water is available for environment benefit at the end of the system, provided there is no impact on consumptive users. In areas where this is applicable, the waterways managers and the Victorian Environmental Water Holder will work together to decide between:

- diverting a portion of the river water for use in watering floodplain wetlands; and
- the water needs of the downstream estuary and any other receiving water bodies.

The waterway manager and Victorian Environmental Water Holder will be required to report on any water that is used.

3.4.2 Complementary river restoration works and measures

In addition to providing adequate environmental flows, protecting or restoring riparian habitat and water quality will sustain healthier waterways. Complementary river restoration works maximise the benefits of environmental flows. These works include:

- revegetating waterways to provide habitat and prevent erosion;
- streamside fencing to protect habitat from livestock damage and allow regeneration;
- providing fish passage to allow fish movement and recolonisation; and
- better management of river banks to maintain and improve water quality.

Adverse impacts on river health can be caused by pressures not related to flow, such as agricultural run-off or disturbance. As well, options to provide additional environmental flows can be limited. In these cases, investment in complementary works and catchment management programs become critical for achieving improved environmental outcomes and can maximise the benefits from the available environmental water.

Catchment management authorities will continue to implement complementary in-stream and streamside works based on their regional river health strategies. The Government's existing commitment of State-wide expenditure of $80 million from 2008/09 to 2011/12 will contribute to the implementation of these strategies. In 2011/12, the Corangamite, Wimmera and Glenelg Hopkins catchment management authorities will invest up to $12.7 million in river health activities in the Western Region.

While not a substitute for adequate environmental flows in stressed rivers, targeted works help to ensure environmental flows achieve the maximum environmental benefit possible.

Policy 3.11 Complementary river restoration works and measures

The Government will continue to invest in complementary river restoration works and measures based on priorities identified in catchment management authorities' updated regional strategies for healthy rivers and wetlands.

Revegetation & fencing Photo: Courtesy of DSE

Protecting riparian land

Riparian land with intact vegetation is vitally important to waterway health and water quality, but its benefits can be damaged by uncontrolled stock grazing[a].

The Government has amended policies for managing 'take and use' (section 51) water licences to assist farmers to fence Crown land frontages along waterways. The changes allow landholders to fence stock out of these riparian areas and still access water for their stock. A licence can be issued in a capped system without the landholder needing to buy an entitlement on the water market. However, licence fees and conditions currently apply. The Government will investigate options to minimise or avoid licensing costs for landholders.

These changes will encourage improved riparian management and prevent degradation of these areas by continuous stock grazing and trampling, while providing water access to adjacent landholders for their stock. If needed, periodic or seasonal grazing may be allowed in fenced riparian areas to manage weeds.

In addition to these licensing arrangements, the Department of Sustainability and Environment and catchment management authorities are working to protect, improve and better maintain Crown and Freehold riparian land in Victoria. This includes financial incentives for activities such as fencing, revegetation, weed management and off-stream stock watering infrastructure.

3.4.3 Adaptive and integrated management

Finding multiple benefits through local water planning

When statutory management plans for WSPAs or local management plans for other areas are being developed or reviewed, water corporations, water users and catchment management authorities should explore opportunities to better meet the needs of water users and the environment.

For example, water corporations may be able to take surface water when it is plentiful and use other sources, such as groundwater, in summer to protect the environment (for example, the Gellibrand River, see Section 7.3.1, page 180). However, these options must be cost-effective, possibly with the environmental manager contributing to any additional costs likely to be imposed on water users.

Local management plans will enable short-term local responses to better meet the needs of water users and the environment. Environmental managers can consider and provide input into the design of restriction triggers and environmental flow requirements. However, local management plans are not intended to significantly increase the environment's share.

"…consultative, place-based planning will be required if real-terms outcomes are to be achieved with benefits to both consumptive users and the environment." – submission on the Draft Strategy DS095

Action 3.21 Managing riparian land

Who: Catchment management authorities, Department of Sustainability and Environment **Timeframe:** Ongoing

Programs will continue to be identified and implemented to assist landholders (and other riparian land managers) to protect, improve and better maintain high priority riparian land. This will include contributing towards the cost of fencing, revegetation and vegetation enhancement, and the provision of off-stream stock watering infrastructure.

Water for stock will be provided consistent with the *Policies for Managing (section 51) Take and Use Licences*. These policies will be amended so licences to access stock water will be issued for up to the maximum licence period to minimise fees associated with renewing the licence. The Government will investigate options to minimise or avoid costs to landholders fencing Crown land frontages.

Policy 3.12 Exploring opportunities to deliver multiple benefits through local water planning

In developing management plans or local management rules, water corporations, in close consultation with water users, catchment management authorities and Department of Sustainability and Environment, will consider opportunities to develop operating rules that, where practicable, deliver multiple benefits to consumptive users and the environment.

[a] See: www.health.vic.gov.au/environment/downloads/protect_our_water.pdf
www.health.vic.gov.au/environment/downloads/protect_water_health.pdf

Seasonally adaptive approach

The seasonally adaptive approach involves adapting environmental watering decisions to prevailing climate conditions in any year. It gives the greatest protection to the most important parts of the environment through drought and dry years, and builds ecological resilience in wetter years (Table 3.4).

This will be most effective in regulated water systems (like the Wimmera-Glenelg system), where water can be stored and released when needed. Nonetheless, the guiding principles are the same for any management decisions for unregulated rivers.

In any given year, the approach identifies the priorities for environmental watering, works and complementary measures, depending on the amount of water available. It is a flexible way to deal with short-term climatic variability. In drought years, the focus is to avoid catastrophic events, such as major fish kills, and to protect drought refuges. In wet years, the focus is to provide high flows and floods to build resilience and enable reproduction and dispersal of key aquatic animals and plants. The seasonally adaptive approach is similar to the way urban water corporations change their levels of service during droughts by introducing restrictions.

Table 3.4 Seasonally adaptive approach to guide management decisions

	Drought	Dry	Average	Wet to very wet
Short-term ecological objectives	• Priority sites avoid irreversible losses and have capacity for recovery	• Priority river reaches and wetlands maintain their basic functions	• Maintain or improve the ecological health of priority river reaches and wetlands	• Improve the health and resilience of priority river reaches and wetlands
Annual management objectives	• Avoid critical loss • Maintain key refuges • Avoid catastrophic events	• Maintain river functioning with reduced reproductive capacity • Maintain key functions of high priority wetlands • Manage within dry-spell tolerances	• Improve ecological health and resilience	• Maximise recruitment opportunities for key river and wetland species • Minimise impacts of flooding on human communities • Restore key floodplain linkages

Monitoring and evaluation

In the longer term, river and wetland management needs to constantly adapt as we continue to learn. Adaptive management in light of new and emerging information will improve environmental outcomes. This Strategy identifies actions to enhance the condition of the region's rivers, wetlands and floodplains. The effectiveness of these actions will need to be monitored and future actions improved in light of this information. This will build knowledge and experience to manage environmental flows, particularly if circumstances change in the future.

The Victorian Environmental Flows Monitoring and Assessment Program coordinates the monitoring of ecosystem responses to environmental flows in eight high-priority regulated rivers throughout Victoria, including the Wimmera and Glenelg. The program provides information to refine estimates of the volumes needed to achieve specific environmental outcomes. This allows future decisions to be improved about environmental flow releases and the environmental benefits they can achieve.

The Index of Stream Condition measures and compares changes in waterway health throughout the State about every five years. The Department of Sustainability and Environment and catchment management authorities use it to refine long-term river management objectives, evaluate past efforts and set priorities for future work. The index combines five key aspects of river health: changes in hydrology (amount, timing and duration of flow); water quality; streamside zone (riparian vegetation); physical form (bank condition and in-stream habitat); and aquatic life. The index was compiled in 1999 and 2004 with the next assessment due at the end of 2011.

The Index of Wetland Condition is a rapid assessment method to measure changes in wetland condition. It compares the current state of a wetland to the best scientific assessment of its condition before European settlement. It assesses six factors critical to the function of wetlands: its catchment, physical form, hydrology, water properties, soils and vegetation. This information helps to identify priorities for management actions. This index was first used on 600 wetlands with recognised high values in 2009/10, with more assessments compiled In 2010/11. The index will provide a comprehensive review of the condition of Victoria's wetlands every six years.

The Index of Estuary Condition is being developed to allow a consistent, state-wide assessment and reporting of the environmental condition of estuaries. It will also help prioritise management activities. The current method is based on a range of estuary types (40 estuaries across the Victorian coast), and will be refined to include high priority estuaries.

Managing the environment if the future is drier

If prolonged dry periods return, management of waterways, wetlands and estuaries will have to adapt.

Drying lakes

During the prolonged dry period from 1997 to 2009, many lakes in the region dried completely causing a range of problems including:

- dust clouds which in some instances carried pollutants or potentially harmful natural substances from the lake beds into communities;
- deposits of lake sediment on roads and in towns;
- extensive growth of native vegetation and weeds on lake beds, creating fire hazards; and
- risks to public safety from exposed jetties and other infrastructure.

There was great uncertainty about the responsibilities for managing these issues.

In 2010, lake managers including committees of management, local councils, Parks Victoria and the Department of Sustainability and Environment developed the *Guide to agency management of drying lakes in Victoria*. This guide clarified the responsibilities of agencies and private landholders and the legislative basis for those responsibilities.

Water has returned to these lakes, but they will dry again. When this happens, the guide can help lake managers respond appropriately.

Reviewing environmental water management objectives

The review of this Strategy and the statutory long-term review of water resources (see Reference Guide 2 and Section 3.1.4 page 65) will allow the Government and the community to consider if less water is available and, if so, what impacts this has had on water users and the environment. These reviews will lead to appropriate action, which could include:

- increasing the environmental water reserve;
- changing the balance between water for consumptive use and the environment through management plans; or
- formally reviewing waterway and wetland management objectives.

If the future is drier, the community may need to make difficult decisions that will affect the environment, consumptive users and regional communities. For the environment, this may mean recovering additional water to support priority environmental values. Alternatively, the community may decide that the cost of additional water recovery is too high and environmental objectives can no longer be met.

These are serious steps to take. As noted above, every effort should be made to manage the region's resources adaptively to ensure they continue to meet the needs of consumptive users and the environment. The region's water and environmental managers should aim to use the tools developed through sustainable water strategies to respond at a local level when problems arise and ideally avoid the need for once-off, centralised changing of environmental objectives or rebalancing in the future.

3.4.4 Managing risks to water quality

The quality of water resources can be affected by floods, droughts, bushfires, salt and acid-producing soils in the catchment, agricultural run-off and streamside grazing. The National Water Quality Management Strategy provides a national approach to improving water quality in waterways, including groundwater protection, acid sulfate soils and bushfires (see www.environment.gov.au/water/policy-programs/nwqms/). The Victorian Government also protects water quality through several programs (see http://www.health.vic.gov.au/environment/downloads/protect_water_health.pdf).

Considering water impacts when undertaking planned burning on forested crown land

Bushfires can reduce water quality in the short term, and in some cases reduce run-off (see Chapter 2).

The Victorian Government undertakes planned burning to reduce the intensity and size of bushfires. In water catchments, planned burning can help protect water quality and quantity by reducing the size and intensity of future fires.

Following a 2009 recommendation from the Victorian Royal Commission, the Government is amending the *Code of Practice for Fire Management on Public Land*. Each year, the Department of Sustainability and Environment prepares fire operations plans for public land in accordance with the Code of Practice. These plans describe fuel management and other fire protection works, including planned burns. In addition to other priorities, particularly protection of assets and human life, these plans will consider protecting water quality and quantity. The positive impacts of planned burning need to be weighed against its relatively minor impacts on water quality and yield.

Action 3.22 Changing environmental management objectives

Who: Catchment management authorities, Department of Sustainability and Environment **Timeframe:** 2019

Should it become apparent with defensible scientific evidence that environmental objectives can no longer be met as a result of long-term changes in water availability, amendment of the objectives will be formally considered as part of the development of regional strategies for healthy rivers and wetlands in consultation with the community.

The review of management objectives through the 2013 and 2019 regional strategies for healthy rivers and wetlands will inform the 15-year statutory review of water resources in 2019.

Action 3.23 Considering water impacts when undertaking planned burning and other bushfire control measures

Who: Department of Sustainability and Environment **Timeframe:** Ongoing

When developing Fire Operations Plans, the Department of Sustainability and Environment will consider how the proposed works can benefit downstream water quality and quantity responses to bushfire. This will take into account the relative importance of other priorities for forest management, as well as the relatively high level of uncertainty around the management action and the catchment response.

Acid sulfate soils and acidification

Acidification is a natural process but can have a significant effect on water quality and the health of a waterway if flushed into a system. Periods of drought, followed by heavy rain - as experienced in September 2010 in Anglesea, where fish kills resulted from a particularly strong acid event in the Anglesea River – can flush acidic run-off or seepage from dried acid sulfate soils, or coal seam and peat swamp soils in the catchment into waterways.

Acid sulfate soils in coastal areas are managed under the Victorian Coastal Acid Sulfate Soils Strategy and the Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils. These aim to protect people, the environment and infrastructure from the harmful effects of disturbing coastal acid sulfate soils. Less is known about acid sulfate soils in inland areas, although their presence was found in some parts of the region during the exceptionally dry conditions from 1997 to 2009. This is an emerging issue in the region and options for prevention and management are limited.

Salinity and salt water intrusion

Salinity is one of the major water quality problems in the region. Saline soils occur on about 153,300 hectares in the region. About half this area is naturally saline and the rest has been affected by induced salinity, most of which has occurred on farmland. Saline wetlands such as Lake Corangamite and White Lake, as well as coastal wetlands, comprise 23 per cent of the original wetland area in the region. Salinisation is managed by containing salt where possible.

Excessive extraction of fresh groundwater from an aquifer can reduce water pressure and draw saltwater into the aquifer, in coastal areas or near saline groundwater. Saltwater intrusion is a concern in the Port Fairy/Yambuk coastal zone area and the Warrion Water Supply Protection Area. It is controlled by managing aquifers to maintain groundwater levels and pressures and monitoring to allow early response.

Managing catchment activities

Water corporations have some powers to manage the impact of new development on water quality in Special Water Supply Catchment Areas. However, these powers do not cover impacts of existing agricultural run-off or streamside grazing.

Good land management practices that minimise agricultural run-off and prevent stock access to natural waterways in drinking water catchment areas help protect the waterways and drinking water supplies. In Victoria, many stream frontages are Crown land (particularly along larger, permanently flowing streams), with grazing of the frontage taking place under licence. In these public areas, there is potential to progressively manage or reduce stock access to waterways for public benefit (see Section 3.4.2, page 95).

3.5 Considering the views of the region's Traditional Owners when managing water

The importance of water to Indigenous communities

"Water is so important to our cultural practice. On a cultural level all our activities were based around water sites."[10]

Water holds a significant place in Aboriginal culture and is generally considered the source of cultural heritage. Water is intimately linked to the health of Country and life. Many Indigenous cultural sites in the Western Region are on or near waterways, and streams and waterbodies are still important sources of food and medicine. Water also holds a significant connection to Indigenous women and a special meaning for women's business, although it is not widely documented. Women hold a sacred relationship to land and water, connected to healing, medicines and birthing practices[4].

Indigenous communities also hold knowledge of the water resources in the region, and these parts of the landscape are important for many cultural practices and values.

Views and concerns of the region's Indigenous communities

Consultation as part of this Strategy identified a wide variety of views, reflecting the broad range of Indigenous groups and people in the Western Region (see Technical Report 2 found online). It highlighted many concerns shared with the rest of the community, as well as issues specific to individual groups. Many Indigenous communities expressed core values of respect for Country, culture and the environment. There is strong concern for the health of the environment as central to culture. However, cultural values, though usually based on or connected to the natural environment, may have different or additional water requirements than the environment.

Traditional activities, such as fishing, catching eels, hunting animals, gathering various plants for food and medicine and basket weaving, are important to Indigenous people throughout the region and are dependent on healthy waterways.

Waterways are important as meeting places to come together as families and communities for cultural, social and recreational activities, as a way to travel throughout the region and teach culture to young people. Access to healthy waterways is vitally important for these activities.

Aboriginal communities want to protect natural resources in a holistic way, while allowing for Indigenous and community economic development and prosperity. Water rights and access to resources have the capacity to generate income for Traditional Owner groups as well as provide cultural and social benefits. Degraded water systems reduce tourism and recreation opportunities. Concerns were raised about weirs, dams and diversions adversely affecting the natural flows of rivers and plants and animals. These not only have an impact on the economic viability of communities, but importantly, limit the ability for elders to pass on their knowledge and culture to young people. Other land use issues, such as excessive land clearing, the impacts of plantations on water availability and cattle grazing near river beds, affect the health of the river system and surrounding areas and place further pressure on already stressed values.

Communities recognised the shared responsibility for protecting water resources, using water more efficiently and the need to share the potential impacts when water is scarce.

Access to water for traditional purposes

Section 85 of the *Traditional Owner Settlement Act 2010* allows for members of a Traditional Owner group with a natural resource agreement (under section 80 of the Act) to take and use water from a waterway or bore for traditional (non-commercial) purposes. These rights are comparable to the private rights allowed by section 8(1) of the *Water Act 1989*, which includes domestic and stock water rights. These Traditional Owner settlement processes will be considered in future discussions with Traditional Owner groups in the region as a possible way of formalising access to water for traditional purposes.

Greater involvement in decisions about water management

Indigenous people have sustainably managed their environment for hundreds of generations.

Traditional Owners and Indigenous communities want to be actively involved in managing water to protect their cultural heritage. However, their capacity for this is severely undermined by a lack of resources and expertise in management processes. They want to develop their capacity to contribute their expertise and knowledge to decision-making processes and water management rather than just being consulted.

Traditional owner involvement in catchment management

All water management agencies have processes to engage and consult with local Indigenous organisations and leaders. Catchment management authorities are a key link for Indigenous groups to become more involved in water resource planning. The Victorian strategy for healthy rivers, estuaries and wetlands (currently being developed) will include a specific requirement for Indigenous consultation when developing regional strategies for healthy rivers and wetlands. This will include documenting the social, cultural, economic and environmental values of the region's rivers, floodplains and wetlands.

Action 3.24 Developing capacity for Indigenous involvement in water management

Who: Department of Sustainability and Environment, catchment management authorities, water corporations **Timeframe:** Ongoing from 2012

Education, training and capacity building for Indigenous people will be improved by inviting Traditional Owners to nominate young leaders to be involved in:

- a scholarship for the biennial Graduate Certificate of River Health offered by Melbourne University;
- a scholarship for the Graduate Diploma of Natural and Cultural Resource Management offered by the Institute of Koorie Education, Deakin University; and
- an annual cadet position in the Department of Sustainability and Environment's Water Group or regional offices, catchment management authorities or water corporations.

Catchment management authorities and water corporations, in consultation with Traditional Owners, will investigate providing traineeships to build participant capacity and confidence levels for ongoing employment in water management.

Box 3.10 Department of Sustainability and Environment Indigenous Partnership Framework

In 2007, the Department of Sustainability and Environment (DSE) developed an Indigenous Partnership Framework to help Traditional Owners and Indigenous Victorians to participate and share their knowledge of natural resource management for the benefit of all Victorians. The framework is based on the following principles:

- DSE's approach to all Indigenous issues will recognise Traditional Owners and that Indigenous Victorians have a continuous connection to Country and a valuable contribution to managing natural resources particularly in an integrated way.
- DSE will develop and support opportunities for Victoria's Traditional Owners and Indigenous people to connect and care for Country.
- The development of all future DSE policy will specifically include meaningful Indigenous consultation and identify opportunities for Indigenous people to gain skills to improve management partnerships.

The framework is currently being reviewed to consider if improvements can be made.

Box 3.11 Dja Dja Wurrung and North Central CMA Partnership Project

The Dja Dja Wurrung Clans Aboriginal Corporation is the corporate representative body for the Dja Dja Wurrung traditional owners of the Bendigo region. The corporation successfully received funding through the Victorian Aboriginal Economic Development Strategy to establish a commercially viable Natural Resource and Cultural Heritage Management business.

The project is being implemented through a co-hosting arrangement with the North Central CMA, as the principal employer and host agency for the project, for two years from January 2011 to December 2012. The project is a first of its kind in Victoria between a catchment management authority and an Aboriginal corporation.

This chapter outlines policies and actions to make the best productive use of the region's valuable groundwater resources while protecting and improving environmental values that rely on groundwater.

102 Stock watering bore Southern Grampians. Photo: SRW

Making the best use of the region's groundwater resources

Guide to this chapter

Key points of this chapter

- Existing management arrangements were developed when there was less groundwater monitoring, fewer areas metered and limited licensing controls. However, the State's knowledge of its groundwater resources has improved over time.
- This Strategy will provide greater certainty to users about how changes in groundwater availability will be managed using the best available information.
- Transparent local management arrangements will be established to manage whole groundwater systems, with clear rules about how water will be shared in times of shortage and advice on the options available to users for managing their own business risks.
- The Strategy will encourage the staged development of the State's groundwater resources through trade, carryover where possible, and ongoing resource assessments and auctions in sustainable groundwater systems.
- Measures will be put in place to monitor and protect the health of groundwater resources for current and future users, and the environment.
- These measures will continue to adapt to emerging pressures of climate variability, periods of increased demand and changes in groundwater and mining technologies.

4.1 An improved approach to managing groundwater

Victoria's approach to groundwater management is respected nationally and internationally. Despite a long period of drought, systems have remained at sustainable levels and very few areas have required restrictions on the licensed level of extraction to maintain sustainability.

In the Western Region, groundwater supplies about 50 per cent of the total water used by towns, farms and industry. It is a critical resource for the region, particularly in the south-west, providing a high reliability of supply to existing users and presenting growth opportunities for new users. It will become increasingly important over the life of this Strategy.

The Strategy aims to provide management arrangements that ensure continued supply to existing users, capture the opportunities for sustainable growth and protect and enhance the environmental values that rely on groundwater.

This will be challenging because groundwater is the hidden water resource, and key influences cannot always be directly measured. It also takes time to observe the major influences on each groundwater system, including the rates of recharge, inflow, outflow and discharge, and the rate and amount of extraction (see Figure 4.1).

Progressively, Victoria has undertaken resource appraisals, monitoring and metering to assess these influences and to inform better management of groundwater. However, there will always be a need to manage groundwater without perfect knowledge of how the resource behaves over time.

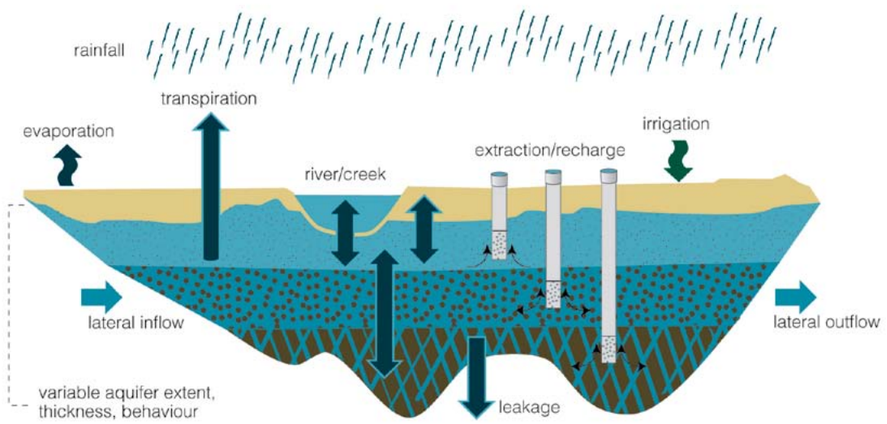
4.1.1 Current management approach

Management areas were established where the resource is of reasonable quality and where there is considerable use. Areas with more use were declared water supply protection areas (WSPAs), while areas where groundwater resources are of a suitable quality but with less water were established as groundwater management areas (GMAs). The rest of the State is classified as unincorporated areas. In these areas, little groundwater is used because its quality is generally poor or deep and expensive to access or constrained by other factors, such as state forests.

Across the State, extraction of groundwater is licensed, with the exception of domestic and stock use, meters are installed on all significant use and groundwater levels are monitored. More recently, caps on extraction, called permissible consumptive volumes (PCVs), have been set for WSPAs and GMAs.

GMAs and WSPAs were developed to manage areas of more intense or potential use. They were not developed to manage entire groundwater systems and do not reflect the full extent of the aquifer or aquifer system from which the groundwater comes.

Figure 4.1 Major influences on groundwater systems

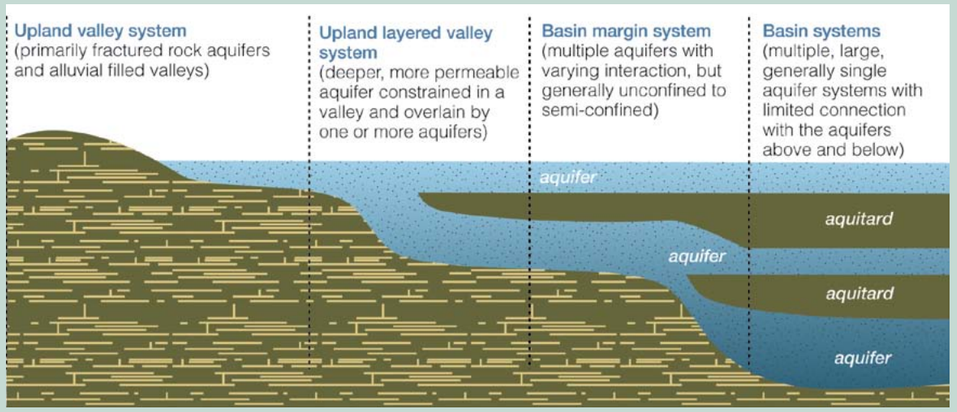


Box 4.1 What is a groundwater system?

A groundwater system begins where water enters an aquifer (recharge) and ends at its point of exit (discharge). It may include a single aquifer, a group of connected aquifers, or groundwater and surface water elements in conjunction.

Groundwater systems can be simple or complex. Smaller, simpler aquifers are common in upland areas. In lowland areas, systems may be larger and more complex (see Figure 4.2). The characteristics of each groundwater system, including its geology, scale and the processes of recharge, flow-through and discharge, influence how it needs to be managed. A groundwater system may include one or more management units. Figure 4.3 (page 108) shows an example of how groundwater systems may be used to define management units.

Figure 4.2 Overview of the groundwater management system structure



The current management approach focuses management effort on areas where there is a greater risk of groundwater extraction adversely affecting the resource base. This approach appears to have been suitable in the past when fewer water users wished to access groundwater, less was known about the resource, and information about the environment's reliance on groundwater was limited. However, as use has increased, and variable rainfall is impacting on water availability, the management arrangements have been tested and concerns have been raised about whether the resource is being managed sustainably. This Strategy provides an opportunity to improve the management arrangements to ensure they strike the right balance between meeting the needs of current and future users, and the environment.

4.1.2 An improved approach for groundwater management

Faced with the prospect of a more variable climate and unpredictable rainfall patterns, groundwater will become increasingly important for supplying agriculture, towns and industry, and supporting regional economic growth.

An enhanced management approach is required that will add to the existing management framework, capture new opportunities and respond to new pressures that may emerge on groundwater systems.

The reliability of groundwater supplies is not guaranteed. Shallow aquifers with limited storage are more responsive to reduced rainfall, and some groundwater users in these types of aquifers have observed declining water levels in the recent prolonged drought. Groundwater levels in some deeper aquifers have declined, and more intensive management has been needed to ensure continuity of access.

There is evidence of a gradual decline in some groundwater systems, and bore interference problems have been reported in some areas, such as the Condah and Hawkesdale GMAs. The levels of decline vary and can be caused by reduced recharge due to climate variability, interception of water by vegetation, licensed extractions and/or domestic and stock use. These pressures are expected to increase so a future management system must be able to adapt accordingly.

It is important to understand that groundwater systems are subject to short-term influences, such as annual cycles of recharge, land use, usage and flow-through, but can also be influenced by long-term factors, such as changes in rainfall patterns. The management of groundwater needs to consider these long-term influences – potentially over decades – in addition to management actions taken in response to short-term influences.

Users and managers need an effective legislative regime, supported by good policy and management tools to adapt to changes in groundwater availability.

Management arrangements also need to provide for additional groundwater to be made available where this is sustainable. While appropriate checks and balances need to be established to ensure the resource is not overused, these should not be overly conservative or precautionary to the point of under-using a resource that can provide significant social and economic benefits to regional communities and the State.

Policy 4.1 An improved approach to groundwater management

Groundwater management in Victoria will be improved by:

- Providing certainty to users through transparent, cost-effective and adaptive local management that:
  - manages whole groundwater systems;
  - ensures water users and stakeholders understand:
    - » the nature of the licence (e.g. one year or 15 years)
    - » the evidence-based rules used in each system to share water in times of shortage
    - » the transparent and consultative processes for changing those rules; and
  - protects existing users' rights by ensuring statutory processes are followed before licensed entitlement can be changed permanently.
- Promoting the sustainable development of the State's groundwater resources by:
  - encouraging groundwater trade where sustainable and, where possible, providing the ability for users to carryover unused water from year to year;
  - undertaking strategic groundwater resource assessments across the State; and
  - after assessing the capacity of a groundwater system, making more groundwater water available through expressions of interest and/or auctions.
- Protecting the health of groundwater resources for current and future users, and the environment by:
  - establishing long-term, viable and cost-effective groundwater monitoring arrangements;
  - improving the way groundwater dependent ecosystems are considered in management decisions; and
  - managing potential impacts from extractive industries and emerging technologies.

4.2 Providing certainty through transparent, cost effective and adaptive local management

As noted in Chapter 3, before making decisions about how water should be managed, water users and managers need to be sure that their rights to water are secure. They need to know that the resource is being shared fairly – that no one is extracting more than they are entitled to – and that the processes and rules for sharing water between entitlement-holders in times of shortage are well defined and transparent.

Entitlement-holders also need to be sure that while their access may be subject to restrictions or bans in times of shortage, their rights to a certain licensed volume will not be changed without evidence of the need for adjustment and consultation. Robust, statutory processes must be followed if licence conditions are to be changed permanently during the life of the licence and cannot be changed without good reason at the time of renewal.

4.2.1 Managing whole groundwater systems

A key test for assessing whether the resource is being shared fairly is determining whether users extracting water from the same groundwater system are subject to the same management rules. As a legacy of where management boundaries were drawn, there are instances where users are subject to different management rules even though they are extracting water from the same groundwater system.

Recent investment in mapping groundwater systems, resource assessments and the completion of the first phase of redeveloping the observation bore network have greatly improved the Government's understanding of groundwater systems. This new information provides an opportunity to review the boundaries of the management areas to:

- ensure they cover all parts of the region, including currently unincorporated areas; and
- align them, as far as practical, with groundwater systems to ensure management decisions are better informed by the major influences on those systems.

The Government, through the Secure Allocation, Future Entitlements (SAFE) project, is developing new groundwater management boundaries based on groundwater systems. The project aims to:

- ensure all of Victoria's groundwater is included in an appropriate management area;
- develop guidelines for better determining the volume of groundwater available for use; and
- provide recommendations about how to transition from current to future management arrangements.

Defining management boundaries based on groundwater systems will provide state-wide coverage of management areas. The water balance and interconnectedness of aquifers within these systems will be better managed. Common management objectives for similar types of groundwater systems will be developed. This approach aims to ensure the needs of water users and the environment throughout a groundwater system are supported by a consistent and efficient management framework. It should also provide greater scope for groundwater trade.

Action 4.1 Revising groundwater management units

Who: Department of Sustainability and Environment, rural water corporations **Timeframe:** Mid 2012

The Department of Sustainability and Environment will work with rural water corporations, catchment management authorities and groundwater users to revise the boundaries of groundwater management units (GMU) to align with groundwater systems.
The revised GMU boundaries will:

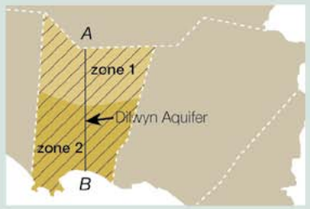
- cover all parts of a groundwater system that share common characteristics and/or are interconnected;
- be set at an operational and administrative scale appropriate for efficient management. Other boundaries, such as surface water catchments, administrative boundaries and existing groundwater management boundaries, will be considered;
- identify zones within management units to be used for specific management needs and variations; and
- where necessary, identify the need for transitional arrangements to avoid sudden changes in management arrangements for water users and processes for implementing future boundary changes.

Figure 4.3 Example of a groundwater management units based on a groundwater system – the Dilwyn Aquifer

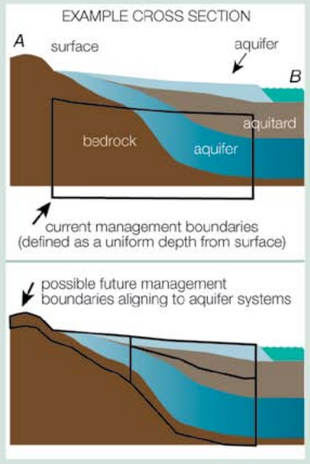
Basin-scale systems
The two major groundwater basins in the Western Region are the Murray Basin and the Otway Basin. There is a basal gravel and sand groundwater management system within each of the basins and the capacity to manage meaningfully at this scale is limited.

Groundwater management unit (GMU)
For the Otway Basin, the basal gravel and sand system can be divided into smaller areas based on the pattern of flow and the level of connection between different parts of the system. This is more at a scale for consideration as individual groundwater management units. There is continuous flow within each unit, with little flow between units, so the water resources can be managed separately.

Management zones
Within a groundwater management unit there may be other criteria that warrant the area being further subdivided into zones. Groundwater management zones may be defined by:
- aquifer characteristics such as unconfined and confined parts;
- areas of intensive groundwater development; and
- areas of particular environmental significance, such as major groundwater dependent ecosystems.



Defining the depth extent
The depth of current management units is defined as a depth from the surface. As aquifer systems vary with the shape of the basin, they do not neatly conform to the ground surface. For example, the aquifer extent in blue. This means that the definition of a GMU needs to, as far as practical, align with the aquifer system.



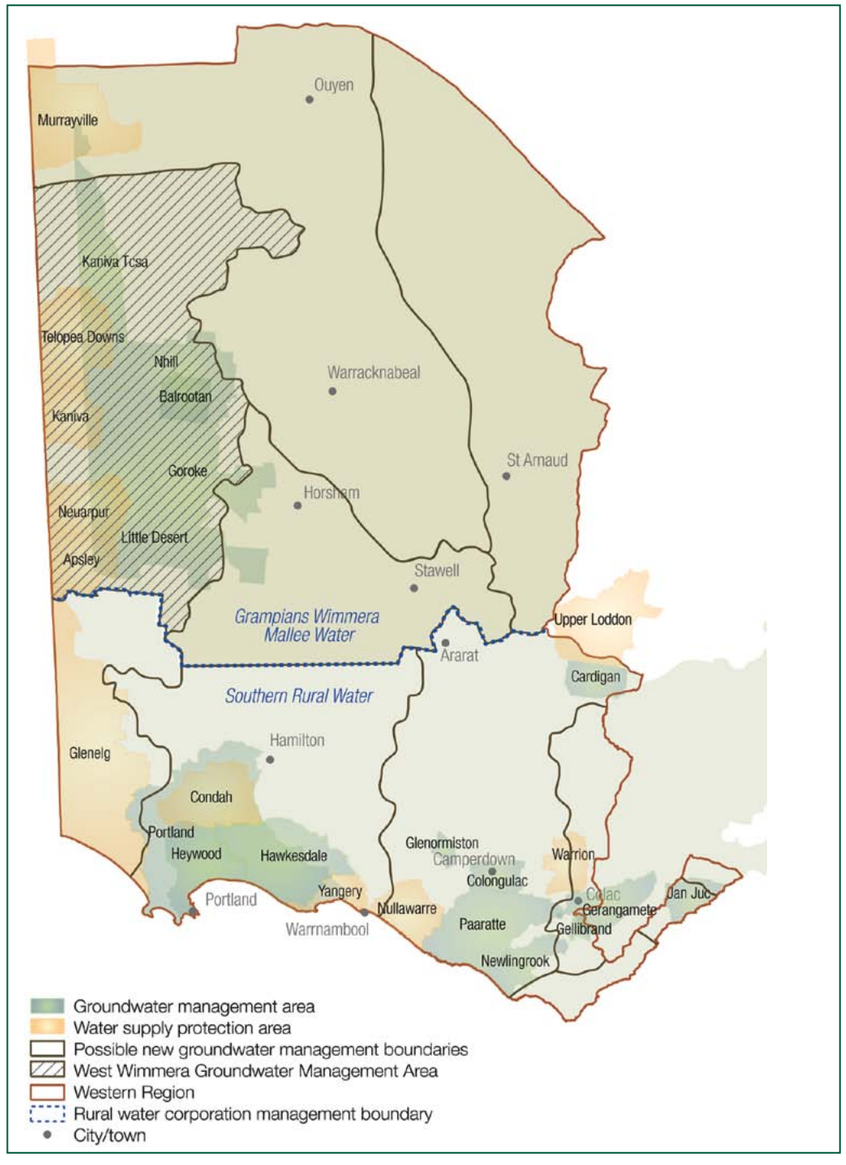
How will the new boundaries look for the Western Region?

Development of new groundwater management boundaries is expected to take some time. Stakeholders, including groundwater users, will be consulted about draft boundaries throughout the development process to ensure the proposed changes are understood and to discuss potential impacts on current groundwater users and management arrangements. This will also identify any necessary transitional arrangements.

The West Wimmera Groundwater Management Area provides a good example of where combining groundwater management units can deliver more effective management. The potential benefits of the amalgamation are discussed in Chapter 10 (see page 224).

Figure 4.4 provides a preliminary example of how the management boundaries might look for the Western Region. Further work and consultation will be undertaken to progress from the concept stage to operational boundaries.

Figure 4.4 Example of potential groundwater management boundaries



4.2.2 Clear rules for sharing water in each aquifer

Chapter 3 outlined a policy to establish local management plans to clearly document specific management arrangements and rules that apply to the users on each system (see Policy 3.3).

Local management plans will play a critical role in helping water users adapt to changes in groundwater availability (see Figure 4.5).

The volume of extraction from an aquifer can vary significantly, from negligible in some areas to a high reliance on extraction for urban, irrigation or domestic and stock use. Groundwater system monitoring has given local managers a good understanding of the risks in each aquifer and when there is a need to intervene to ensure fair and sustainable use.

Where there is reduced groundwater availability, the preferred response is to place short-term restrictions on water use to match availability.

Restriction rules have been developed based on trigger levels devised from local knowledge. Some groundwater management units may not have well defined restriction rules because of historically high reliability. Others have had triggers introduced in response to a rapid decline in groundwater availability or to manage specific issues. To provide greater certainty to users, restriction rules should be clearly documented.

Where aquifers provide significant storage capacity and the rate of recharge is good, it may be possible to use seasonal restrictions to share the available resource. Seasonal restrictions on licences (similar to seasonal allocations made to water shares) allow water to be allocated at the start of the year based on the resource status.

The process for any seasonal restrictions will be documented in management plans. This will provide more certainty to users.

"It will be important that the concept of annual allocations is only used where truly warranted, and there is adequate understanding of aquifer response to extraction and recharge from rainfall variability." – Draft Strategy submission DS205

Action 4.2 Managing short-term variability in groundwater systems

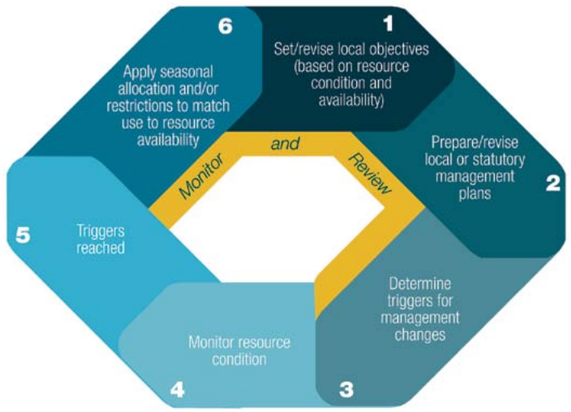
Who: Rural water corporations **Timeframe:** Progressively

If required, annual processes such as restrictions will be applied to reduce groundwater use to match water availability and to minimise the risk of the resource being over-used.

The merits of introducing seasonal restrictions (similar to seasonal allocations made to water shares) will be investigated for appropriate groundwater systems.

The introduction of restrictions will be based on trigger criteria, such as levels or rates of decline, set out in local management plans to ensure equitable and long-term sustainable use. Existing rules for restrictions, rosters or any bans will be documented and adopted into local management plans to formalise existing water-sharing rules.

Figure 4.5 Using local management plans to adapt to changes in groundwater availability



As discussed in Chapter 3, local management plans will be developed for all groundwater management units that are not currently subject to an approved statutory management plan. Statutory management plans in the Western Region include the Murrayville, Nullawarre, Warrion and Yangery Groundwater Management Plans.

Groundwater management units in the region can be broken into two categories:

i. **Areas where existing rules will be documented in local management plans.** In these areas, where the management rules are working effectively and water corporations believe that there are no immediate concerns about the reliability of supply, local management plans can be established based on existing rules. It is a simple exercise of documenting the existing rules in a local management plan and publishing them on the water corporation's website.

ii. **Areas where rules need to be reviewed or improved before being documented in local management plans.** In these areas, where changes in water availability are not well understood, further work is required to ensure changes in water availability are being effectively managed (that is, by applying rules for restrictions or temporary bans, before documenting them in a local management plan).

Table 4.1 lists the region's groundwater management units by category and the proposed timing for developing local management plans for each unit.

The Minister will issue guidance for developing local management plans that will require stakeholders to be consulted before these plans are amended (see Section 3.1.3). This will ensure that if groundwater availability changes rapidly and it becomes clear that the existing rules are inadequate, the water corporation will be able to initiate a review of the local management plan as needed and stakeholders will be consulted on any proposed amendments.

The development of local management plans will provide certainty to licensed water users by outlining the rules for managing water supplied under a section 51 take and use licence. It should also help to improve water users' and the community's understanding of how groundwater is managed. The processes to develop these plans, combined with education programs delivered by water corporations such as the Southern Groundwater Futures program (see Box 4.2), should help water users and the community use Victoria's groundwater resources sustainably.

Table 4.1 Local management plans for groundwater systems

Action	*Management areas*	*Timeframe*
Areas where existing rules will be documented as local management plans	Colongulac Glenormiston Gellibrand Unincorporated areas	Mid 2012
	Balrootan Kaniva TCSA Goroke Little Desert Nhill	Mid 2012 GMAs will be incorporated into the West Wimmera GMA – the new strategy will inform the local management plan
Areas where rules need to be reviewed or improved	Heywood Hawkesdale Portland Paaratte Newlingrook Nullawarre WSPA[a] Yangery WSPA[a]	End 2012

[a] WSPAs proposed to be undeclared (see Table 4.2, page 112); once undeclared, existing management plans will be revised and documented as local management plans.

Box 4.2 Southern Groundwater Futures

Southern Rural Water's Southern Groundwater Futures project provides detailed information about groundwater across the southern part of the State. A three-dimensional map was created, using information selected from about 70,000 bores, to help describe the shape and depth of aquifers. Together with information about land use, catchment features and the location of bores, more can be understood about groundwater levels and where they may be altered by rainfall patterns and extraction rates. This information will be used by the SAFE project (see Section 4.2.1) to better inform the management of groundwater across the State.

The maps can be viewed at Southern Rural Water's website, www.srw.com.au, by following the links to the Southern Groundwater Futures mapping page.

4.2.3 Statutory processes to protect groundwater

There may be times when a permanent change to entitlements or conditions of use may be warranted to protect the resource. However, permanent changes to entitlements will be made only if there is clear evidence that the use of short-term or annual processes have failed to halt a decline in groundwater levels due to extraction and there is a risk of irreversible damage to the resource base or the environment.

Licensed entitlements can be permanently reduced through the development of a statutory management plan. This Strategy has not identified new areas where a statutory management plan needs to be developed to reduce licence volumes permanently.

Permanent reductions can also occur as an outcome of the statutory 15-year review of the State's water resources (see Section 3.1.4, page 65).

Action 4.3 Undeclaring water supply protection areas (WSPA)

Who: Rural water corporations **Timeframe:** Mid 2012

Rural water corporations will initiate a process to formally undeclare WSPAs where the Strategy has not identified the need to amend licence conditions or volumes and has proposed the development of local management plans. See Table 4.2 for a list of actions associated with WSPAs.

Table 4.2 Management of current water supply protection areas

Action	*WSPAs*	*Timeframe*
Undeclare existing WSPAs and revise management plans	• Nullawarre – will revise current management plan as local management plan • Yangery – will revise current management plan as local management plan • Apsley – no management plan in place; will become part of West Wimmera GMA • Telopea Downs – no management plan in place; will become part of West Wimmera GMA • Kaniva – no management plan in place; will become part of West Wimmera GMA • Neuarpur – area will be managed as a sub-zone within the West Wimmera GMA	Mid 2012
Further investigation needed to undeclare WSPAs	Glenelg WSPA – no management plan currently in place; further investigation needed before undeclaring	End 2012
Maintain existing WSPAs and associated management plans	Condah WSPA – a management plan may be developed subject to an assessment of recent resource technical assessments Warrion WSPA - management plan in place (2010) Murrayville WSPA – management plan in place (2001)	2013 Ongoing
Declare WSPAs and prepare associated management plans	None	Not applicable

Changes to licence volumes or conditions can also occur when a licence is renewed. However, the *Water Act 1989* requires the licensing authority to renew the licence unless there are good reasons not to do so. In practice, there have been very few occasions across the State where a licence volume has not been maintained at the time of renewal. In most cases the statutory review is a more effective and equitable process to address licence conditions.

The process for undeclaring requires public notice to be given of the Minister's intention to undeclare an area and an opportunity for stakeholders to provide comment. Technical Report 5 found online provides further information on the areas proposed to be undeclared, information about the process that will be followed and how stakeholders can comment.

Technical Report 5 shows that for all the proposed areas where WSPAs will be undeclared, the resource condition is considered sustainable. Local management plans will provide sufficient management, and the relevant caps, metering/monitoring and charging arrangements are already in place through other means, to meet the original objectives for declaring a WSPA. The report also discusses how undeclaring WSPAs will facilitate permanent water trading, which is banned in WSPAs until statutory management plans are complete.

4.3 Promoting sustainable development of the region's groundwater resources

The region's groundwater resources are highly valued and every opportunity should be explored to use these resources productively while protecting the interests of existing users and the environment.

The Strategy aims to:

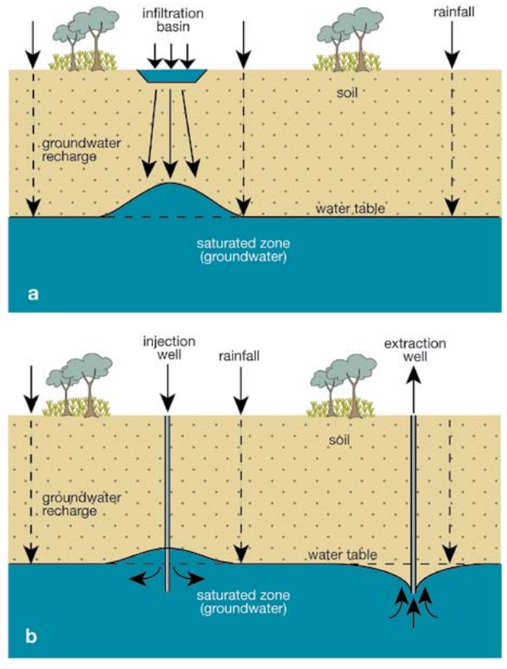
- encourage new opportunities to store water for use in dry times;
- make the best use of existing groundwater by encouraging trade and carryover (where sustainable – see Section 4.3.2); and
- explore the potential for more water being made available following resource assessments.

4.3.1 Using aquifers to store additional water

In the right situations, managed aquifer recharge (MAR) could be used to store raw water, recycled water and treated stormwater for later reuse. In simple terms, water is stored underground rather than in a dam.

For example, water could be stored in an aquifer over winter and extracted in summer to improve supply reliability and ease pressure on other water users or the environment in summer. The use of MAR could potentially remove the need to build more expensive off-stream storages.

Figure 4.6 Managed aquifer recharge



Water can be put into the aquifer by:
- 'infiltration' - a passive process using a recharge basin (Figure 4.6a); or
- 'injection' - an active process of pumping water into a bore for deeper or confined aquifers (Figure 4.6b).

The implementation of MAR has been slow in Victoria, because:
- there is a lack of operational knowledge of MAR in Victoria, together with the need to adapt technologies to suit aquifer conditions;
- there are potential environmental and water quality risks associated with injecting recycled water and/or stormwater into aquifers;
- there is a need for further education and working examples to develop social acceptance and community confidence in this new technology;
- there are economic risks associated with the application of all new technologies;
- there are untested regulatory provisions and processes; and
- investment is restricted by the need to investigate local aquifer properties without the certainty the aquifer will be suitable.

Several MAR projects are being investigated in the region, including the Anglesea Managed Aquifer Research project and the Brauerander Park project in Warrnambool. Both projects are in the trial phase of investigating the potential of the aquifers in the area to store water, and the volumes that could be stored. Preliminary results indicate the potential to store 15 ML per year of stormwater for the Brauerander Park project and 10 to 15 GL per year of surface water, stormwater or recycled water for the Anglesea project. Trials will continue at Brauerander Park until mid-2012 and Stage 2 of the Anglesea project is due to be completed by the end of 2011.

MAR schemes must be developed in a way that does not adversely affect groundwater resources, other groundwater users and the environment (see Box 4.3). This involves ensuring water quality in the aquifer is not compromised and injecting water does not cause unacceptably high groundwater levels.

Box 4.3 Policies for Managed Aquifer Recharge

In September 2010, the Minister for Water issued policies to guide rural water corporations in assessing and licensing MAR projects, including:
- licences and approvals required under the Water Act;
- a proponent's entitlements to water;
- rights to carryover water from year to year;
- rights to trade water;
- standards required to protect human health and the environment; and
- information required to accompany an application.

Key aspects of the policies are:
- Storing water in an aquifer must not be detrimental to an aquifer, a bore, or other groundwater users (including the environment) as specified in the *State Environment Protection Policies (Groundwaters of Victoria)*.
- An entitlement to take groundwater will be linked to the volume of water recharged to an aquifer.
- An entitlement of up to 80 per cent of the volume of water recharged to an aquifer will be permitted for an unconfined aquifer and up to 100 per cent for a confined aquifer.
- Transfers and carryover are permitted, but may need to be managed to minimise interference with other groundwater users including the environment.

The policies also clarify other approvals that may be required for some MAR projects (for example, approvals from EPA Victoria for associated recycled water treatment).

4.3.2 Encouraging trade and carryover where sustainable

Trade in groundwater has been limited to date. A total of 4,032 ML of groundwater was traded in the region in 2009/10, made up mostly of temporary trade. Further development of groundwater trading is possible and could bring significant benefits to water users and the region and encourage regional growth. However, opening up further trade will need to ensure that there are no third party impacts on existing water users or the environment.

Facilitating a more active market for groundwater

Chapter 3 identified several actions to promote water trading on unregulated surface water and groundwater systems (see Section 3.2.3, page 75). These actions include providing general information on the benefits of trade and more detailed market information, such as comparative data on price and trade volumes and education programs to inform water users of trade processes.

The policy of auctioning unallocated water in systems where there is additional capacity (see Actions 3.15 and 4.8) will reveal the value of resources in the region, which should help existing and new users consider the potential benefits of temporary or permanent trades.

Interstate groundwater trade

Many areas in the region next to the State border overlie aquifers that continue into South Australia. Victorian legislation already enables interstate trade of groundwater entitlements. However, practical issues limit the ability to trade interstate, including:
- the need for joint management plans in both States to ensure the proper management of PCVs in declared zones following trade;
- compatibility of entitlements between the states – South Australia has area-based licences but is in the process of converting to volumetric licences similar to the approach used in Victoria; and
- the South Australian-Victorian Border Groundwaters Agreement is likely to require amendment to address these issues and to incorporate suitable provisions to cover interstate trade.

Action 4.4 Facilitating groundwater trading

Who: Rural water corporations **Timeframe:** Ongoing

Groundwater trading will be further developed by ensuring:
- New groundwater management unit boundaries are set having regard to the need to enable trade to occur, as far as practical, between interconnected systems.
- Where permanent trade is not allowed because a statutory groundwater management plan is being developed, that these plans are finalised as soon as possible to enable permanent trade in those management areas.
- Where permanent trade is not allowed because a WPSA has been declared but the WSPA is no longer required, that the process to undeclare these areas be initiated as soon as possible to enable permanent trade in those areas.
- Local management plans clearly advise groundwater users of their ability to trade in their groundwater management unit.

Action 4.5 Developing groundwater trade between South Australia and Victoria

Who: Department of Sustainability and Environment **Timeframe:** End 2012

The Victorian Government will encourage the development of arrangements and trials for interstate trade under the South Australian - Victorian Border Groundwaters Agreement, including resolution of current differences in groundwater management between South Australia and Victoria.

Carryover of groundwater entitlements

Carryover of groundwater in systems where there is adequate storage enables individual water users to make decisions about how to best manage the risks of reduced water availability on their businesses. An important part of managing risk is the ability for entitlement-holders to access and use water when it is most needed. Carryover is a way for entitlement-holders to do this by providing the opportunity for unused water from one year to be carried over and reserved for use in the following year.

Consultation on the Draft Strategy raised several concerns about the proposed introduction of groundwater carryover in the Western Region including:

- demand would be limited so it is not needed;
- it could lead to overuse in some instances;
- we do not know enough about each groundwater system to determine whether carryover might impact adversely on third parties or the environment; and
- it would be costly to implement in terms of establishing billing and register systems.

In considering these concerns, the Consultative Committee noted that carryover is not possible or necessary on all groundwater systems. As such, the Government considers that groundwater carryover should only be implemented due to the desire and support of existing users, to ensure that unnecessary cost burdens are not placed on existing users.

Photo: Visions of Victoria

Windmill near Mount Elephant, Camperdown

4.3.3 Strategic groundwater resource assessments

There may be further opportunities on certain systems throughout the Western Region for more groundwater to be made available. However, before allocating more groundwater to new or existing users, assessments need to be made to ensure the groundwater system has the capacity to supply the additional water without having an adverse impact on existing users or the environment.

The capacity of the resource is assessed:

- on a case-by-case basis, groundwater licence applicants may be asked to demonstrate that the groundwater system has the capacity to supply the water through commissioning a hydrogeological report from a suitably qualified expert; or
- periodically through a groundwater resource appraisal commissioned by the Department of Sustainability and Environment or the water corporation.

The priority will be to assess the capacity and ability of aquifers to provide additional supplies, based on their response to the recent prolonged drought and recovery under more recent wet conditions. This may include the Dilwyn (see Section 8.2.3), Port Campbell Limestone and Newer Volcanics aquifers.

Action 4.6 Strategic groundwater resource assessments

Who: Department of Sustainability and Environment, rural water corporations **Timeframe:** Progressively

The Victorian Government will support ongoing strategic assessments to determine the capacity of groundwater systems to supply additional water while protecting existing users and the environment.

4.3.4 Managing groundwater and surface water interactions

In some systems increased groundwater extraction can reduce streamflow and therefore impact on groundwater dependent ecosystems and the reliability of existing surface water users. Allocation, trade and management rules must recognise these interactions.

The *Water Act 1989* enables groundwater and surface water interconnections to be managed, while resource assessments can increase understanding of these interconnections and where they are, to refine current management. Local management plans and statutory management plans will consider these interactions to ensure the interests of existing surface water and groundwater users and the environment are protected (see Section 4.2.2).

Action 4.7 Groundwater/surface water interactions

Who: Department of Sustainability and Environment, rural water corporations, catchment management authorities **Timeframe:** 2013

Systems with high groundwater and surface water interaction will be identified and considered as part of ongoing strategic groundwater resource assessments and local management plans or statutory management plans. This will ensure the interests of existing surface water and groundwater users and the environment are protected.

4.3.5 Making more water available after assessing the capacity of the resource

As noted in Chapter 3, where unallocated water is available and can be used sustainably, the Strategy promotes the staged development of this water through expressions of interest and auctions (see Action 3.15).

Given the costs involved in developing groundwater extraction, it will be important for the rural water corporation to work through a robust and transparent auction process, which asks prospective buyers to register their interest and ensures they understand the relevant approvals required to use the water if successful, such as the need for a bore construction licence and location-specific, bore interference assessments.

As discussed in Chapter 3, if interest in the water is limited and there are not enough market participants to hold an effective auction, rural water corporations may need to establish an appropriate reserve price to encourage the sustainable development of unallocated groundwater resources.

Action 4.8 Auctioning water where groundwater systems have additional capacity

Who: Rural water corporations **Timeframe:** Progressively

Where a strategic groundwater resource appraisal has identified additional capacity, the additional water will be made available to existing and new users through expressions of interest and/or auctions.

Where a strategic resource appraisal has not been made but water is available under the PCV, rural water corporations will continue to consider applications for new licences on a case-by-case consistent with section 40 of the *Water Act 1989*.

4.4 Protecting the health of groundwater resources for current and future users, and the environment

To make the best use of the State's groundwater, the health of groundwater resources must be maintained by:

- monitoring the condition of the resource;
- considering how the environment relies on groundwater and how it might be affected by current and future groundwater extraction; and
- identifying how changes in groundwater or mining and emerging technologies might impact on the quality or quantity of groundwater resources, and what measures should be established to ensure the introduction of new technologies do not have an adverse impact on the health of groundwater resources.

4.4.1 Long-term, viable and cost effective groundwater monitoring

Adequate groundwater monitoring is critical for ensuring the effective management and beneficial use of Victoria's groundwater resources.

Groundwater levels across the State are monitored using the State Observation Bore Network. This network is a collection of about 2,500 bores managed by the Department of Sustainability and Environment, which spends about $1.3 million a year on quarterly bore monitoring ($900,000) and minor maintenance ($400,000).

Rural water corporations contribute to the cost of monitoring bores where more frequent monitoring is required. From 2011/12, rural water corporations will also contribute towards the management and minor maintenance of the bores they monitor monthly. Currently they monitor 627 of the 2,500 bores monthly, rather than relying on the State's quarterly readings. Across the State, rural water corporations contribute $415,000 to $560,000 a year towards monitoring, management and minor maintenance on these bores.

Rural water corporations' contributions will be maintained until at least 2013/14, when the state-wide monitoring contract will be reviewed and revised or extended for another two years. During this period, the contributions from water corporations would only increase if a statutory management plan or local management plan identified the need for the corporation to increase the number of bores to be monitored monthly.

The current network is adequate in some areas but deficient in others. While Government funding has been used to periodically upgrade the system, the availability of ongoing secure funding to maintain and refurbish the system has been limited. This is partly due to a lack of clarity about who should pay for the cost of maintaining the network, with the National Water Initiative suggesting water users should pay an appropriate share.

The Victorian Government accepts that the State has an ongoing responsibility for monitoring the condition of the resource and recognises the need to further develop the bore network to ensure it provides adequate coverage and is in reasonable condition. Once the network is upgraded, the cost of maintaining and renewing the network should be shared between the State, water users and environmental managers on an equitable and 'beneficiary pays' basis.

The future cost-sharing arrangements recognise that domestic and stock groundwater users do not contribute towards the cost of monitoring the resources on which their businesses rely.

Photo: DSE

Policy 4.2 Clarifying responsibilities for groundwater monitoring

Groundwater monitoring in Victoria will be guided by the following principles:

1. The Government is responsible for maintaining a baseline of continuous monitoring that provides sufficient information to identify changes in groundwater resource availability and condition over time.
2. The Government will continue to cover the cost of monitoring groundwater resources on behalf of domestic and stock users.
3. Water corporations, on behalf of licensed consumptive users, are responsible for additional monitoring required to:
   - manage water availability for groundwater license-holders during the water year;
   - ensure extraction does not impact adversely on entitlement-holders and third parties, including the environment; and
   - assess and investigate, at the applicant's expense, applications for new groundwater allocations or transfers to ensure there are no third party impacts, including on the environment.
4. The need for water corporations to perform additional monitoring in future will be subject to consultation with groundwater users and environmental managers through the development of statutory management plans or local management plans.
5. Environmental managers are responsible for monitoring to support the management actions outside the licensing regime and initiated by them to protect high value environmental assets.
6. Groundwater monitoring should be as efficient as possible, with every opportunity to reduce the capital and operational costs explored.
7. Monitoring undertaken by the State, water corporations or environmental managers should be coordinated and made publicly available.

The Government's commitment to progressively upgrade and rationalise the network, combined with the maintenance of water corporations' current contributions until at least 2013/14, will provide time to transition to arrangements that ensure:

- groundwater monitoring is adequate across the State; and
- formal processes and equitable sharing of future costs provide secure, ongoing funding.

Based on this approach, the costs of the backlog program will be quarantined. This will enable the forward-looking costs of maintaining and any future renewal of the upgraded network to be shared on an equitable and 'beneficiary pays' basis.

Action 4.9 Upgrading and refining the monitoring network

Who: Department of Sustainability and Environment, rural water corporations, environmental managers **Timeframe:** End 2012

The Department of Sustainability and Environment will work with rural water corporations and environmental managers to identify a backlog program of works to upgrade and refine the monitoring network to ensure it provides adequate coverage and is in reasonable condition. This backlog program will identify:

- the number and location of new bores required to ensure adequate baseline level of monitoring across the State;
- the number and location of existing bores not required for the baseline level of monitoring and which should be capped, decommissioned or transferred to an interested party;
- the estimated cost of commissioning new bores or decommissioning obsolete bores; and
- how the commissioning or decommissioning of bores should be prioritised.

The Government will invest to deliver the program on a priority basis. The need for additional funding will be considered through the annual Budget process.

Action 4.10 Establishing secure, ongoing funding for future maintenance and renewal of the monitoring network

Who: Department of Sustainability and Environment, rural water corporations, environmental managers **Timeframe:** Ongoing

The Government will establish a formal process for determining arrangements for the future operating, maintenance and any renewal of the network having regard to:

- The process for setting and allocating funding from the environmental contribution levy (currently every four years, with the next period beginning on 1 July 2012).
- Water corporations' water planning and price setting process overseen by the Essential Services Commission (currently every five years, with the next pricing period beginning on 1 July 2013).

Each planning period, the Department of Sustainability and Environment, in consultation with rural water corporations and environmental managers, will develop the forward operation, maintenance and renewal program, which will:

- Identify the cost of operating (monitoring), maintaining and renewing the network over the planning period, taking into account a planning horizon that extends beyond the period.
- Propose cost-sharing arrangements between the State, water corporations and environmental managers on a 'beneficiary pays' basis having regard to:
  - the guiding principles in Policy 4.2 above;
  - consideration of the minimum level of monitoring the State would perform in the absence of consumptive extraction; and
  - the State's current commitment to continue to pay the share of monitoring costs attributable to domestic and stock users.

The Minister for Water will be given the opportunity to review and comment on the forward works program before it is submitted for consideration in the process to set and allocate the environmental contribution levy. The process will include mechanisms for resolving disputes in the event that the Department, water corporations and environmental managers can not agree on the future program and/or relative cost shares. This mechanism could include the ability to refer a dispute to the Essential Services Commission for resolution.

4.4.2 Managing groundwater dependent ecosystems

The Strategy aims to establish management arrangements that make the best use of groundwater resources whilst protecting the environment.

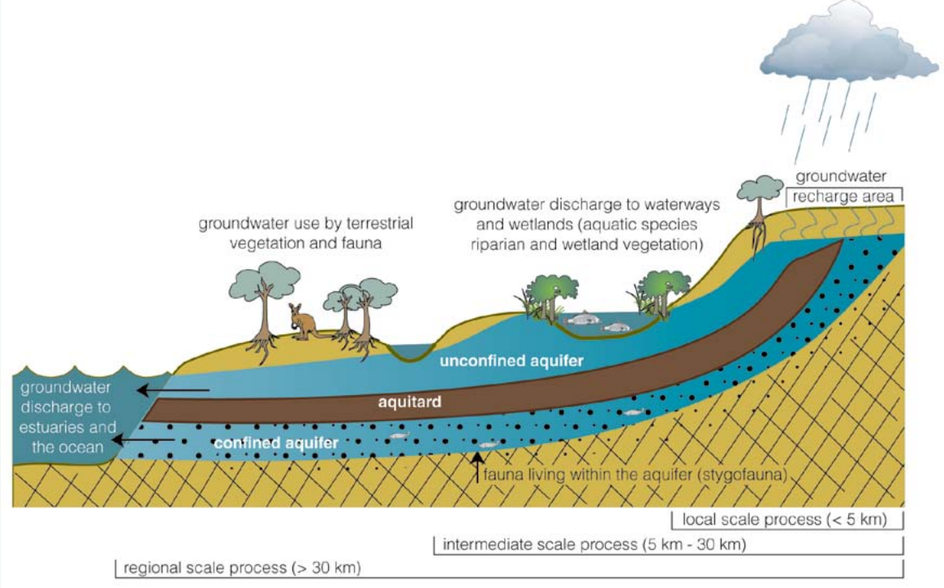
The environment's reliance on groundwater is generally understood, but in most areas it is not understood in any detail at a local scale. There is a risk that in some aquifers, excessive groundwater extraction could damage environmental assets. However, a limited knowledge about the interaction and level of dependence between groundwater and the environment makes it difficult to assess this risk. In addition, it is difficult to isolate the influence of groundwater extraction on the environment from the impact of other pressures such as reduced rainfall/recharge, land use change, evaporation or management of surface water drainage.

The challenge for the future is to determine how to assess the degree of risk to environmental assets in the face of imperfect knowledge and develop appropriate management actions that strike the right balance between meeting the needs of consumptive users and the environment.

What are groundwater dependent ecosystems?

Groundwater dependent ecosystems (GDEs) are ecosystems such as wetlands, streams, estuaries or vegetation that rely totally or in part on groundwater (see Figure 4.7).

Figure 4.7 Groundwater dependent ecosystems



There are three types of groundwater dependent ecosystems (GDEs):

- surface ecosystems that depend on groundwater flowing (discharging) to the surface, for example river baseflows, springs and some wetlands and estuaries;
- ecosystems that tap into groundwater, for example terrestrial vegetation using groundwater directly from shallow aquifers; and
- ecosystems within aquifers, for example in caves and in the cracks and pores in aquifers themselves.

Just as surface water provides a source of water to rivers and wetlands, groundwater that discharges to the surface can help support a variety of ecosystems such as springs, wetlands, streams and estuaries. For example, rivers and streams that flow permanently during summer can be sustained by groundwater, known as baseflows. These baseflows are particularly important in low flow periods or droughts, where they can help sustain drought refuges from which aquatic plants and animals can recolonise waterways. However, in some areas, baseflows may be salty.

Terrestrial vegetation with roots that tap into groundwater can also be dependent on groundwater.

Current understanding of GDEs

Information about groundwater dependent ecosystems, such as identifying how they connect to groundwater and how sensitive they are to changes in groundwater levels and chemistry, is limited but is growing through a range of national and state-funded projects.

Different types of GDEs have different levels of dependence on groundwater (see Box 4.4). The characteristics of a groundwater system will influence how connected groundwater is with the surface and the likelihood that groundwater supports a particular type of GDE. For example, unconfined aquifers are more likely than deeper confined aquifers to have direct interconnection with the surface. So unconfined aquifers are more likely to provide water to wetlands and streams, and supply groundwater users. Therefore these groundwater dependent ecosystems will most likely be the focus of the management actions outlined in this Strategy.

The scale of a groundwater system can also be used to indicate the size and significance of the groundwater ecosystems they may support. Groundwater systems less than 30 km long are less likely to support large ecosystems compared with regional groundwater systems (more than 30 km).

"The most significant challenge to date has been to develop the knowledge base to identify GDEs, and understand their sensitivity to potential changes in groundwater levels so that proposed management plans, rules or licence conditions can be evidence based, meaningful and defensible." – Draft Strategy submission DS205

How should GDEs be considered in future management decisions?

Without a clear understanding of the potential impact on the environment, licensing authorities could adopt an unnecessarily conservative approach to allocating more groundwater, and/or require detailed and sometimes costly environmental assessments when licensing or management decisions are being made.

However, a lack of perfect information should not stop decisions from being made. Management decisions should use the best available information to consider the potential risks, make fair and reasonable decisions at a point in time, and establish appropriate measures to manage any residual risks, for example, through monitoring, reporting or licence conditions.

Box 4.4 GDEs can have different levels of dependence on groundwater:

- An ecosystem is entirely dependent if it would be lost with only a slight change in key groundwater characteristics. Such ecosystems include the saline discharge lakes of the western Murray Basin.
- Some ecosystems may be highly dependent on groundwater, and even moderate changes in groundwater discharge would cause substantial change to the ecosystem.
- Some wetlands rely on groundwater and surface and/or soil moisture. They would be substantially changed if they stopped receiving groundwater or if groundwater inflows were reduced moderately at certain times.
- Some ecosystems have limited or opportunistic use of groundwater, for example at the end of a dry season or during extreme drought. These include coastal floodplain swamp forests, banksia woodlands and lignum shrublands along inland river systems and summer flows in rivers. This water source may be critical to the survival of some ecosystems. For example, river baseflows may maintain drought refuges during low flow periods.
- Some ecosystems may appear to be groundwater dependent, but are entirely supported by rain or surface flows. Examples include the large seasonal floodplain lakes and in-stream ecosystems of the Murray and Darling rivers.

This Strategy aims to provide more certainty about how the needs of the environment will be considered by outlining a risk-based approach to guide licensing authorities' decisions to:

- allocate groundwater available under PCVs;
- approve a temporary or permanent transfer of an existing licence;
- consider whether the location of a new bore or increased extraction from an existing bore could impact on the environment; and
- document trading rules in local management plans to protect GDEs.

Policy 4.3 Risk-based approach to managing groundwater dependent ecosystems

The following principles will apply when risks to groundwater dependent ecosystems are being considered:

- the protection of high value GDEs will be considered when setting or adjusting permissible consumptive volumes;
- GDEs with high environmental values, and a high risk of being affected by changes in groundwater levels, will be given the highest level of protection;
- GDEs with high environmental values that rely on regional and intermediate scale groundwater systems will be considered in groundwater management planning; and
- GDEs with high environmental values that rely on the surface expression of local scale groundwater systems will be assessed site-by-site in the licensing regime.

Action 4.11 Developing Ministerial guidelines for groundwater dependent ecosystems

Who: Department of Sustainability and Environment, rural water corporations, catchment management authorities **Timeframe:** End 2012

The Department of Sustainability and Environment, in consultation with rural water corporations and catchment management authorities, will develop Ministerial guidelines to help licensing authorities consider the risk to groundwater dependent ecosystems.

How will high environmental values be determined?

To help water corporations identify GDEs where groundwater is likely to interact with the surface and/or where there are high environmental values, the following should be considered:

- latest technical information identifying recharge zones, areas where groundwater is likely to interact with the surface or where terrestrial vegetation is reliant on groundwater;
- lists of threatened species or protected environmental assets: for example Ramsar listed wetlands, rivers listed in the *Heritage Rivers Act 1992*, species listed under the *Flora and Fauna Guarantee Act 1988* or the *Environment Protection and Biodiversity Conservation Act 1999;* and
- regional river health strategies.

The Department of Primary Industries has recently conducted research identifying terrestrial vegetation across Victoria. This research uses satellite imagery to identify vegetation across the State where water levels are less than five metres from the surface. At this depth the vegetation is more likely to be reliant on groundwater.

For more information on the DPI research identifying potential terrestrial GDEs across the State, see the DPI reports available online at http://www.dpi.vic.gov.au and follow the links to GDE research.

While this research has some limitations and relies on several assumptions to extrapolate information from a local to regional scale, when combined with information about areas where there are high environmental values it is possible to identify potential high value GDEs that could be at risk from groundwater extraction.

For example, when applied to the Western Region, the Western District Lakes are identified as potential high value GDEs. The lakes are Ramsar-listed and although there is uncertainty about the connectivity between groundwater and surface water, Lake Corangamite is considered to be supported by groundwater from a regional groundwater system[11]. The Warrion groundwater management plan aims to maintain the groundwater gradients towards the lakes and wetlands, and requires the monitoring of water levels in bores adjacent to Lake Corangamite and any other GDEs identified in the area.

Lake Corangamite ©Alison Pouliot

How will the risk-based approach work in practice?

Rural water corporations will apply the principles when making licensing decisions, and developing statutory or local management plans. The approach will help rural water corporations:

- identify where groundwater extraction may impact on high value GDEs;
- guide the level of assessment and scale of risk management required for different management decisions; and
- ensure the latest available information is used to assess the potential risks and determine the need for risk mitigation measures.

For example, if a water corporation received an application for a new licence or transfer of an existing licence, it would:

1. Consider whether any rules relating to protecting groundwater dependent ecosystems exist in a statutory or local management plan.
2. Consider whether there were any high environmental values at the location of the proposed bore or associated with the aquifer system from which the water would be extracted.
3. Consider the scale of the aquifer system to form a view on the size and significance of the ecosystems it may support.
4. Based on 1, 2 and 3, determine the level of assessment or mitigation measures required to satisfy section 40 of the *Water Act 1989*, which requires the impact on existing users and the environment to be considered before a licence can be granted or transferred.
5. Consider whether or which conditions should be placed on licences to mitigate risks of future groundwater extractions adversely affecting the environment. For example, issuing a temporary trade and requiring monitoring over a certain period to demonstrate there are no adverse impacts before allocating or approving the trade on a permanent basis.

While the permissible consumptive volumes set by the Minister to protect water users' reliability and to maintain groundwater levels also help manage the needs of the environment, rural water corporations can use a variety of additional management tools to protect high value groundwater dependent ecosystems. These can be applied in statutory or local management plans or included as conditions on licences and include:

- creating buffer zones or setting trigger levels to protect recharge areas, streams, wetlands or other assets;
- developing restriction rules;
- creating trading zones ;
- creating buffer zones for water trading to ensure trades to areas outside the buffer zones can be approved in most cases, without the need for detailed environmental assessments;
- establishing monitoring requirements; and
- allowing a temporary transfer to enable additional information to be compiled to support consideration of a permanent transfer.

In developing a statutory or local management plan, water corporations may choose to identify buffer zones for water trading to ensure trades to areas outside the buffer zones could be approved in most cases, without the need for detailed environmental assessments.

While the guidelines will provide advice and checklists to help water corporations consider the needs of GDEs when making management decisions, and the latest research will help guide those decisions, water corporations are ultimately responsible for considering the matters in section 40 of the *Water Act 1989* before approving a new allocation or trade.

What else can be done to protect environmental values that rely on groundwater?

Other risks to environmental values may require complementary actions to protect or improve those values. For example, a wetland that relies on groundwater may also be affected by drainage schemes diverting water from it or excessive nutrients running off farms.

The Victorian strategy for healthy rivers, estuaries and wetlands will clarify the responsibilities for protecting and maintaining the health of rivers, estuaries and wetlands now and into the future. It will also identify complementary actions, beyond licensing decisions, that could be taken to protect or improve the health of the State's high value GDEs.

4.4.3 Managing potential impacts on groundwater resources from extractive industries and emerging technologies

Extractive industries

Extractive industry projects bring significant benefits to the region and Victoria, but can have indirect or unintended effects on water resources.

The extractive industries with the greatest potential to affect water resources in the region are on-shore and off-shore oil and gas extraction in the Otway Groundwater Basin, and coal mining in the Jan Juc Groundwater Management Area.

Other extraction activities in the region include quarrying, and mineral sand and gold mining. These can affect surface water and groundwater by altering surface drainage, intercepting groundwater (and therefore requiring the mine to be dewatered), generating an off-site discharge or requiring water supply for processing. Dewatering can lower the water table locally and affect other groundwater users or the environment. There is also the potential for water quality to be impacted from the leaching of mining wastes into waterways.

Where potential impacts are identified, project proponents should mitigate the impact by minimising the amount of water taken or helping affected water users to source alternative supplies. If mitigation options are not available, the project proponent could explore options to offset the impact of the project by investing in environmental programs to provide net benefits to the region or compensation to affected water users.

The most appropriate offset will vary depending on the type of project and the location and needs to be determined project by project, and subject to approval through the relevant approvals processes.

Policy 4.4 Managing the impact of new extractive industry projects on water resources

The Victorian Government's approval processes will continue to require proponents of any new earth resources projects in the Western Region and its Victorian coastal waters to:

- identify if the activity will impact adversely on the region's water resources;
- identify mitigation strategies, where possible, to reduce impacts, or manage the impact to an acceptable level; or
- where necessary, provide offsets that will aim to ensure no net loss to existing water users and environmental values, where impacts cannot be mitigated to an acceptable level.

Emerging technologies

As new technologies and industries, such as geothermal energy or carbon capture and storage, emerge over time, their potential impact on the availability of groundwater must be considered.

The licensing issues presented by these new technologies were not contemplated when the *Water Act 1989* was prepared. However, legislation can always be amended or redrafted to ensure appropriate protections are provided. Over the life of this Strategy, licensing requirements will be reviewed to ensure that water use by new technologies and industries does not impact on other users or the environment.

The Department of Sustainability and Environment and the Department of Primary Industries will work together to determine licensing and management issues for emerging technologies to clarify responsibilities and give greater direction to the resource development industry about approval requirements.

Action 4.12 Emerging technologies

Who: Department of Sustainability and Environment, Department of Primary Industries **Timeframe:** Ongoing

The Department of Sustainability and Environment and the Department of Primary Industries will work together to ensure that approvals and licensing decisions under the *Water Act 1989* for new and emerging technologies consider the potential impacts on groundwater, including:

- water quality (consistent with its beneficial uses);
- environmental, social and economic impacts; and
- other water users.

Facts about current and future extractive and emerging industries in the Western Region

Extractive industries

Coal mining

The Western Region contains relatively small reserves of brown coal, mostly in the Anglesea Groundwater Basin, around the margins of the Otway Ranges and potentially around the southern margin of the Murray Groundwater Basin.

Oil and gas extraction

On-shore and off-shore gasfields have been identified in the Port Campbell area. The gas lies in the deep Warre and Eumeralla Formations, which lie below the main water-bearing formations of the Dilwyn and Pebble Point Formations (collectively called the Lower Tertiary Aquifer).

While gas extraction may reduce water pressure in overlying aquifers, the risk to groundwater availability from onshore or offshore gas production in the Otway Groundwater Basin is considered low, and there has been no indication of impacts from this industry. There is also minimal risk of surface land subsidence.

Quarrying and mineral sands mining

The Western Region is rich in mineral sand deposits, particularly in the Murray Basin. More than 260 million tonnes of mineral sand deposits is available for extraction in mines in Douglas, Donald and in and around Ouyen. Mineral sands mined at Douglas and in the Murray Basin are transported to Hamilton for further processing.

Mineral sand deposits have also recently been identified in the Otway Basin and have the potential to support several long-life mining operations[12].

Geothermal energy

The Victorian Government has awarded 11 permits for geothermal exploration under the *Geothermal Energy Resource Act 2005* in areas across the Western Region. Two forms of regulated geothermal energy are relevant to the Western Region:

- hydrothermal energy involves extracting naturally heated water from deep in the ground, typically between three and five kilometres. Once the water is brought to the surface, energy is extracted and the water is usually returned to the aquifer.
- hot dry rock geothermal energy derives energy from heat stored within the rock itself, at similar depths to hydrothermal energy. Water (or another fluid) is injected into the artificially fractured hot rock through an injection well and once heated it is brought back to the surface where the heat is extracted. The water is then recirculated through an injection well.

It is unlikely that the extraction of hot water from these very deep saline aquifers will impact on other beneficial uses of groundwater, which rely on groundwater much closer to the surface.

Carbon capture and storage

Carbon capture and storage involves capturing carbon dioxide from industrial emissions and injecting it under pressure into rock formations that can store it. This technology is being trialled in the Otway Basin as part of the CO2 Cooperative Research Centre. The potential for this technology to affect aquifer pressures and quality is assessed through the *Greenhouse Gas Geological Sequestration Act 2008* (onshore) and the Offshore Petroleum *and Greenhouse Gas Storage Act 2006* (offshore).

Underground coal gasification/liquefaction

Underground coal gasification/liquefaction involves turning coal into hydrocarbons in the coal bed without the coal being extracted. This technology is under consideration in Victoria.

Deeper coal seams in the Anglesea, Otway and Murray Groundwater Basins that cannot be commercially mined are potential targets for these technologies. These coal seams could be part of, or occur above or below, aquifers used for water resources. Unless well regulated, underground coal gasification/liquefaction could affect aquifers in the Western Region through additional demand for water, or the creation of by-products that could pollute groundwater resources.

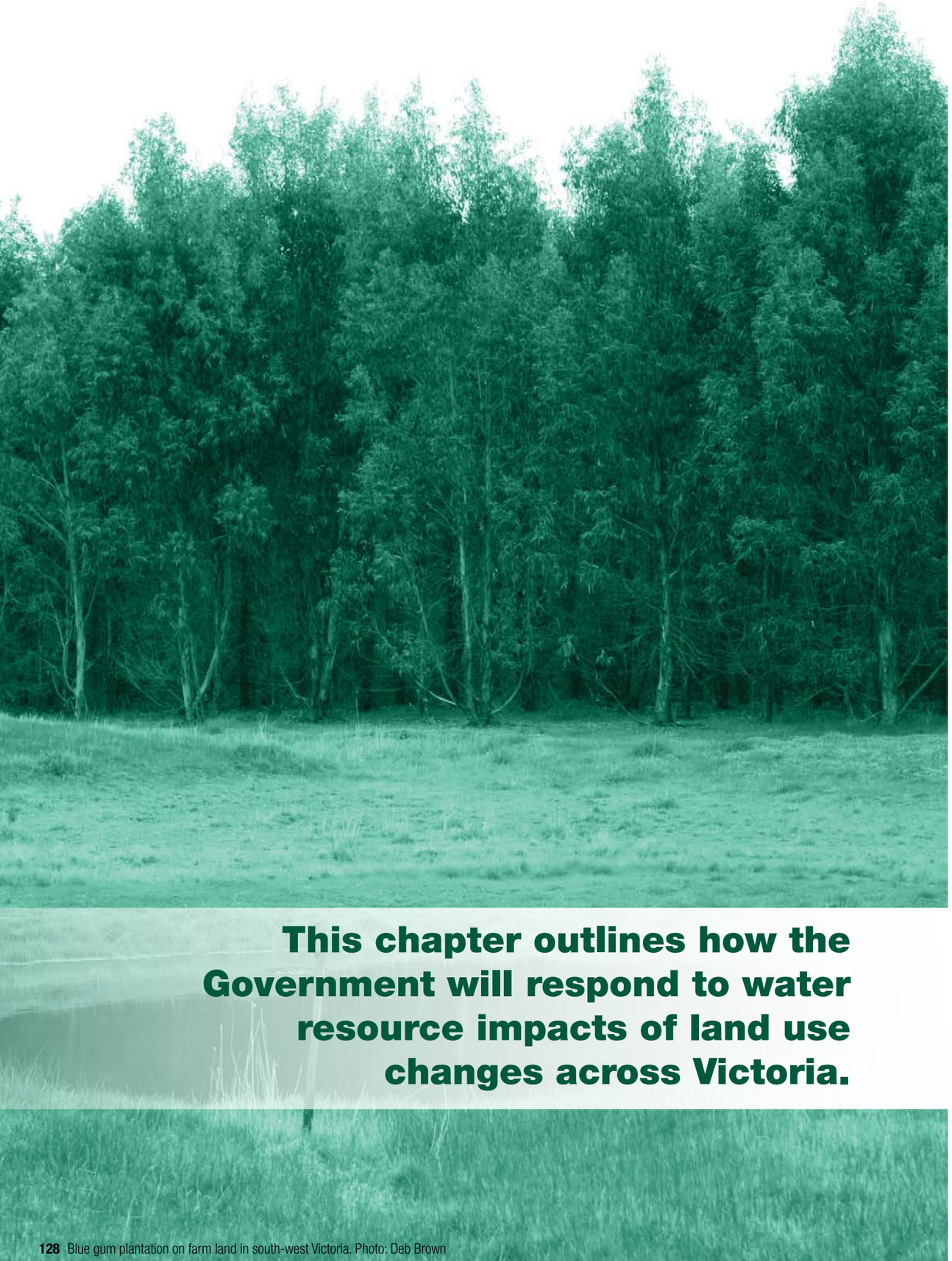
Coal seam methane

Coal seam methane is the extraction of methane gas from deeper coal seams. The process of extracting coal seam methane involves extraction of water and gases from the coal seam. There may be potential to apply coal seam methane commercially in the Western Region. Apart from extraction of groundwater, this could affect aquifers by changing water levels, water quality and aquifer properties. There is also the potential of land subsidence from compacted coal seams.

Under current definitions contained in the *Water Act 1989*, any coal seam methane projects will be required to obtain a licence for all water taken and used during the project.

Primary commodities derivatives from brown coal

A range of primary commodities derivatives can be obtained from coal, including methanol, ammonia and oil (from coal to liquids technology). The extraction of coal for the production of these products has the potential to impact on groundwater systems.



This chapter outlines how the Government will respond to water resource impacts of land use changes across Victoria.

128 Blue gum plantation on farm land in south-west Victoria. Photo: Deb Brown

Managing adverse water resource impacts from land use change

Guide to this chapter

Key points of this chapter

- Large-scale land use changes can affect water quantity and quality by taking more water that would otherwise reach streams and/or extracting water directly from shallow aquifers. New rural land uses and land management practices are tending to use more water, and this trend is expected to continue.
- These impacts need to be appropriately included in water management due to: increasing competition for water especially in dry times; community concerns, outlined in submissions to the Draft Strategy, about impacts of rapid land use changes; and requirements under external policies such as the National Water Initiative and Murray-Darling Basin Plan.
- Water impacts of land use changes will be integrated into water management by: obtaining the best estimates of water use and tracking changes over time; and controlling new forestry developments in intensive management areas declared under the *Water Act 1989*. Controlling new forestry developments in these areas will help to protect the reliability of water supply for water users and the environment.
- Only landholders in intensive management areas will be affected by this policy. However, most landholders in these areas will not be affected because their existing land use will be recognised and they will be able to plant 20 ha or 10 per cent of a property, whichever is greater, to farm forestry or native revegetation without restriction.
- In intensive management areas, the commercial forestry industry will have certainty that the water use of their existing plantations is protected, and this will continue as plantations are rotated. This approach will protect plantation asset values and jobs in harvesting and hauling timber.

5.1 A state-wide approach

Large-scale changes in land use can affect water availability for existing water users and the environment by taking more water that would otherwise reach streams and/or extracting more water directly from shallow aquifers. These impacts are felt most keenly during dry years and in summer, and where water is already fully committed.

Many land use changes can affect water resources. However, in moderate to high rainfall areas plantation forestry generally uses more water per unit area than other land uses, and has been the most studied. In south-west Victoria, the establishment of blue gum plantations began in 1991 and in 2009 covered 130,000 ha. This is a relatively small proportion of the region, but plantations are concentrated in some areas, for example hardwood plantations cover 32 per cent of the Stokes River catchment[13]. Plantations are now estimated to intercept about 20 per cent of the flow in the Glenelg River, where flows have already been lowered by diversions to supply the Wimmera-Mallee area (see Chapter 6)[14].

Combined with other pressures such as lower rainfall from 1997 to 2009, plantations caused some aquifers to decline and resulted in applications for new groundwater licences being rejected in some areas (for example Hawkesdale). Like other farming commodities, plantation forestry is strongly affected by market forces. The expansion of plantations slowed markedly following the collapse of many managed investment schemes, but a price on carbon may lead to a resurgence.

During the development of the Western and Gippsland sustainable water strategies, the community expressed concerns about land use change impacts on the reliability of supply for water users especially in dry times. The community also expressed support for a sound policy to protect water resources from the impact of rapid expansion of water-intensive land uses in the future.

This Strategy sets out an approach with three main elements:

- getting the best estimates of water use by vegetation and tracking changes over time (see Section 5.2, page 131);
- changing the *Water Act 1989* so that the Minister for Water can declare and manage 'intensive management' areas to protect other water users and the environment (see Section 5.3, page 134); and
- recognising the rights to existing use in declared areas but controlling expansion of new forestry developments covering at least 20 ha or more than 10 per cent of a property, whichever is greater (see Section 5.4, page 134). Property refers to all the land owned by one person or company in a declared area.

Plantations are the most water-intensive land use and were identified by the National Water Initiative as an example of a water interception activity that should be regulated in water-stressed areas. Other land use changes such as perennial pasture systems and land forming can affect water quantity and quality, particularly on a cumulative basis, but the Government does not support regulating all land use changes (see Section 5.5, page 139). The need to regulate other land use changes can be considered in future reviews of sustainable water strategies, using evidence from monitoring and further research.

Declaring 'intensive management' areas will enable targeted management. In declared areas:

- Most landholders and government land managers will not be affected. They will be able to plant to forestry up to 20 ha or 10 percent of their property, whichever is greater, without restriction.
- The commercial forestry industry will have certainty that the water use of their existing plantations is protected, and this will continue as plantations are rotated. This approach will protect plantation asset values and jobs in harvesting and hauling timber.

This approach strengthens the existing water management arrangements (see Section 3.1.2, page 56). It is consistent with Victoria's obligations under the National Water Initiative, and allows Victoria to manage plantations if required under the Murray-Darling Basin Plan, and match South Australia's approach of requiring permits for plantation water use in border areas.

Policy 5.1 State-wide approach for managing water impacts of land use change

Throughout Victoria, the Government will manage the impacts of land use changes on other water users and the environment by:

- getting the best estimates of water use by vegetation and tracking changes over time;
- proposing changes to the *Water Act 1989* to enable the Minister for Water to declare and manage 'intensive management' areas where more active management is required to protect other water users and the environment; and
- recognising the rights to existing use in declared areas but controlling expansion of forestry developments covering at least 20 ha or more than 10 per cent of a property, whichever is greater.

Box 5.1 Views on the need for better management

Sixty-five submissions to the Draft Strategy commented on land use change. Most of these submissions recognised that the Victorian Government may need to actively manage targeted areas and determine what a significant change is. Most submitters agreed that in some water-stressed areas the licensing of trees may be needed to protect water resources, particularly if a price on carbon is introduced. Several submitters believed the Victorian Government should not restrict any landholder decisions about pasture and cropping systems.

There were many different opinions about how to manage water impacts of land use changes. Options using the *Water Act 1989* were generally preferred. Many submitters singled out blue gum plantations for licensing and wanted immediate action taken. Plantation forestry submissions highlighted their position that: any approach should be efficient and not retrospective; ongoing rotations should not constitute land use change; and plantations should be treated equitably with other land uses.

5.2 Estimating water use

Over the past two decades, understanding of land use changes across the State and their impacts on water resources has improved. Many studies have been conducted to estimate:

- changes in water use (that is, evapotranspiration); and
- the impacts of those changes on streamflow and groundwater levels.

The Department of Sustainability and Environment will estimate evapotranspiration of major land use types state-wide, and include these estimates in water accounts (see Action 3.4, page 60). These estimates will be based on the best available computer modelling using land use information from Department of Primary Industries' Victorian Land Use Information System (see Figure 5.1). This information will provide a better overall picture of how catchment water balances change over time.

Combined with measured streamflow and groundwater level data, estimates of evapotranspiration will allow changes in water resources caused by changing land use to be tracked over time. This will be done by the Department of Sustainability and Environment, with water corporations and catchment management authorities contributing their understanding of land and water resources at a local level, for example through groundwater monitoring (see Section 4.4.1, p.118). This information will help water and land managers cope with change and strike the right balance between future economic growth and protecting existing water users and the environment. It will also inform water corporations' decisions to approve new allocations or transfers of water licences, and processes to introduce or review caps on licensed water use.

Techniques for estimating water use from satellite imagery and other remotely sensed data are now being used more widely. The suitability of remote sensing techniques needs to be established and potentially improved before being used to estimate evapotranspiration for state-wide water accounts (see Action 5.2).

The Department of Primary Industries has a long-term study in western Victoria assessing catchment-scale land use change impacts on surface water and groundwater for different combinations of soil and groundwater[15]. This study will improve our understanding of water use of a range of land uses including pastures, and provide valuable data on impacts.

Box 5.2 Can new technology help measure whole-of-catchment water use?

Nationally, the Bureau of Meteorology uses remote-sensing products that measure actual evapotranspiration to:

- estimate water use for irrigation areas, open water, dry land, plantation forests, urban areas, and wetlands;
- compare water uses for different locations or times (for example trends, or anomaly maps); and
- identify groundwater dependent ecosystems and assess drought areas.

Many remote-sensing techniques exist, with some products being more appropriate than others for measuring water use at a range of scales and vegetation types. Researchers are assessing several techniques, including water balance models and methods based on satellite observations. Their performance is being compared to field measurements of evapotranspiration and streamflow, and against one another, to analyse their relative strengths and weaknesses and provide insight into how they can most effectively be combined[16].

Unlike traditional data-hungry computer models, remote-sensing techniques can estimate water use in real time, and over a given period of interest. These techniques, while still being developed and assessed, have useful applications in tracking land use changes and water accounting.

Action 5.1 State-wide recording of water use by land use changes

Who: Department of Sustainability and Environment **Timeframe:** End 2012

The Department of Sustainability and Environment will:

- produce state-wide whole-of-catchment estimates of water use by key land use category that will be included in wholesale water accounts; and
- establish a framework and guidance for how estimates will be updated.

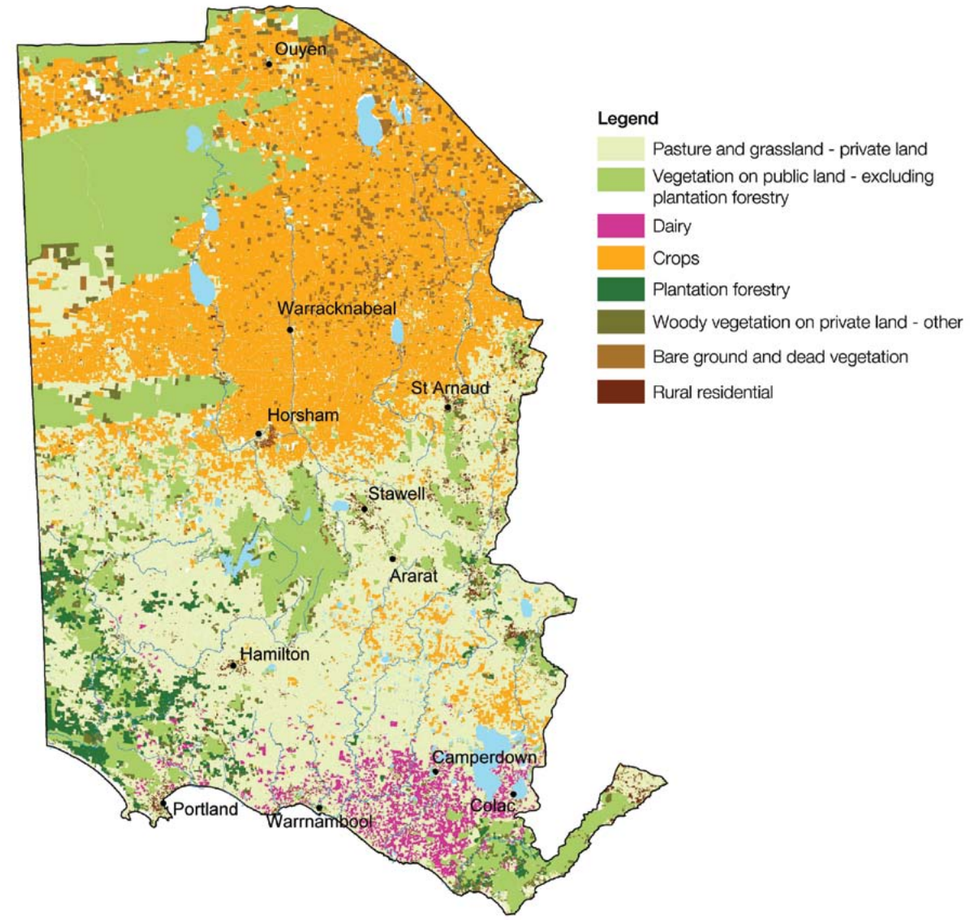
These water uses will be reported in the Victorian Water Accounts.

Action 5.2 Reviewing models and recommending methods for improving estimates of whole-of-catchment water use

Who: Department of Sustainability and Environment **Timeframe:** End 2012

The Department of Sustainability and Environment will review tools for estimating evapotranspiration, and recommend how they can be improved over time. Ways to combine computer modelling and remote sensing techniques will be considered.

Figure 5.1 Map of selected land uses and covers, 2008/09



Source: Victorian Land Use Information System (DPI)

5.3 How would areas be declared?

Intensive management areas would be identified:

- when a sustainable water strategy is reviewed every 10 years; or
- by the Minister for Water in response to a written request from a catchment management authority or water corporation, for a declaration to be considered.

Once an area has been identified for further consideration, the Minister for Water will appoint a regional committee to assess the need to declare the area. This committee, comprising community leaders and technical experts, and supported by the relevant rural water corporation, will consider:

- the potential for future land use changes to reduce aquifer recharge and streamflow, and the relative contribution of plantation forestry;
- water-dependent economic, social and environmental values that would be affected by active management; and
- the degree of stress on water resources and its causes, and the ability to cater for future impacts.

The committee will provide advice to the Minister about:

- the need to declare the area, and how declaring the area would align with other relevant plans and strategies;
- the appropriate boundaries of the area for declaration; and
- issues to be considered in managing the declared area.

Based on this advice, the Minister will decide whether to declare the area. The Minister would not be bound by the committee's recommendations. However, the Minister's decision, and any reasons for not following the committee's recommendations, will be tabled in Parliament and subject to disallowance.

Legislation will be proposed to give the Minister the power to declare an area consistent with this process. Provision will also be made for an area to be undeclared if required.

Action 5.3 Amending the *Water Act 1989* so that intensive management areas can be declared to control water intensive land use changes in these areas

Who: Department of Sustainability and Environment **Timeframe:** 2013

The Department of Sustainability and Environment will propose amendments to the *Water Act 1989* to enable the Minister for Water to declare and manage an area according to the process outlined in this Strategy.

5.4 How would declared areas be managed?

Once an area is declared:

- existing water use will be recognised. This includes the right to replant existing plantations; and
- new forestry developments will be restricted if they cover more than 20 ha or 10 per cent of a property, whichever is greater. No expansion would be allowed without approval from a rural water corporation. Approval would be granted only if the proponent is able to offset, within the declared area, the extra water used.

To provide certainty to proponents, the Minister for Water will issue guidelines to inform landholders and to ensure applications for new forestry developments in a declared area can be assessed rapidly. The Department of Sustainability and Environment will develop these guidelines in consultation with water corporations, catchment management authorities, the forestry industry and other stakeholders. In developing the guidelines, the Department will identify the technical support required by the industry when seeking approval for new developments in intensive management areas.

Determining which land uses to manage in declared areas was not simple. Submissions to the draft Western and Gippsland sustainable water strategies and stakeholder discussions indicated strong and divergent views. The draft strategies noted a workable outcome needed to balance comprehensiveness and the possibility of major delays to implementation, with simplicity and possibly not addressing all significant water uses.

The proposed approach focuses on using the best available information to identify the most water-intensive land uses. As a first step, new forestry developments will be controlled in declared areas, because:

- deeper-rooted woody vegetation such as plantation forestry uses more water than other land uses on a per unit area basis; and
- restricting a greater range of land uses including pastures and crops is not practical at this stage, and the community is unlikely to consider regulating all land uses reasonable (see Box 5.3 for more details).

Action 5.4 Guidelines for rapidly assessing new forestry development proposals

Who: Department of Sustainability and Environment, rural water corporations **Timeframe:** 2013

In consultation with water corporations, catchment management authorities, the forestry industry and other stakeholders, the Department of Sustainability and Environment will develop guidelines to ensure applications for new forestry developments in a declared area can be assessed readily.

Box 5.3 Why should land use changes from pasture to forestry be managed?

There are two main reasons for only controlling land use changes from pasture and crops to plantation forestry.

Forestry uses more water than other land uses

In moderate to high rainfall areas, deeper-rooted woody vegetation uses more water on average than shallower-rooted pastures and crops on a unit area basis. As an example, on average, streamflow or recharge from blue gum plantations is about one-third of that occurring from the same area of pasture[17].

Mature blue gums in the Crawford River catchment will reduce combined long-term mean annual streamflow and groundwater recharge in this catchment by an estimated 35 per cent[18]. Where plantation forests have direct access to groundwater, their peak rate of water use can be particularly high. In this context, CSIRO research in south-east South Australia and south-west Victoria showed blue gums have peak extraction rates of up to 6.7 ML per ha per year[19]. Effects of plantation forestry on groundwater levels have also been observed in the Lower Glenelg area (see Figure 5.2). Consequently, controls that focus on this type of land use change are likely to be most effective.

Land use changes from pasture to forestry change the water balance most. However, detecting these changes at a catchment scale or modelling the impacts on water resources is difficult. For example, separating the reduction in streamflow due to plantation forestry from the effects of all the other factors, such as changes in rainfall, is typically very challenging.

This does not mean these changes are insignificant and have no impacts. Plantation forestry takes water out of a catchment before run-off, seepage and recharge reaches streams, farm dams and aquifers. Importantly, impacts can occur at a local scale, even if impacts at larger scales (for example, a river basin) are not detectable. Plantation forestry has high peak annual and seasonal rates of water use that increase the likelihood of impacts such as reduced summer flows[20], and lower water levels in wetlands, farm dams, or bores.

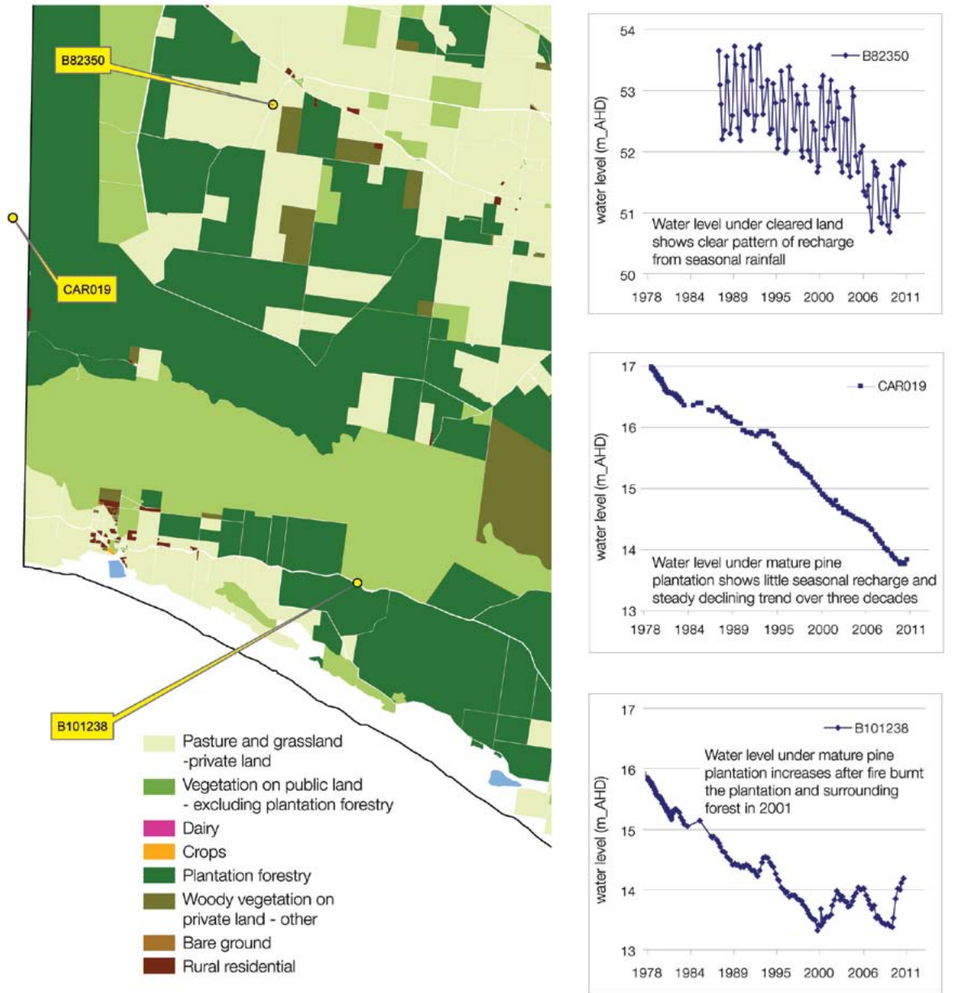
Controlling a greater range of land uses is not practical

Other land use changes including broad-scale cropping and perennial pasture can also have impacts on water resources, particularly cumulatively. The major reasons for not controlling a greater range of land uses in declared areas are:

- their water use per unit area is lower, therefore acute local impacts are less likely;
- controlling all land use changes that increase water use is likely to be expensive, resource demanding and difficult to implement, with the costs likely to outweigh the benefits;
- it would be much harder to track and adequately account for the water resource impacts of a much faster changing agricultural landscape; and
- based on submissions to the draft Western and Gippsland sustainable water strategies, the community is unlikely to consider regulating all land uses reasonable.

The need to regulate other land use changes can be considered in future reviews of the sustainable water strategies, using evidence from monitoring and further research.

Figure 5.2 Groundwater levels from the same aquifer in the Lower Glenelg area



Source: Victorian Land Use Information System (Department of Primary Industries); Victorian Water Resource Data Warehouse; Obswell.

This figure shows the differences between seasonal recharge of pasture and mature plantation forestry.

The regional declining trend is due to the effects of land use changes, groundwater extraction and lower rainfall from 1997 to 2010.

5.4.1 Recognising existing water use

The water use of existing plantations at the time an area is declared will be recognised, including the right to ongoing harvesting and replanting. Change of ownership will not affect the right to ongoing planting and harvesting. The plantation industry has invested heavily in south-west Victoria creating a more diverse economy with long-term jobs. The Great South Coast Strategic Plan stated[21]:

"The timber harvest of around 955,000 tonnes for the Green Triangle region in 2008 is set to nearly quadruple to 3,695,000 tonnes in 2011, with this to be a sustainable harvest level. An estimated 1,000 new jobs will be created in the harvesting and haulage of this resource."

The approach in this Strategy is designed not to threaten existing investments or the jobs in harvesting and hauling timber. Businesses will know if their water use will be controlled before they make investment decisions. Not recognising existing use would undermine investor confidence and potentially devalue forestry industry assets.

While rights to existing plantations would be recognised under the law, landholders would not be issued a volumetric licence or require formal registration for their current land use. This would be expensive and time-consuming because of the studies needed to determine water availability for these licences, and the administrative arrangements required to issue and record licences for all plantations in the area.

The onus will be with forestry companies to advise the rural water corporation of their existing properties when an area is declared. Existing registers of forestry properties will be used where possible to minimise administrative costs. If forestry companies wish to expand their operations in declared areas, they will need to buy existing plantations or explore opportunities for offsets (for example, a decrease could offset an increase of equal area elsewhere in the declared area).

If plantations in intensive management areas are replaced with another land use, proponents could offset new plantation developments against the cleared area. This would maintain some flexibility in land use options in intensive management areas. Regional committees will be given scope to recommend against this option for offsets being available. In some cases, not allowing cleared plantations to be replaced with an equivalent area of new plantations may offer a way of gradually reducing water stress.

5.4.2 What about pressures from historic uses of water and land?

In some areas, historic land uses and water uses already put pressure on water availability, especially in dry conditions. If such an area were declared, a process to reduce water use or change land uses would need to be pursued after recognising existing water use. This process should clearly identify the need for reducing water use, assess options for doing so and work through the preferred option(s) with key stakeholders and the community. Intensive management areas should ideally be identified before this is necessary.

Rural water corporations would recognise existing commercial forestry but they would not issue volumetric licences that could be changed through statutory processes such as a statutory management plan (see Policy 3.3, page 61) or a long-term resource assessment (see Section 3.1.4, page 65). If existing land use was considered the major stressor of water resources in the area, the Government would need to consider other options, such as a buyback program targeting plantation forestry or other water users.

Blue gum plantation near Skipton Photo: Deb Brown

5.4.3 What is meant by 'new forestry development'?

In declared areas, new forestry developments will be restricted if they cover more than 20 ha or 10 per cent of a property, whichever is greater. Here, 'new forestry development' refers to:

- Plantation forestry replacing pasture or crops. The following would not be restricted:
  - a change from one type of plantation forestry to another; and
  - plantings rehabilitating existing native vegetation.
- Plantation forestry includes timber, pulp, carbon and biofuel plantations, and large environmental and farm forestry plantings. Remnant native vegetation is not included.
- 'New' development means those that are greater than the unrestricted area, and occur after an area is declared. This includes staged developments that cause the total plantation forestry on a property to exceed the unrestricted area.

The unrestricted area of 20 ha or 10 per cent of a property, whichever is greater, was set because a practical area-based criterion was needed that would not overly constrain individual landholders or have excessive cumulative impacts. It is also consistent with South Australia's approach. Regional committees will have the scope to modify this criterion to suit certain circumstances in declared areas. The primary consideration of the regional committee is water security, but they can also consider the multiple benefits of different forestry types such as salinity mitigation, greater biodiversity and carbon sequestration. These forestry types include integrated farm forestry or farming techniques such as alley farming, where pasture or crops are grown between rows of trees, and landscape-scale revegetation programs.

This policy does not intend to discourage landholders from farm forestry, revegetating their properties or protecting remnant native vegetation. Catchment management authorities and landholders use revegetation projects in a holistic way to attain many specific land management objectives such as controlling erosion, managing salinity and providing habitat for wildlife to move through farming areas. Since 1985, about half the revegetation projects recorded by catchment management authorities in the Western Region were less than three ha, and 90 per cent were less than 18 ha. This indicates that most individual plantings were below 20 ha and would not be controlled.

If there were many plantings replacing pasture or crops on one property, they could still exceed the criterion and trigger the approval process. Large forestry plantings for environmental purposes are subject to approval because they would have similar impacts on water resources as plantation forestry.

Farm forestry offers multiple benefits including potential for additional income without reducing the productivity of other farm enterprises[22]. However, uptake in south-west Victoria has been slow, with about 1,330 hectares planted in the Victorian Green Triangle area by 2008[23]. This figure excludes native forests on private land and managed investment scheme plantations on leased farmland. Some farm forestry enterprises might be more viable if they were larger than 20 ha or 10 per cent of a property, for example harvesting may be more economic. Due to the targeted nature of intensive management areas and opportunities for offsets within them, however, the policies in this Strategy are anticipated to have little impact on farm forestry.

The three catchments recommended for consideration by a regional committee in Action 5.6 are relatively well forested. Native forest cover for the Stokes River, Crawford River and Glenelg WSPA is 42, 24 and 28 per cent, respectively. Although revegetation for specific environmental objectives will continue in these catchments, there is likely to be less focus on re-establishing the more water-intensive ecological vegetation classes.

Policy 5.2 Land use changes to be managed in declared areas

Once an area is declared:

- New forestry developments replacing pasture or crops would be restricted if they are greater than a certain size:
  - the state-wide default area is at least 20 ha or more than 10 per cent, whichever is greater, of a property (excluding remnant native vegetation); and
  - regional committees will have scope to modify this condition for a given declared area.
- Plantation forestry includes timber, pulp, carbon and biofuel plantations, and large environmental and farm forestry plantings. A change from one type of plantation forestry to another would not be controlled.
- If plantations in intensive management areas are replaced with another land use, proponents could offset new plantation development against the cleared area. Regional committees will have scope to recommend against this option for offsets being available, so they have a way of gradually reducing water stress if needed.

5.5 What about other land use changes that increase water use?

New land uses that use more water than the previous land use can:

- reduce water quantity; and
- affect water quality.

Depending on where and how such changes occur, these effects can be positive or negative. For example, many farms have improved productivity by increasing the water use efficiency of pastures, land forming such as contour ploughing, and using vegetation to control salinity and erosion. Appropriately targeted reforestation can store carbon and also provide secondary environmental benefits (for example, plantings in riparian zones). Government land and water managers should manage increasing water use where needed, and not interfere with increasing water use in other areas where its benefits outweigh costs.

The past two decades saw cropping, perennial pastures, and dairying expand throughout western Victoria. Dryland farmers responded to dry conditions by managing their pastures and land to capture more moisture. The cumulative impacts of these changes over a catchment can be significant, even though they are not as water intensive as forestry on a unit area basis. These trends are predicted to continue[24].

Regardless of whether these changes are in a declared area, Government, water corporations and catchment management authorities can respond to them to prevent negative impacts on water resources by:

- monitoring and tracking changes in water use as a result of land use changes, and integrating research from other programs (for example the Future Farm Industries CRC's Evergraze Program);
- including estimates of water use by vegetation in decisions about water use licences, and introducing or reviewing caps on licensed water use (see Box 5.4);
- considering the effects of changing water use on the water balance in the 2019 long-term resource review (see Section 3.1.4, page 65);
- providing information about the contribution of changing land use to water stress in regional growth plans; and
- educating landholders about the possible cumulative effects of their activities at a broader catchment scale.

Box 5.4 Considering pressures on water resources in the Hawkesdale Groundwater Management Area

The Victorian Civil and Administrative Tribunal affirmed Southern Rural Water Corporation's decision to refuse section 51 take and use licences for 1,220 and 280 ML per year in the Hawkesdale Groundwater Management Area[25].

The tribunal found the key issue was the sustainability of groundwater in the Hawkesdale area and across the Port Campbell Limestone aquifer, and that the *Water Act 1989* required impacts on water quality, other users and groundwater-fed waterways to be considered.

The tribunal applied the precautionary principle and asserted that Southern Rural Water acted correctly in refusing to grant these licences. It was found that when the potential for climate change and land uses (such as plantations) to reduce rainfall recharge to the aquifer were considered, groundwater allocations were likely to be at the limit of sustainability. Additional licences should not be granted to prevent the serious and potentially irreversible environmental damage that depleting groundwater may cause.

Action 5.5 Considering cumulative impacts of land use in decisions about water use

Who: Department of Sustainability and Environment, rural water corporations **Timeframe:** Ongoing

Cumulative impacts of land use changes, including those that are not controlled, will be considered in decisions about:

- new water use licences;
- setting and revising caps on extractions; and
- the long-term resource assessment.

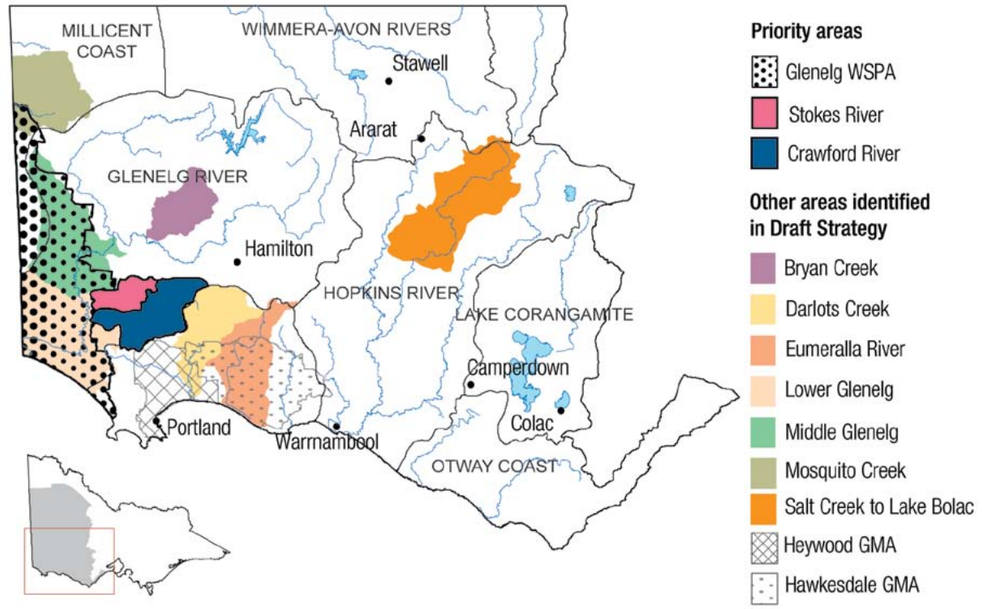
Glenelg River, Lower Glenelg National Park Photo: Maggie Bardis

5.6 Which areas could be declared?

The Draft Strategy indicated areas where managing the water impacts of land use change were likely to be a higher priority (see Figure 5.3). This was based on several sources including measured data, the Water and Land Use Change study[26], as well as other computer modelling studies. Submissions on the Draft Strategy also mentioned the west Wimmera, Hopkins and Otway Coast catchments. Several submitters were concerned about the information the Government would use to make decisions about which areas to declare.

Based on the information available, the highest priority areas for assessment by a regional committee(s) are all or parts of the Crawford and Stokes River catchments and Glenelg Water Supply Protection Area (see Technical Report 6 found online). The Government will appoint a regional committee to consider whether these areas should be declared to protect water users and the environment by controlling new plantation forestry developments.

Figure 5.3 Priority areas



Note: The boundaries of these areas would be subject to change by the regional committee(s) assesing an area for possible declaration.

Action 5.6 Appointing regional committees to assess intensive management areas

Who: Department of Sustainability and Environment **Timeframe:** 2014

Once the proposed legislation is passed, the Minister for Water will appoint one or more regional committees to consider if all or part of the Crawford River and Stokes River catchments and the Glenelg Water Supply Protection Area, particularly around Lake Mundi, should be declared.

The informal assessment of these areas will begin by the end of 2011 in consultation with water corporations, catchment management authorities, regional industry stakeholders and the broader community.

The following rationale was used in choosing these areas for assessment:

- Plantation forestry now covers about one-third of all three catchments after substantial expansion over the past two decades, and has changed the water balance. Older softwood plantings often replaced native forest, but newer blue gum plantings generally replaced pasture. Once recently established blue gums in the Crawford River catchment reach full canopy cover, combined long-term mean annual stream flow and groundwater recharge in this catchment will be an estimated 35 per cent lower than before[26].
- Surface water in the Glenelg catchment, which includes the Crawford and Stokes rivers, is already highly committed and competition for water is likely to increase. Land use changes that increase water use will increase this competition, especially in dry times.
- The Lower Glenelg River has especially high social and recreational values that could be affected by further decreases in streamflow, and it and the Stokes and Crawford rivers are high conservation value aquatic ecosystems. They support several species listed under the *Environmental Protection and Biodiversity Conservation Act 1999* and *Flora and Fauna Guarantee Act 1988*, such as the Glenelg freshwater mussel and Glenelg spiny crayfish, which have been identified as threatened by the impacts of plantations.
- In some locations in the Glenelg Water Supply Protection Area, such as Lake Mundi, there is evidence of water users being affected by plantation forestry.
- Water users and environmental values, such as native fish in the Crawford River, may be negatively affected if the duration of cease-to-flow periods become longer due to lower groundwater levels and less water reaching streams in summer as a result of higher water use.

In most of the Western Region within the Murray-Darling Basin, which includes the Wimmera-Avon, Avoca and Mallee river basins, the drier climate and typically deeper groundwater mean that impacts of land use changes on water resources will be limited. The Department of Sustainability and Environment will review the Murray-Darling Basin Plan after it is released to examine the implications for these catchments (see Action 5.7).

5.7 What about other jurisdictions?

5.7.1 National Water Initiative

Under the National Water Initiative (NWI), Victoria and other states and territories:

- recognise that the impacts of land use change activities, such as forestry and farm dams, are outside existing water entitlement frameworks and have potential to intercept significant volumes of surface and/or groundwater; and
- recognise these activities, if not controlled, present a risk to the future integrity of water access entitlements and environmental and social objectives.

Measures to implement the NWI are based on the level of water allocation[27]:

- In water systems that are fully allocated, over-allocated, or approaching full allocation, significant interception activities should be recorded, with any new interception activities requiring a water access entitlement.
- In water systems that are fully allocated or approaching full allocation, estimates should be made of the amount of water likely to be intercepted over the life of the relevant water plan, and a threshold level of interception calculated, above which a water access entitlement would be required for additional significant interception activities.

The NWI notes this and requires:

- identification of current and potential activities that could intercept significant volumes of water;
- establishment of water use thresholds to trigger the use of water access entitlements; and
- development of frameworks for incorporating interception activities under existing water access entitlements.

The approach in this chapter is consistent with the NWI, and is appropriate for Victoria. The Victorian Government believes that, at present, the cost of determining volumetric thresholds and licences would outweigh the benefits. Future reviews of sustainable water strategies can assess whether circumstances have changed, and a licensing approach needed.

5.7.2 South Australia

Victoria and South Australia share surface water and groundwater resources. The Draft Strategy and public submissions identified the need for compatibility between Victoria's approach and South Australia's policy framework to ensure land and water management is balanced and equitable between states.

The approach in this Strategy allows new plantation forestry developments in Victoria next to South Australia to be controlled, if an area(s) next to the South Australian border is declared by the Minister for Water. The water use of plantation forestry would then be capped on both sides of the border (see Box 5.5).

The way water impacts of land uses are managed would differ between the states on several points; for example, in how water use is estimated and whether trade is allowed. If intensive management areas next to the South Australian border are declared, the Victorian Government will work with the South Australian Government to ensure land and water management is balanced and equitable between states.

5.7.3 Murray-Darling Basin Plan

Through the Murray-Darling Basin Plan, the Murray-Darling Basin Authority is considering options for managing the water impacts of 'interception activities' such as plantation forestry. The implications for the way plantation forestry or other consumptive water uses are managed will be clear once the final plan is completed in 2012.

Action 5.7 Reviewing implications of the Murray-Darling Basin Plan for managing the water impacts of land use change

Who: Department of Sustainability and Environment **Timeframe:** 2013

The state-wide approach described in this chapter will be reviewed after the Murray-Darling Basin Plan has been finalised and the role of the Commonwealth in managing the impact of plantations on water availability in the Murray-Darling Basin is confirmed.

Box 5.5 Controls on plantation water use in south-east South Australia

South Australia is considering introducing a new licence-based system to manage the water impacts of forestry plantations in the south-east of the State. The system was developed over several years and will be linked to the existing water allocation planning process. Key milestones of the South Australian system:

- In June 2004, plantation forestry was prescribed as a water-affecting activity requiring a permit. Plantation development applications can be refused if there will be detrimental impacts on the groundwater resource.
- The South Australian Government dedicated a maximum area of commercial forest, of about 59,000 ha, for plantation expansion in defined areas without the need to secure water allocations.
- Expansion of plantation forestry beyond this threshold is permitted if water impacts are offset by obtaining an appropriate water allocation.
- In July 2007, the policy was expanded to require new plantation developments in areas with shallow groundwater (less than six metres deep) to secure an appropriate water allocation to offset their water use.

This chapter explains how the Wimmera-Mallee Pipeline will benefit the area and how the new pipeline system will be managed to fully realise these benefits.

144 Wimmera River, Dimboola. Photo: Paul Lloyd

The Wimmera-Mallee Pipeline and the Wimmera-Glenelg system

Guide to this chapter

Key points of this chapter

- The Wimmera-Glenelg is the only regulated river system in the Western Region. Water from the upper Glenelg River is stored and transferred to supply towns and farms in the drier north.
- The Wimmera-Mallee Pipeline greatly improves the efficiency of harvesting, storing and distributing water in the supply area. About 85 per cent of water in the previous channel system was lost to evaporation and seepage.
- The pipeline underpins the economy, amenity and aquatic environment of the area it serves. It gives greater confidence for investment in the region, and greatly increases the water available for the environment.
- Water savings from constructing the pipeline provide an additional 83 GL of water each year on average for the environment based on a continuation of historic inflows to the system. This includes 9.4 GL held in storage with the highest level of reliability, providing a total of 41.6 GL of formal environmental water entitlement which can be managed to achieve the optimum environmental outcomes in the Wimmera and Glenelg rivers in any year. Environmental water provides more reliable flows which can support recreation in waterways.
- An additional 20 GL of water savings from the pipeline is available each year for economic development in the supply area. The remaining 18 GL is to be sold from late 2011.
- The pipeline also improves recreation and other social values for the community with a 3 GL entitlement to supply priority lakes and weir pools throughout the area.
- This chapter outlines actions to improve management of the supply system over time and options to manage possible prolonged dry conditions in the future.

6.1 The Wimmera-Mallee supply system

6.1.1 History of the system

Historically, water in the Wimmera-Mallee (see Figure 6.1) was delivered to towns and farms across 2.6 million hectares via a channel system. This system, first constructed in the 1880s, connected three river basins (the Wimmera-Avon, Avoca and Glenelg).

The system used an extensive 20,000 km network of open, earth channels and sourced most of the water from rivers, storages and weirs in the south of the region. These southern areas, which include the Grampians and the headwaters of the Glenelg River, have higher and more reliable rainfall than the north. These storages make the Wimmera and Glenelg basins the only major regulated river systems in the Western Region.

The channel supply system was extremely inefficient, losing up to 85 per cent of the water to seepage and evaporation. Large volumes had to be released from storage to deliver the relatively small volumes used in towns and on farms. This reduced the water available for the environment and reduced flows to the Wimmera, upper Glenelg, Avoca, Avon-Richardson and MacKenzie rivers. The environmental stress due to these reduced flows was particularly significant in dry periods, such as from 1997 to 2009.

6.1.2 Benefits of the Wimmera-Mallee Pipeline

Piping of the domestic and stock supply system was first proposed in the early 1900s. Recent pipelining developments made the project more economic and practical. Over the past 18 years, the open channel system was replaced with pipelines to recover water for the environment and to improve the delivery efficiency and reliability of the supply system.

The Northern Mallee Pipeline was constructed between 1992 and 2001, replacing 2,500 km of inefficient channels and saving 50 GL a year in the Wimmera and Glenelg rivers. The 6.4 GL of water entitlement to run this system is now sourced from the River Murray.

The $688 million Wimmera-Mallee Pipeline, completed in May 2010, has made the supply system far more efficient and achieved greater supply security for water users and the environment. The project was funded by the Victorian Government ($266 million), the Commonwealth Government (up to $291 million) and GWMWater and its customers ($131 million). Rural pipeline customers are also investing a further $82 million in on-farm water supply infrastructure.

Together these pipelines give reliable water supply for 34 towns and more than 3,000 farming enterprises and return flows to the stressed Wimmera and Glenelg rivers. During the recent dry years, the partly completed pipeline contributed to delivering basic supply to many farms and towns that had severe water restrictions.

Box 6.1 Indigenous involvement in the Wimmera-Mallee Pipeline project

In 2007, GWMWater and the Barengi Gadjin Land Council signed an historic partnership to protect Traditional Owner interests during construction of the pipeline. The agreement included employment and education opportunities and support for youth programs.

GWMWater and Barengi Gadjin worked closely to complete the pipeline while taking native title and cultural heritage values into account, particularly along the culturally significant Wimmera River. The partnership provided for Indigenous cultural heritage site monitoring services at sites such as crossings of the Wimmera River at Gross Bridge near Drung, at Tarranyurk and near Wail Nursery.

The partnership between GWMWater and Barengi Gadjin highlights the importance of protecting cultural heritage sites and involving those who have links with the land.

Figure 6.1 The Wimmera-Mallee supply system and pipeline

6.2 Providing increased certainty to water users and the environment

6.2.1 Sharing the water savings from the pipeline

Water-sharing arrangements have been formalised in a set of legal entitlements. The entitlements are held by GWMWater (on behalf of its urban and rural customers and other water users), urban water corporations (Wannon Water and Coliban Water) and the Victorian Environmental Water Holder (on behalf of the environment). These entitlements cover the Wimmera-Mallee supply system and the upper Glenelg River which supplies water inland to the system.

The entitlements were amended in 2010 to share the water savings from the pipeline[30]. Based on a continuation of historical inflows to the system, the amended bulk entitlements provide for an additional annual:

- 83 GL on average for the environment;
- 20 GL for new economic growth;
- 3 GL for recreation lakes; and
- 1 GL for former channel supplied wetlands (intended to compensate for the impact on wildlife from the loss of open water in 20,000 dams across the landscape previously supplied from the channel system).

The amended bulk entitlements also ensure increased reliability for existing town and domestic and stock customers.

6.2.2 Managing the new pipeline system

Defining responsibilities more clearly

Submissions on the Draft Strategy and the report of the Independent Panel noted the need for greater transparency and clarity around how system operating decisions will be made.

The amended entitlements clearly define and separate the roles and responsibilities for operating the system:

- The Storage Manager - GWMWater was appointed by the Minister for Water to develop storage management rules for approval by the Minister and annual operating plans to manage the system (see Box 6.2) on behalf of all entitlement-holders, including the environment. The Storage Manager will manage the environmental effects of operating the weirs and storages and report on and review system operation.
- The Resource Manager - GWMWater was appointed as the Resource Manager by the Minister for Water to monitor the entitlement holders' compliance with their entitlements.
- Bulk entitlement-holders supply their customers (GWMWater, Wannon Water and Coliban Water) or environmental flows to waterways (Victorian Environmental Water Holder – VEWH, see Section 3.4.1, page 91). All bulk entitlement-holders:
  - » are responsible for ensuring metering is in place to show compliance with the conditions of their bulk entitlement;
  - » work with the Storage Manager to develop rules, plans and reviews;
  - » can propose new or changed storage management rules; and
  - » contribute to the costs of operating the system.

Catchment management authorities (CMAs) provide advice about managing environmental water. The Glenelg Hopkins CMA, with the VEWH and Storage Manager, plans the release of the Glenelg River compensation flow from Rocklands Reservoir on behalf of GWMWater.

Policy 6.1 Role of the Storage Manager

The GWMWater, as Storage Manager, will manage and operate the Wimmera-Mallee supply system to:

- ensure integrity of the system headworks;
- meet entitlement-holders' needs in accordance with their entitlements;
- maximise community benefits;
- enhance environmental benefits;
- deliver a safe and reliable water supply;
- manage water quality;
- provide opportunities for recreation; and
- mitigate flood risks.

Storage management rules and annual operating plans will be developed in consultation with entitlement-holders to allow these objectives to be achieved.

Box 6.2 Storages and infrastructure for the pipelined supply system

The system headworks are the storages and other infrastructure needed to capture, store and supply water for the pipeline system. Improvements in efficiency with the pipeline mean that some previous headworks are no longer needed for supply. The headworks for the pipeline system comprise:

- Storage reservoirs – Lakes Bellfield, Fyans, Lonsdale and Wartook; Taylors Lake; Moora Moora, Rocklands, Toolondo, Mt Cole, Langhi Ghiran and Panrock reservoirs.
- Weirs – Dad and Dave, Distribution Heads, First and Second Wannon Creeks, Fyans Creek diversion, Radial Gates, Glenelg Diversion Channel, Huddlestons, Mount Zero channel diversion, Scrubby Creek inlet (on Moora channel) and Stewarts.
- Transfer channels and pipes (including associated structures such as weirs) – Burnt Creek channel; Bungalally Creek; Lubeck Loop; and Fyans Creek diversion, Fyans inlet, Fyans outlet, Lonsdale bypass, Moora, Mt Zero, Rocklands Outlet, Toolondo and Wimmera inlet channels; and Bellfield-Taylors Lake pipeline.

All other lakes and infrastructure are no longer needed to supply water.

Implementing bulk entitlement changes

To implement the new bulk entitlements, the following plans and rules will be completed by the end of 2011:

- Storage management rules – these rules will outline how the system will be operated to meet the objectives outlined in the bulk entitlement and Policy 6.1.
- Annual operating plans for the headworks storages and infrastructure – these plans will outline how the storages will be operated each year given the seasonal inflow conditions and considering the other plans listed below.
- An annual operating plan for supplying the Glenelg River compensation flow – this plan will outline the timing and rates of water release from the compensation flow entitlement.
- An annual recreation lakes water supply plan – this plan, prepared in consultation with the community, lists the lakes to receive water from the 3,000 ML recreation entitlement including priorities, timing, method of supply and costs.
- An annual wetlands supply plan – this plan lists the wetlands to receive water from the 1,000 ML wetland entitlement including location, priorities, timing and method of supply (to be completed in 2012).
- Metering programs for each entitlement.

Adaptive management

Management of the pipeline supply system will build on previous experience. However, the pipelined supply system is new and untried. The revised bulk entitlements allow management of the supply system to adapt as GWMWater (the system operator) and entitlement-holders gain experience and more is learnt about operating the pipelined system efficiently.

Each entitlement-holder can propose new storage management rules for the system or an alteration to existing rules. The Storage Manager will decide whether to adopt these proposals by considering the impact on the supply reliability for each entitlement-holder, the impact on environmental flows, and the cost-benefit trade-offs it will require. All entitlement-holders will be advised of the decision and rationale behind it.

GWMWater will monitor the operation of the supply system including flows, losses, water use, water trade and any improvements in operating efficiency. This information will be used to assess system management, the need for specific operational changes to improve the storage and distribution efficiency, and the ability to meet the needs of entitlement-holders. The entitlements and associated documents include mechanisms to continuously improve system operation.

Based on the amended bulk entitlements, the entitlement-holders, Storage Manager, Resource Manager and other key stakeholders have agreed on a framework for a collaborative and cooperative approach to managing and operating the system. This framework will implement the responsibilities set out in the bulk entitlements and supporting documents. It aims for greater transparency and openness, and better and more adaptive outcomes from managing the system. It will establish forums to raise and discuss:

- ongoing consultation between stakeholders and with the broader community;
- refining the various operating rules and plans; and
- adapting and improving management arrangements.

Reviewing operating arrangements

The operation of the Wimmera-Mallee system will be reviewed by 2014 to assess how well it has met the relevant storage management objectives. This review will be part of a broader refinement of operating the pipeline supply system.

The timing of this review allows:

- experience operating the new pipeline system and refining that operation to best meet the needs of entitlement-holders;
- water users to adjust to the new supply system and its operation including the system reserve, trade and carryover of entitlements (see Section 6.3.1);
- better understanding of the location and level of water demand in different parts of the supply system, particularly after the sale of the growth water (see Section 6.3.2) and possible water trading;
- the Department of Sustainability and Environment to gather more information about the long-term risks from climate variability; and
- the community to consider options for managing the system more efficiently, particularly in prolonged dry periods.

The review will consider the best use of any additional water savings achieved by refining system operation.

Policy 6.2 Adaptive management of the bulk entitlements and the supply system

The Storage Manager, entitlement-holders, catchment management authorities and the Department of Sustainability and Environment will consult to clarify the actions needed to adapt and improve the management of the system over time.

Storage management rules will be reviewed and updated periodically to ensure they remain relevant and clear to all parties, and entitlement-holders can propose amendments to the storage management rules at any time.

Action 6.1 Reviewing operation of the bulk entitlements

Who: GWMWater, Wannon Water, Coliban Water, Victorian Environmental Water Holder, catchment management authorities, Department of Sustainability and Environment **Timeframe:** 2014

GWMWater as Storage Manager and Resource Manager, entitlement-holders, catchment management authorities and the Department of Sustainability and Environment will review the operation of the bulk entitlements and system management arrangements after three years of experience in operating the new pipeline system.

6.3 Promoting the sustainable use of the Wimmera-Mallee Pipeline

6.3.1 Making the best use of existing supplies

Water efficiency

Recent drought conditions have highlighted the important role water efficiency measures can play in ensuring reliable supplies (see Section 3.2.3, page 68).

The Victorian Government will continue to support these measures:

- GWMWater and other water corporations with entitlements in the supply system will continue to pursue water efficiency initiatives as part of their strategies for balancing supply and demand.
- Permanent water savings rules will be reviewed to promote responsible use of water.
- Efficient rural water use will be promoted.

Protecting reliability of supply

The revised bulk entitlements also introduce tools to allow entitlement-holders and individual water users to manage their water supply (see Table 6.1). These tools include the system reserve, carryover of entitlements and water trading.

Action 6.2 Collaborating to improve efficiency

Who: Bulk entitlement-holders, Storage Manager, Resource Manager, environmental managers, Department of Sustainability and Environment **Timeframe:** Ongoing

Bulk entitlement-holders (GWMWater, Wannon Water, Coliban Water, VEWH), the Storage Manager, the Resource Manager, catchment management authorities and the Department of Sustainability and Environment will collaborate to consider and develop ways to improve the efficiency of managing and operating the supply system.

Table 6.1 Measures to protect reliability of supply

System reserve	• A reserve is to be accumulated in storage to protect entitlement-holders' reliability of supply. • This provides insurance against prolonged dry conditions by setting aside water to secure future supplies. • The amount of reserve varies from 15 to 95 GL depending on the availability of water in the system. • The reserve can be modified as experience with the pipelined system grows and conditions change (see Section 6.2.2, page 148).
Carryover	• Bulk entitlement-holders (rural and urban water corporations and environmental managers) can carry over their unused entitlements for use in a later year. • This will help bulk entitlement-holders manage their supply risk. • Carryover will be recorded on the Victorian Water Register, and be subject to evaporation (15 per cent loss allowance) and spill rules. • Carryover is not available to individual water users.
Trading water (see also Section 3.2.3, page 75)	• A system of tradable water allowances will be introduced for GWMWater's domestic and stock customers[a] and recorded in the Victorian Water Register. • These water users will be able to trade water to meet their business needs and manage their supply risks. • Water trades will be recorded on the Victorian Water Register. • Information on the Water Register about trades will be available to potential buyers and sellers and to help develop a water market.

[a] The water in the supply system is legally owned by GWMWater. Each individual water user does not own the water they use. Tradeable allowances will allow one landholder to sell the contract with GWMWater to deliver a specific volume of water to another landholder.

Developing trade in the supply system

Trade is a valuable tool for water users to manage changing circumstances. It is particularly useful when water is scarce. The Wimmera-Mallee Pipeline will provide opportunities to develop permanent and temporary trade within the capacity of the supply system.

GWMWater supplies water users connected to the pipeline under a system of water allowances. It has the legal right to the water and is responsible for distributing it to customers (who hold a water allowance). This differs from individual water entitlements, which are legally owned by each water user and set the maximum volume of water that each holder can take.

Trade in the supply system will be facilitated though tradable water allowances. Customers will be able to transfer some or all of their water allowance volume to other pipeline customers. The Victorian Water Register will keep track of volumes traded and supplied for each water allowance.

6.3.2 Promoting sustainable use of the growth water

Of the water savings from the Wimmera-Mallee Pipeline, 20,000 ML (under long-term average inflows) was identified for regional development and farm diversification. This growth water pool (or development reserve) is included in GWMWater's entitlement and has the same reliability as other pipeline consumptive use entitlements (and the regulated environmental entitlement). It contains 17,650 ML from the Grampians storages and 350 ML from the River Murray for Supply System 5. The balance of 2,000 ML was sold to Wannon Water to secure supply for Hamilton and surrounding towns.

The growth water is an important asset for GWMWater and the region. Its sale will help offset the costs of constructing the pipeline system and stimulate regional prosperity. This will also help the water market to develop in the supply system and stimulate future water trading.

Growth water can be used from the headworks or the pipeline:

- Headworks growth water is available directly from storages – Rocklands Reservoir, Taylors Lake, Lake Fyans and potentially Mt Cole Reservoir. This water will not be delivered through the pipeline network, and buyers will be responsible for investing in their own delivery infrastructure from the relevant storage.
- The remaining 10,000 ML of growth water will be delivered through the Wimmera-Mallee Pipeline network each year. The use of this water will need to fit in with the delivery capacity of the new system. The system has 5,000 ML of capacity built in to provide this growth water during peak periods in the warmer summer months. A further 5,000 ML is expected to be delivered through major trunk mains of the pipeline system during off-peak periods (April to September).

Sale of the growth water

Wannon Water has bought 2,000 ML from the Grampians storages to secure water supplies for Hamilton and surrounding towns. The sale of the remaining 18,000 ML will be made with the following objectives:

- all existing pipeline customers will have an opportunity to buy the peak growth water to improve their supply reliability;
- the growth water is distributed through a market approach to promote the development of water trading in the supply area; and
- GWMWater achieves the best sale price for the water to raise revenue to help pay for its contribution to the pipeline.

The process for selling the growth water will be transparent and equitable. An independent water broker will conduct the sales, and each sale will be recorded on the Victorian Water Register. An auction or tender process will be used for the sale of the headworks growth water to achieve a fair market price for the water and maximise the return to GWMWater. The sales will be subject to a reserve price.

Action 6.3 Sale of the growth water

Who: GWMWater **Timeframe:** End 2011

GWMWater will make water available from the growth water to existing and new users through expressions of interest, auctions or other appropriate competitive processes and subject to a reserve price.

Taylors Lake Photo: Paul Lloyd

6.3.3 Managing consumptive supplies in times of shortage

During the driest 13 years on record from 1997 to 2009, including the driest year on record, communities suffered greatly. They lived through harsh water restrictions, drying gardens and parks, the loss of recreation venues as lakes and rivers dried, decreased tourism income and weakened economies. But they revived with the recent wetter years and celebrated the return of river flows. Many people lined the dry Wimmera River to cheer the first significant flush of water in August 2010. Farms battled during the dry, but most endured.

However, droughts and prolonged dry periods can be expected to return. The bulk entitlements, together with Victoria's water allocation framework, include ways to maintain supplies to entitlement-holders through dry spells. System-wide measures include clear water-sharing rules (see below), a system reserve, carryover of entitlements and water trading (see Section 6.3.1). Even with these measures, water users and environmental managers may need to build resilience in wetter times to help manage future dry periods.

Water-sharing rules

During water shortages, water is not shared equally – some uses have greater reliability than others. As less water is available, some entitlements are restricted first. Water-sharing rules set out how this happens. They define the reliability of supply for different types of water entitlement as the amount of water in storage changes. These rules aim to share the 'pain' of reduced water availability, while giving greater priority to the higher reliability entitlements. Supplies to urban, domestic and stock and supply-by-agreement customers and the regulated environmental entitlement have highest reliability.

Bulk entitlement-holders managing their supply

Individual bulk entitlement-holders (rural and urban water corporations and environmental managers) can manage water shortages by:

- Accumulating their own reserve – by participating in the water market to supplement their seasonal allocation which can then be carried over to the following year (see Table 6.1). This includes the option of purchasing some of the growth water.
- Managing demand – reducing consumptive demand through awareness programs in normal years and implementing restrictions when storages fall during dry spells. The water saved by demand management measures is credited to the water corporation through the ability to carry over unused water in any year.

More efficient operation of the system

Even with the new, piped delivery system, there will be water losses in the headworks (the storages and channels between them) due to evaporation from storages, and seepage and evaporation in transfer channels when water is moved between storages. These losses will vary from year to year depending on how the system is operated in response to the location and timing of inflows.

With more experience in operating the new system, opportunities can be identified to manage the system more efficiently and minimise water losses (see Section 6.2.2, page 148).

Implementation of the amended bulk entitlements will provide better information about system operation and efficiency. Improvements to monitoring in critical areas would pinpoint where investment in efficiency measures should be made to reduce losses.

Managing potential risks from selling the growth water

If future conditions are drier than historically, GWMWater will use ongoing water planning processes to manage any implications from the sale of the growth water for long-term reliability of supply. This may include additional investment and/or augmentation. In addition, all customers and entitlement-holders, including the environment, will have the opportunity to buy a share of the growth water through the market to improve their reliability of supply and manage the risks of climate variability.

Possible responses to extreme dry conditions

Several submissions on the Draft Strategy suggested options for more efficient management of the supply system including taking out of service storages that do not contribute to efficient capture, storage and delivery of water. This may deliver substantial water savings by reducing evaporation as well as reducing the cost of running the system and potentially providing greater flexibility for flood mitigation. The water savings can improve the reliability of consumptive and/or environmental water. However, the impacts on other uses, such as recreation, must be considered in assessing the potential overall benefit of any option to decrease inflows into a storage. Changes to operation should only be considered after sufficient experience is gained in operating the pipelined system.

Lakes Lonsdale and Toolondo have been identified as having some potential for more efficient storage management. These storages store water in wet years for use in subsequent years. However, they have high evaporation losses, and releases from them can be used for a limited range of purposes.

Action 6.4 Improving the efficiency of operating the supply system

Who: GWMWater as Storage Manager **Timeframe:** Ongoing

GWMWater as Storage Manager will monitor the efficiency of the supply system operation and report headworks water losses in the storage management rules and annual storage operating plans. This information will be considered during the review of the rules and annual plans (see Policy 6.2) and the review of the operation of the bulk entitlements (see Action 6.1).

Action 6.5 Considering more efficient headworks management

Who: GWMWater as Storage Manager, Department of Sustainability and Environment, entitlement-holders **Timeframe:** 2014

Options for managing storages that do not contribute to efficient water capture, storage and delivery will be assessed following the review of the operation of the bulk entitlements (Action 6.1). This will consider:

- likely water savings from decommissioning storages under different inflow scenarios;
- any physical limitations at each storage (such as unusable storage);
- potential benefits to system operation and entitlement-holders (such as the cost per ML saved and decreased headworks costs);
- coordination with other options to improve system operating efficiency or achieve additional water savings;
- implications for other users of each storage, particularly from the potential loss of recreation and amenity values; and
- the most appropriate future manager for these decommissioned storages.

Given the significant recreation and social values of many water storages, thorough community consultation will be undertaken to inform assessments.

Action 6.6 Efficient operation of lakes Lonsdale and Toolondo

Who: GWMWater as Storage Manager, Department of Sustainability and Environment, entitlement-holders **Timeframe:** 2015

The operation of lakes Lonsdale and Toolondo will be reviewed as part of the broader development and refinement of storage management rules for the entire supply system. The management rules for each storage will be developed in consultation with stakeholders including entitlement-holders and lake users.

Action 6.7 Sharing any additional water savings in the supply system

Who: GWMWater as Storage Manager, Department of Sustainability and Environment, entitlement-holders **Timeframe:** 2015

Any additional future water savings within the system should be managed so that:

- water savings are shared by the organisations that invest in these works;
- the rights of existing entitlement-holders, including the ability to supply those entitlements, are protected; and
- the effects on third parties are evaluated and addressed.

6.4 Maximising benefits for the environment

6.4.1 Making the best use of environmental water

More water for the environment

A major driver for constructing the Wimmera-Mallee Pipeline was to recover water to improve the environmental health of the area's stressed river systems. The Wimmera, MacKenzie and Glenelg rivers were severely affected during the recent prolonged dry period.

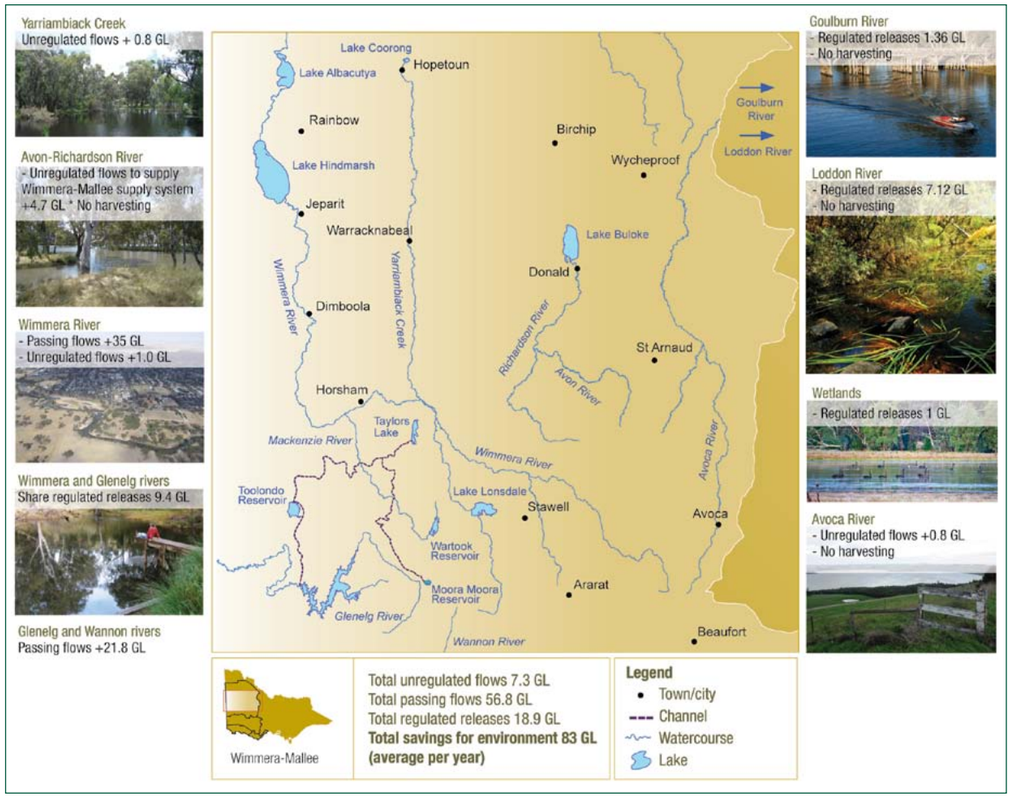
Under historic inflows, the environment will receive an additional 83 GL of water each year on average, made up of (see Figure 6.2):

- a formal high reliability entitlement held in storages (18 GL);
- passing flows required before harvesting water in storages (57 GL);
- unregulated flows when storages spill (7 GL); and
- the wetland entitlement (1 GL – see below).

As part of the water-sharing arrangements, the reliability of the water savings from the Northern Mallee Pipeline was raised to the highest level. This means the reliability of all of the environment's entitlement held in storages is equal to the reliability of the other pipeline products, such as urban water and growth water. This gives much greater security than previously possible for supplying environmental flows in drier years.

"The creation of environmental entitlements that have equal security to other consumptive users and are consistent with the National Water Initiative is a matter of utmost importance and urgency for all the region's rivers." - submission on the Draft Strategy DS264

Figure 6.2 Additional environmental water for each river system



Note: Volumes are based on historical flows between 1903 and 2000.
Images: Glenelg and Wannon - Bruce Cumming, Wimmera River - Paul Lloyd, Avon-Richardson River - Emma Davidson, Yarriambiack Creek - Emma Davidson, Goulburn River - Bruce Cumming, Loddon River - Alison Pouliot, Wetlands Lake Fyans - Click Zoom, Avoca River - Bruce Cumming

These additional flows will help restore a more natural flow regime and can be managed to:

- protect and maintain native fish and platypus habitat in the MacKenzie River and the recently discovered Wimmera bottlebrush which is listed as critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999;*
- improve the ecological health and resilience of the heritage-listed mid Wimmera River;
- allow flows in the Wimmera River to be better managed to maximise environmental benefits further downstream, flush the lower reaches and, when possible, increase the volume reaching the terminal lakes and possibly beyond into Wyperfeld National Park;
- improve the ecological health and water quality of the Glenelg River between Rocklands Reservoir and Harrow; and
- return flows in the Avon-Richardson, Avoca, Loddon and Goulburn rivers to more natural patterns.

Where consistent with the delivery of water to sites of highest environmental values, the additional flows may also:

- provide more frequent flows in Yarriambiack Creek with an increased likelihood of flows reaching and filling weir pools at Jung, Warracknabeal, Brim and Beulah and terminal lakes Corrong and Lascelles in wet years; and
- improve recreational values by providing opportunities for rowing regattas, water skiing and fishing in waterways, weir pools and the terminal lakes.

Photo: Wimmera CMA

Wimmera Bottlebrush (*Callistemon Wimmerensis*)

Wetland entitlement

Included in the 83 GL of pipeline water savings for the environment is an entitlement of 1,000 ML. This will support a number of off-stream wetlands and waterbodies once supplied with water from the former channel system. This will offset the loss of 20,000 farm dams that stored water from the channel system and provided habitat for native plants and animals.

Criteria for allocating this water most effectively were developed by representatives from the catchment management authorities, local Landcare groups and GWMWater's customer committee. The criteria aim to target wetlands with the highest environmental values and ensure these wetlands can be protected and sustained.

So far, seven wetlands have been identified for connection to the pipeline. These include Sawpit Swamp, Harcoans, Bull Swamps, Barbers Swamp (3 ML has already been supplied), Boyles (Connellans) and Connelly Wetland. Members of the community had an opportunity to nominate additional wetlands to receive water from the entitlement. These were yet to be confirmed at the time this Strategy was released.

Managing the Wimmera and Glenelg environmental water entitlements

The environmental water for the Wimmera and Glenelg river systems is managed under one entitlement.

The recent drought severely affected both river systems. The plight of the Glenelg River was highlighted by submissions on the Draft Strategy from the Glenelg community requesting a change to current arrangements to better protect flows in that river.

Views about the arrangements for sharing water between the river systems varied. Most acknowledged the need for flexible management and were concerned about potential disproportionate impacts on one river or the other.

A study commissioned by the Glenelg Hopkins Catchment Management Authority on the benefits of separating the environmental entitlement found that the combined entitlement gave considerable flexibility to achieve the best environmental outcomes under different conditions each year. This benefit offset the potential limitations of combined management, and there would be little to no net benefit to the long-term health of the rivers from separating the entitlement[28].

The desire of the Glenelg River community to ensure equitable, objective and transparent management of environmental flows in the two rivers will be met with the formation of the Victorian Environmental Water Holder (VEWH, see Section 3.4.1, page 91). The Minister for Water transferred the environmental entitlement for the Wimmera and Glenelg rivers to the VEWH on 1 July 2011.

The benefits of separating the environmental entitlement, and the management of the entitlement will be reviewed through broader management processes (see Action 6.1, page 150).

Action 6.8 Managing the Wimmera-Glenelg environmental entitlement

Who: Victorian Environmental Water Holder, catchment management authorities, Department of Sustainability and Environment

Timeframe: Ongoing Review - 2014

The Victorian Environmental Water Holder (VEWH) will work with the Wimmera and Glenelg Hopkins catchment management authorities to achieve the optimum environmental outcomes for flows in each river system through the shared entitlement.

The VEWH will consider the benefits of separating the Wimmera-Glenelg environmental entitlement, and the management of the entitlement will be reviewed as part of the broader review of the operation of all bulk entitlements in the Wimmera-Glenelg system.

6.4.2 Managing the environment's needs in times of shortage

The Wimmera-Mallee Pipeline returns water to the area's waterways. However, in dry times the environment may still suffer stress from reduced flows. In dry conditions, storages will be lower and will spill less frequently, and passing flows will be reduced. The following sections outline ways to manage these conditions and protect the environment.

Regulated environmental entitlement

Of the 83 GL returned to the environment, about 18 GL can be held in storage. This includes an additional 9.4 GL to increase the Wimmera-Glenelg regulated environmental entitlement to 41.6 GL. The higher reliability of this entitlement gives environmental managers more certainty about water availability.

The Victorian Environmental Water Holder (VEWH) will manage this entitlement with advice from catchment management authorities to achieve the optimum environmental outcomes for all of the Wimmera and Glenelg rivers and their tributaries. The VEWH will decide the best timing for releasing this water from storage to achieve the best possible environmental outcomes under the flow conditions each year. This flexibility is improved with environmental managers having the option of carrying over all or part of this entitlement from one year to the next. This means a larger volume can be available for use in the subsequent year to achieve specific environmental outcomes.

Maximising the benefits of environmental water

Catchment management authorities also have a range of other measures to improve the condition and resilience of waterways (see Section 3.4.1, page 90):

- Seasonally adaptive management – this involves adapting environmental watering decisions to match climate conditions in any year to protect the most important parts of the environment in dry times.
- Using consumptive water *en route* – in some situations, consumptive water can be delivered in a way that provides environmental benefits by timing the release to meet ecological objectives. This may be possible for the MacKenzie River (Wartook Reservoir) and Mt William Creek (Lake Lonsdale) (see Box 3.9, page 93).
- Structural works to deliver environmental water – in some circumstances, well designed structures can be installed to achieve environmental outcomes with less water.
- Complementary works, such as protection of streamside vegetation, improves the long-term resilience of waterways and helps them recover quicker after dry periods.
- Better integration of water management – there may be opportunities to better meet the needs of water users and the environment, for example when developing annual operating plans.

VEWH and catchment management authorities will work with GWMWater, other entitlement-holders and water users to identify options to improve outcomes for the environment under dry conditions. This includes the ongoing review of storage management rules and annual operating plans for the supply system, and other measures mentioned above.

6.4.3 Options for additional environmental water

The options for additional water savings outlined in Section 6.3.3 (page 153) are available to improve the reliability of existing environmental entitlements or to recover additional water for the environment.

During the prolonged dry period from 1997 to 2009, the Wimmera River suffered more than most other rivers in Victoria. This experience, and the uncertainty about climate variability, needs to be considered in planning environmental flow arrangements for the river system. The environmental water needs of the Wimmera River, particularly its extensive terminal wetlands, will be reviewed, and this information will be used to assess management of the environmental entitlement and the potential benefits of additional environmental water.

Initial assessment indicates that, despite the pipeline's significant environmental benefits, extra environmental water would provide significant improvements to the health of the terminal wetlands. These environmental benefits must be considered with the economic and social benefits and costs of obtaining additional water. See Chapter 10 for information about the significance of the terminal lakes.

Additional environmental water needs for the Wimmera River could be met by purchasing Wimmera irrigation system entitlements and incorporating this into the environmental entitlement (see Box 6.3).

Murray-Darling Basin Plan and environmental requirements for the Wimmera River

The 2010 Guide to the Murray-Darling Basin Plan did not propose returning more water to the Wimmera-Avoca river systems (see Section 10.4.1 for more information about the plan). However, more recent work by the Department of Sustainability and Environment, in consultation with GWMWater and the Wimmera CMA, on the environmental flow requirements for the Wimmera River system showed that buying the Wimmera irrigation entitlements for the environment would deliver noticeable benefits to the terminal lakes.

These benefits include:

- meeting the environmental requirements for Lake Hindmarsh by filling the lake for 24 months every 11 years; and
- increasing the frequency of Lake Albacutya being full for six months from once every 39 years to once every 15 years.

The findings were provided to the Murray-Darling Basin Authority to consider as part of the Commonwealth Government's $3.1 billion water purchase program and development of the Basin Plan. The plan is due to be released in late 2012.

Box 6.3 Wimmera irrigation system entitlements

Some 220 irrigation customers farm about 3,200 hectares in the Wimmera Irrigation Area. The recent prolonged dry conditions had a severe impact on irrigation in the area with no allocations in five years between 2000/01 and 2008/09. The irrigation system, which is old and costly to maintain, would be expensive to upgrade and would not achieve a sufficiently reliable supply to justify the investment.

Irrigators were not included in the pipeline project because it was not economically feasible to deliver the required volumes through a pipeline. Therefore, the reliability of their entitlement remains largely unchanged post-pipeline.

The Wimmera irrigation community is united in its commitment to voluntarily sell their water entitlements. The Wimmera Irrigators Association (WIA), with the support of GWMWater, has offered to sell 28,000 ML to the Commonwealth Government through the Commonwealth's $3.1 billion purchase program. This volume comprises the 19,000 ML irrigation entitlement and the 9,000 ML system loss entitlement that is required to deliver the water.

To date, all offers made by the WIA have been rejected. However at the time of release of this Strategy, the latest offer was being considered by the Commonwealth. The sale is dependent on the Murray-Darling Basin Plan recognising the need for extra environmental water for the Wimmera river system.

GWMWater and the Victorian Government support the sale of the entitlements to the Commonwealth. The full sell-off of the entitlements will allow the Wimmera irrigation system to be permanently closed and improve environmental flows to the Wimmera River. The funding received by irrigators from the purchase can be invested into alternative agri-business initiatives and activities to expand and reconfigure their agricultural enterprises.

6.5 Water for recreation and other social values

6.5.1 Water for recreation

Rivers, weir pools, storages and lakes are an integral part of community life throughout the Wimmera-Mallee. They provide social, recreational and environmental benefits for the community, attract tourists and can provide water for special community purposes such as firefighting.

Recreation in waterways

Several submissions on the Draft Strategy noted waterways throughout the area provide a broad range of social, economic and environmental benefits. Water in rivers and creeks provides amenity and recreation opportunities for local communities and supports tourism. The delivery of environmental water entitlements will increase these opportunities.

Recreation in storages supplying the pipelined system

Storages for the pipelined supply system are available for a range of recreational uses. The primary objective of managing flows into and out of these storages is the efficient capture, storage and delivery of water supplies to entitlement-holders (with a formal right to water supply), especially during dry periods. In some cases it is possible to manage the timing of releases to achieve social benefits, such as recreation at times of popular use, as well as environmental outcomes. This will depend on the conditions each year including overall storage levels, storage management rules and entitlement-holders' demands for water. For example, Taylors Lake is an important storage in the pipelined Wimmera-Mallee system, so it will provide more reliable recreational opportunities than other storages particularly in dry years. It is being developed for recreation for the Horsham area, and more investment will be sought to improve facilities.

The more efficient delivery of water via the pipeline means that not all the storages from the former channelled system need to be used. Storages no longer needed for water supply or distribution include Dock Lake, Green Lake (near Horsham), Pine Lake and Lake Batyo Catyo. Water will not be diverted into and stored in these lakes to supply water to towns and farms, although Lake Batyo Catyo will receive water periodically (see below).

Weirs no longer needed to divert water for supply or distribution include Antwerp, Banyena, Sheepwash, Swedes Creek Diversion and Trudgeons. The responsibility for future management of these structures is yet to be resolved.

Recreation water entitlement (3,000 ML)

The bulk entitlements include a formal 3,000 ML recreation entitlement from the pipeline water savings, to be delivered through the pipeline. This entitlement is held by GWMWater in storage for use in the Wimmera-Mallee (2,590 ML) and Supply System 5 (410 ML from the River Murray).

A recreational water users advisory group, comprising community representatives from throughout the supply area, advises GWMWater about how to use this entitlement each year. The advisory group identified 10 lakes and weir pools as priorities for water from the entitlement in 2011 (Table 6.2). The 3,000 ML entitlement will be allocated each year through a recreational lakes water supply plan. These lakes and weirs will be filled, when water is available under the entitlement and as needed, during off-peak winter months when delivery is more efficient.

If these arrangements need to change, GWMWater will consult the advisory group and interested community groups.

Table 6.2 Recreation water bodies supplied by the 3,000 ML recreation entitlement in 2011

Lake/weir	Nearest town	Capacity (ML)	Estimated max. volume for 2011 (ML)
Warracknabeal Weir	Warracknabeal	210	100
Brim Weir	Brim	120	60
Beulah Weir	Beulah	36	15
Lake Lascelles	Hopetound	440	120
Lake Marma	Murtoa	170	100
Watchem Lake	Watchem	259	80
Tchum Lake South	Birchip	730	200
Donald Park Lake	Donald	35	15
Wooroonook Lake	Charlton	600	150
Green Lake – supplied from the Murray system	Sea Lake	547	350
Total		**3,147**	**1,190**

Diversion of natural high river flows during wet years

In wet years, high natural flows in waterways may flow or be diverted to specific waterbodies that can then be used for recreation. These diversions can be made if they do not significantly affect the interests of entitlement-holders including the environmental values the high flows support in waterways. Water was diverted into many waterbodies in 2010 and 2011 to mitigate local flooding. Future diversion of high flows will be based on clearly defined management rules for each waterbody.

The arrangements for making these diversions will be defined for each waterbody as part of the development of storage management rules for the pipelined system. For example, conditions for diverting water to Green Lake (near Horsham) are being developed by the Wimmera-Mallee system Storage Manager in consultation with entitlement-holders and the community.

Policy 6.3 Principles for managing the diversion of river flows in the Wimmera-Mallee for recreation in wet years

Using the latest streamflow information and having regard to short-term weather forecasts, unregulated flows will be diverted in order of priority to:

- sites with high environmental values subject to having sufficient flows to achieve desired environmental outcomes;
- sites with high recreational values subject to having sufficient flows to achieve desired recreational outcomes; and
- sites where desired recreational outcomes can be achieved with the available flows.

Unregulated flows should be diverted to recreational sites only when there are no unacceptable impacts on existing entitlement-holders or the environment.

Action 6.9 Developing rules for diverting river flows for recreation in wet years

Who: GWMWater as Storage Manager **Timeframe:** 2013

GWMWater as Storage Manager will work with entitlement-holders and the community to implement these principles through the operating rules for each waterbody.

Water bodies with high community value

The environmental entitlement nominates five waterbodies as having high value to the community:

- Horsham, Dimboola, Jeparit weirs on the Wimmera River; and
- Rich Avon weir and Lake Batyo Catyo on the Avon-Richardson River.

Dimboola Weir is particularly important as an ecological drought refuge for the Wimmera River. These waterbodies will be filled from natural river flows under conditions agreed between the catchment management authorities and local councils.

6.5.2 Managing recreational needs as water availability changes

Many lakes in the region will receive inflows only in wet years. During prolonged dry periods, this will be less frequent, and some lakes may not be available for recreation (as occurred from 1997 to 2009). However, water savings from the pipeline and the more efficient supply system provide other more secure recreation options.

The 3,000 ML recreation entitlement gives much greater security to the recreation lakes and weirs throughout the supply area identified by the recreational water users' advisory group. Recreation opportunities will also be reliably available in major storages, such as Taylors Lake, and in the area's waterways. These are likely to have water in all but the driest years. In addition, water for the five water bodies of high community value (see above) will be supplied by natural flows, and a supplementary supply to Lake Batyo Catyo, to improve recreation and continue to support environmental values in these areas.

6.5.3 Opportunities to find more water for recreation

The options for additional water savings outlined in Section 6.3.3 (page 153) are available to improve water availability for recreation.

There may also be an opportunity to provide water to lakes and other waterbodies of high amenity and environmental value through the purchase of part of the Wimmera irrigation entitlements.

Dimboola Rowing Club Photo: Paul Lloyd

Figure 7.1 The Otways

The Otways

The actions presented in this chapter aim to meet the specific water needs of the Otways (which for this Strategy does not include the Barwon River catchment). They focus on protecting the reliability of supply for existing and future consumptive water users and enhancing environmental values. Together with region-wide actions, they aim to provide a strong and flexible framework that will allow water managers and users to respond to existing and potential pressures in the Otways.

Guide to this chapter

7.1 Water availability and use

- Surface water
- Groundwater
- Environmental values
- Pressures on water resources

7.2 Promoting sustainable use of water

- Providing certainty and improving flexibility for water users
  - Local management plans
  - Implementation of the new groundwater management framework
  - Significant land use changes
  - Water for new entitlements
  - Water trading
  - Managing other pressures on future water availability
  - Other policies and actions
- Improving reliability of supply for urban and industrial water users
  - Urban water supply planning
  - Other actions

7.3 Protecting waterways, aquifers, wetlands and estuaries

- Environmental flows for the Gellibrand River
- Complementary works and programs
- Protecting the environment's share
- Other policies and actions

7.1 Water availability and use

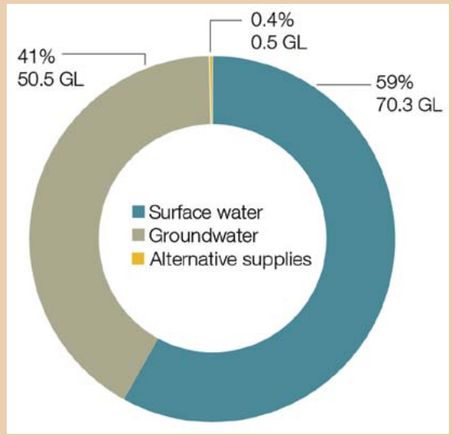
The Otways (see Figure 7.1) is a heavily forested area stretching from Anglesea to Peterborough. It has relatively plentiful and reliable surface water and groundwater resources and highly valued environmental assets such as the Great Otway and Port Campbell national parks, the Gellibrand River and the heritage-listed Aire River.

The sub-region encompasses the numerous small creeks and rivers in the Otway Ranges flowing to the coast between Torquay and Cape Otway. The parts of the Otway Ranges in the Barwon River catchment were included in the Central Region Sustainable Water Strategy and are not covered by this Strategy. Native forests cover 60 per cent of the sub-region. Major towns include Torquay, Anglesea, Lorne, Apollo Bay and Port Campbell on the coast and Cobden inland.

The Otways supports a major tourism industry with significant economic benefits. Dairying and cattle grazing are important land uses, particularly in the Curdies River catchment. The Otway geological basin contains significant fossil fuel reserves with exploration of oil and gas continuing. A range of other emerging technologies and industries like carbon capture and storage may have development potential in this area.

The water resources of the Otways provide reliable supplies to the surrounding area, including major regional cities and towns, such as Warrnambool, Camperdown and Colac. Most water is available for extraction from surface water (59 per cent) with groundwater providing 41 per cent (see Figure 7.2).

Figure 7.2 Proportion of water available for extraction in the Otways



Notes:
- The surface water data is based on long-term modelling and Victorian Water Accounts (VWA) information and is the water available under current entitlements and caps.
- The surface water volumes include farm dams which account for a large proportion of total surface water available for use in some areas.
- The groundwater volume is the total of permissible consumptive volumes (at 14/7/11).
- The volume for alternative sources is from VWA 2009/10.

The predominant agricultural and rural water use in the Otways is from numerous domestic and stock users, a relatively small number of licensed diverters on unregulated streams and licensed groundwater users.

A significant portion of the Otways is forested and/or within the Great Otway National Park, which limits the land available for agriculture and consequently water use. The historically high rainfall means large volumes of water are not required for irrigation. Dryland agriculture is mainly dairying and mixed grazing. Plantation forestry is also an important industry with extensive areas of hardwood and softwood plantations.

The major sources of supply for the Otways' towns are:
- Gellibrand and the Carlisle rivers (Simpson and Cobden);
- Barham River (Apollo Bay, Skenes Creek and Marengo);
- St George River (Lorne);
- Painkalac Creek (Aireys Inlet and Fairhaven);
- Lardners Creek (Gellibrand township); and
- Dilwyn Aquifer (Port Campbell, Peterborough and Timboon).

The Gellibrand River catchment is also the major source of water for Warrnambool, Camperdown, Colac and numerous smaller towns outside the Otways (see Section 7.2.2).

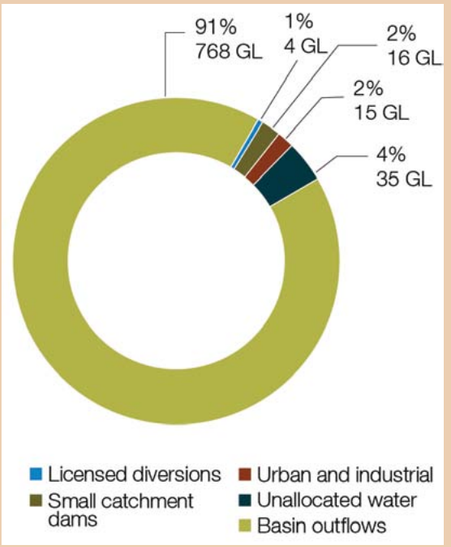
7.1.1 Surface water

The Otways have high, reliable rainfall ranging from 800 mm to 1,200 mm per year in most areas with up to 2,000 mm in a small section of the southern Otway Ranges. This provides plentiful surface and groundwater resources compared with the rest of the Western Region. Despite this, parts of the Otways are susceptible to dry conditions with average streamflows from 1997 to 2009 almost one-third less than the long-term annual average.

The Gellibrand, Aire and Curdies rivers are the major waterways. Many other short, steep streams drain to the coast. The historic average surface water availability in the Otways is about 838 GL (see Figure 7.3 and Appendix 2). Figure 7.3 indicates the maximum volume that can be taken and used for agriculture, towns and local industry. On average, most surface water is available for the environment, but flow varies from year to year and some rivers can be stressed during dry periods.

Water is extracted under licence for farm use from the Curdies and Gellibrand rivers and Lake Purrumbete. The Curdies catchment also has a high density of small catchment dams.

Figure 7.3 Surface water available for different uses in the Otways



Notes:
- Figures are sourced from REALM models, the Victorian Water Resource Data Warehouse, Victorian Water Accounts 2009/10, and water corporation annual reports. These sources may have different timeframes and methods of calculation, and are compiled for indicative purposes only.
- The small catchment dam volume includes licensed and unlicensed farm dams.

7.1.2 Groundwater

The Otways are underlain by a series of aquifers that provide good water supply for domestic and stock, town, agricultural and industrial use. Groundwater is also extracted from deep groundwater formations for gas production.

There are five groundwater management units in the Otways (Figure 7.4 and Table 7.1), although several of these extend beyond the sub-region.

The total permissible consumptive volume (PCV) of the five management units is 50,528 ML and there are 48,433 ML of licensed groundwater entitlements. Metered groundwater use is approximately 4.5 GL (2009/10) with about 2.1 GL remaining available under the PCV. An estimated further 0.4 GL is extracted by domestic and stock users.

Figure 7.4 Groundwater management units in the Otways

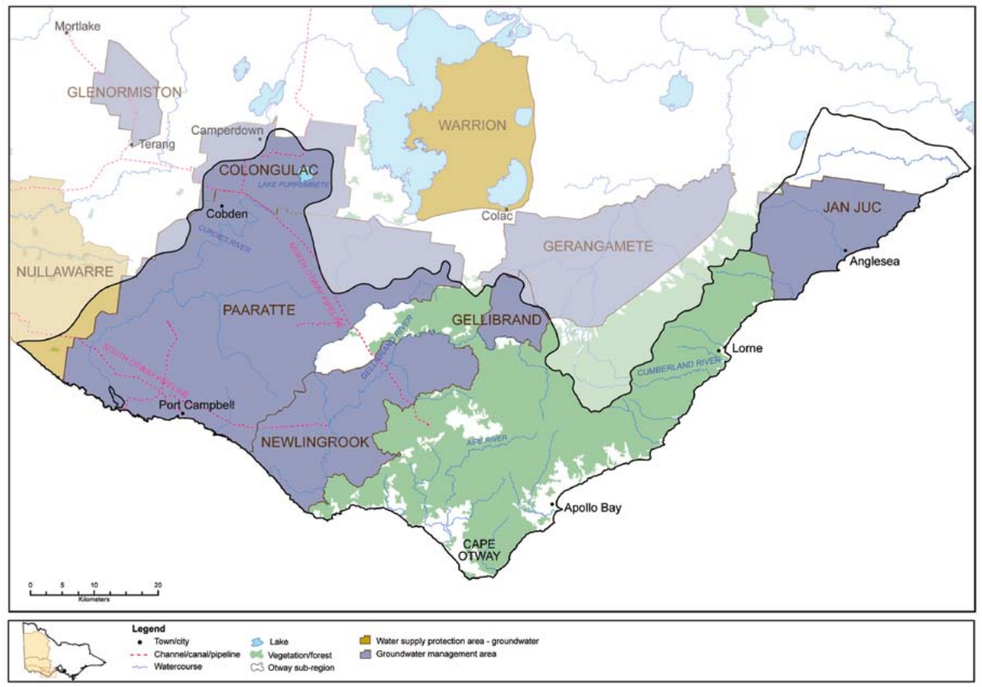


Table 7.1 Groundwater availability and use[1]

Groundwater management unit[2]	Allocation limit[3]	Entitlements	Available volumes	Metered use	No. licences	Estimated non-metered use	No. D&S bores	Estimated D&S use[4]	Licensed and D&S use
Colongulac GMA	4,695	4,043	652	684	45	0	183	366	1,050
Gellibrand GMA	0	0	0	0	0	0	4	8	8
Jan Juc GMA[5]	39,250	39,250	0	3,457	2	0	6	12	3,469
Newlingrook GMA	1,977	1,947	30	95	5	0	12	24	119
Paaratte GMA	4,606	3,193	1,413	291	4	0	12	24	315
Total	**50,528**	**48,433**	**2,095**	**4,527**	**56**	**0**	**217**	**434**	**4,961**

GMA – Groundwater management area.

[1] Groundwater allocations, licences and usage figures are those to be published in the Victorian Water Accounts 2009/10.
[2] Some groundwater management areas are only partly in the Otway sub-region. Some of the water extracted from these areas may be used outside the Western Region.
[3] Allocation limit refers to the permissible consumptive volume (PCV) as published in the Government Gazette as at 14 July 2011. Where a PCV has not been established, the allocation limit is the sum of licensed entitlements.
[4] Domestic and stock bore use is estimated at 2 ML/bore/year.
[5] The PCV for Jan Juc is: Zone 1 – 250 ML/yr, Zone 2 Upper Eastern Formation 4,000 ML/yr, Zone 2 Lower Eastern Formation 35,000 ML in any five years, Zone 2 all other formations 0 ML. This PCV was gazetted on 25 June 2009, with the Bulk Entitlement for Barwon Water gazetted on 30 June 2009.

Groundwater resources of the deep confined Dilwyn Aquifer are not intensively used largely due to the cost of extraction (see also Section 8.2.3, page 196). Shallower unconfined aquifers, such as the Newer Volcanics and the Port Campbell Limestone, are more intensively used where water quality is suitable.

The Jan Juc Groundwater Management Area augments Geelong's urban supply (up to 7,000 ML per year) and Alcoa's operations at Anglesea (up to 4,000 ML per year). This water is extracted at the Anglesea borefield from the Lower Eastern View Formation. Specific management arrangements are in place to protect the environmental values of groundwater dependent ecosystems (see Section 4.4.2, page 121) in the upper reaches of the river from the potential impacts of this extraction.

Water is also extracted from the Gerangamete Groundwater Management Area at the Barwon Downs borefield. This was considered as part of the Central Region Sustainable Water Strategy, and is not dealt with in this Strategy.

Parts of some of the aquifers in the Newlingrook and Gellibrand groundwater management areas are highly connected to surface water in the Gellibrand catchment. The Central Region Sustainable Water Strategy considered the potential development of the groundwater resources in this area, and further studies were recommended. However, other supply augmentations for the Geelong area were subsequently implemented.

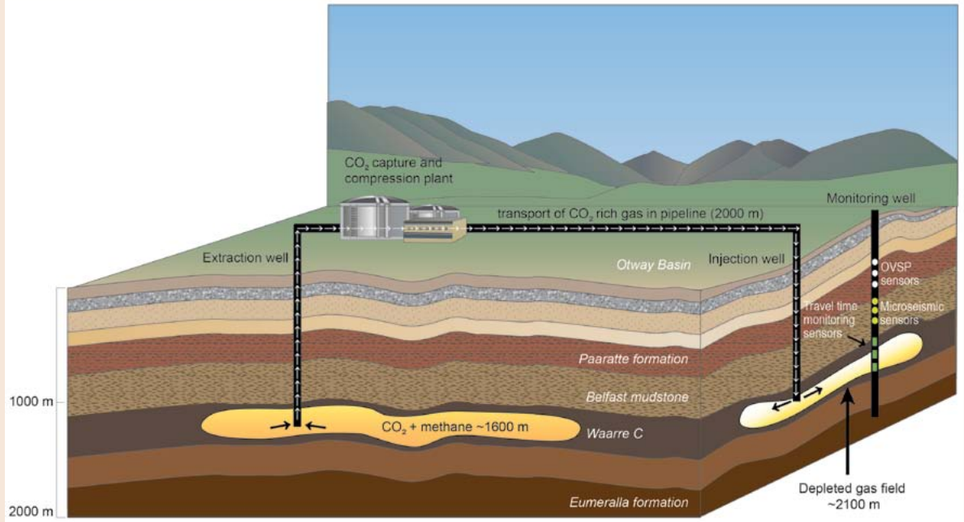
Carbon Capture and Storage

Carbon capture and storage (also known as CCS or carbon geosequestration) involves collecting carbon dioxide and other greenhouse gases released by power stations and other emitters and storing these emissions securely in liquid form deep underground. These technologies may help power stations cut atmospheric emissions while continuing to produce affordable electricity.

CO2CRC – The Otway Basin project

This is Australia's only operational carbon capture and storage demonstration project and is the largest of its kind in the world. The $40 million project, which is supported by 15 companies and seven government agencies, involves researchers from Australia, New Zealand, Canada, Korea and the USA.

Since April 2008, 65,000 tonnes of CO_2-rich gas from a nearby gas well has been injected into a depleted natural gas-field at a depth of two kilometres. A monitoring program has been set up to monitor the CO_2 in the air, groundwater, soil and subsurface over the life of the project. This includes sampling and analysing the groundwater in and around the project area and identifying the baseline or current levels of CO_2 in the water. This will enable the cause of any changes to the groundwater composition to be investigated.



7.1.3 Environmental values

Streams in the Otways contain significant environmental values. Many are in good or excellent condition and several are considered ecologically healthy. They are generally in much better condition than in other parts of the Western Region, reflecting the largely forested catchment. Many streams have recently been incorporated within the Great Otway National Park in recognition of their high environmental values.

The 37 estuaries in the Otways are some of the most diverse in Australia. The strong local tourism industry relies on healthy streams and estuaries for activities such as fishing, swimming and boating. Populations of threatened fish species, such as the Australian grayling, rely on the flow regime and connectivity with the sea that these high value coastal streams retain.

Estuaries along the Otway coast, including the Curdies and Anglesea, are popular recreational areas with the population expanding significantly with visitors during summer.

The Aire and Gellibrand rivers flow into estuaries surrounded by wetlands that are of national significance. These wetlands rely on streamflows to maintain natural flooding and drying patterns, which encourage and protect important vegetation communities and allow the estuaries to function as nurseries for fish. Water extraction and rural drainage can have significant impacts on these values.

Environmental water in the Otways is protected by caps on consumptive use and rules associated with the management of bulk entitlements and section 51 take and use licences. Because there are no regulated systems, no environmental entitlements are held in storage.

7.1.4 Pressures on water resources

There will be significant pressures on the Otways' future water use due to climate variability and population growth, as well as other pressures on environmental values. The Otways is expected to be less affected by drought than other parts of the region. However, this remains a significant risk (see Section 2.2, page 39).

The populations of urban centres and coastal towns are expected to continue to increase, with the population served by the Wannon Water Otway water supply system predicted to rise by about 40 per cent by 2055[28]. Peri-urban growth may also increase the number and volume of farm dams intercepting run-off.

On-shore and off-shore gas is produced from the deep groundwater formations in the Port Campbell Limestone Aquifer. Although this can reduce groundwater availability and cause land subsidence, there is no indication this has occurred in the Otways (see Section 4.4.3, page 125). Agricultural water use may increase in some areas, such as the Curdies catchment, due mainly to expansion of the dairy industry (see Section 3.3.2, page 86). Future peri-urban development may increase demand for domestic and stock supplies.

The Aire River is protected under the *Heritage Rivers Act 1992* and is valued for its pristine upper reaches and fish populations. Heritage River status means the river has important nature conservation, scenic, recreational and cultural values. Rare and endangered fish populations found in this river include the Australian grayling, dwarf galaxias, Yarra pygmy perch and the Australian mudfish.

7.2 Promoting sustainable use of water

7.2.1 Providing certainty and improving flexibility for water users

None of the waterways in the Otways has any significant flow regulation. In these unregulated flow catchments, water is allocated to:

- water corporations with bulk water entitlements to access surface water and groundwater;
- individuals with a licence under section 51 of the *Water Act 1989* to take and use surface water; and
- individuals and water corporations with a licence under section 51 of the Act to take and use groundwater.

If water is available, it can be taken and used in accordance with the licence or bulk water entitlement conditions. If there is not enough for all needs, water use is restricted to share the available water between existing users and the protection of the environment, as well as domestic and stock water users and the long-term use of the resource.

Local management plans

In many areas, management of licensed water use needs to be more responsive and adaptable to local conditions and the characteristics of each groundwater or unregulated river system. Local management plans will be used in the catchments and groundwater systems of the Otways where there are a significant number of licensed water users (see Policy 3.3, Action 3.5 and Tables 7.2(a) and (b)).

Local management plans will clearly define the rules for how water is managed on unregulated systems to meet the needs of licensed water users and the environment. They are operating plans that address all significant issues in an area and define water sharing and management arrangements, particularly during times of shortage (see also Section 3.1.3, page 60).

Table 7.2(a) Local management plans for surface water

	River Basin	Unregulated river system	Timeframe
Areas where existing rules will be documented as local management plans	Otway Coast	Otways (Aire River – Anglesea River) Gellibrand River[a] Curdies River Lake Purrumbete	Mid 2012
Areas where existing rules will be reviewed or improved	None	None	None

Note: A local management plan will be developed for each river basin. Where needed, plans for specific unregulated rivers within each basin will be developed and attached as a schedule to the local management plan for the basin.

[a] The Gellibrand River will be managed based on a local management plan. A statutory streamflow management plan will not be prepared (see Section 7.3.1).

Table 7.2(b) Local management plans for groundwater

	Management Area	Timeframe
Areas where existing rules will be documented as local management plans	Gellibrand GMA Colongulac GMA Unincorporated areas	Mid 2012
Areas where existing rules will be reviewed or improved	Paaratte GMA Newlingrook GMA	End 2012

Better aligning groundwater management boundaries with aquifer systems

Groundwater management boundaries in the Otways will be adjusted to be based on groundwater systems. This will ensure that all users of the same groundwater system are subject to consistent rules. This will better protect the resource, existing users and the environment.

The rights of existing licence-holders to take and use groundwater will be protected throughout this process, and transition arrangements will be developed to help users with management changes (see also Section 4.2.1, page 107).

Managing significant land use changes

Some land use changes can reduce water availability for other water users and the environment. Where needed, areas under pressure from land use changes will be declared under the *Water Act 1989* to allow more intensive management including controlling new forestry developments.

Land use changes are not expected to affect water availability in the Otways because:

- there is already a high proportion of land covered by native forests; and
- the high value of agricultural land will limit the economic viability of further plantation developments.

Land use changes and their impacts on the Otways' water resources will be monitored to identify the need for more intensive management in the future (see also Chapter 5, page 129).

Photo: David Trevenan

Farmland near Nirranda South

Water for new entitlements

The Otways has approximately 34 GL of unallocated surface water available for the winter-fill period under existing sustainable diversion limits. However, this water is spread across 33 waterways. As well, use of this water is limited in some areas by the lack of suitable land for development, with large parts of the Otways contained within the Great Otway National Park and Otway Forest Park.

The Government supports a balanced approach to making new water available having regard to the principles in Policy 3.7 (page 80). A key issue for the Strategy is determining how these unallocated resources should be shared to ensure an appropriate balance between water consumption and the environment. Water not extracted for consumptive use provides environmental, recreational and cultural benefits to the community and supports the supply reliability for existing water users.

Studies were completed recently of the likely demand for, and availability of, water in the Otways (Technical Reports 3 and 4 respectively, available online). The likely future demand was determined from discussions with regional industries. The upper limits of these estimates were used as a guide to adjust the volume of water available under the caps in each catchment. Unallocated water remains available in catchments identified as likely to support further agricultural development or intensification, particularly the Curdies and Gellibrand catchments. For several catchments, the volume of unallocated water available for use was revised, based on the:

- greater than previously estimated volume of farm dams in some areas (for example, an additional 4,000 ML in the Curdies River and the Port Campbell area);
- low historic uptake of unallocated water;
- high proportion of forested public land in some catchments where agricultural development cannot occur; and
- high environmental, recreational and tourism values of specific catchments, waterways and estuaries (for example, the Aire and Gellibrand rivers and estuaries).

This balanced approach will help to protect the reliability of supply to existing users as well as protecting environmental values. It will also enable new allocations to be made as knowledge of the resource improves over time. This approach will allow flexibility to adapt over time, with volumes to be evaluated again in 10 years as part of the review of the Strategy.

Action 7.1 Revised caps on the amount of unallocated surface water available for winter-fill diversions in Otways catchments

Who: Department of Sustainability and Environment, Southern Rural Water, catchment management authorities **Timeframe:** End 2012

Consistent with the principles outlined in Policy 3.7, the following caps will be placed on the amount of unallocated surface water that remains available for new winter-fill (July to October) diversions from unregulated waterways:

- 1,500 ML in the catchments of the Curdies River and the Port Campbell area;
- 1,000 ML in the Gellibrand River catchment;
- 300 ML in the Johanna River, Milanesia Creek and Brown Creek catchments;
- 300 ML in the Aire River catchment;
- 300 ML in the catchments between Parker River to Skenes Creek (inclusive); and
- 100 ML in the catchments between Tambryn and Aireys Inlet.

No further water is available in the relatively highly developed catchments between Anglesea to Torquay, and these will be capped at the current level of allocation. The availability of water within each catchment will depend on location and the access conditions imposed on licences.

Not all of the remaining water will be made available immediately. A staged approach will be taken to allocate this water, with Southern Rural Water determining how it will be allocated in each catchment – which may occur initially through expressions of interest, auctions or allocations based on a reserve price.

The amount of water available for new entitlements in the Otways will be reviewed as part of the review of this Strategy in 10 years.

New groundwater entitlements are available in the Colongulac (652 ML), Paaratte (1,413 ML) and Newlingrook (30 ML) groundwater management areas (see Table 7.1). In these areas, groundwater will continue to be allocated case by case, depending on potential impacts on existing users and the environment as defined in the Water Act.

More water may be available in the Newlingrook, Paaratte and Gellibrand groundwater management areas, subject to resource appraisals and investigations. The Government supports additional water being made available where a resource appraisal shows this can be done sustainably (see also Section 3.2.5, page 80).

Water trading

In those parts of the Otways where no new water entitlements are available, the only way to obtain more water is to buy it from other water users unless an alternative source (such as recycled water) is available.

An investigation into water trading in unregulated catchments including those in the Otways was undertaken as part of this Strategy. The conclusions from these investigations, and the consequent actions to improve the ability to trade surface and groundwater entitlements throughout the region, are presented in Section 3.2.3 (page 68). Actions include:

- improving information about water markets and trading;
- increasing the potential for trade in unregulated surface water and groundwater systems;
- developing a risk-based approach to approving water trades; and
- facilitating limited-term transfers or leases in unregulated surface water and groundwater systems.

Managing other pressures on future water availability

Bushfires pose risks to the quality of run-off immediately after a fire and the volume of run-off as the forest regrows and starts using more water. Impacts on run-off volume are particularly significant in mountain ash forests. Much of the forested areas of the Otways are mixed eucalypt forests. The regeneration of this forest type after fire has less impact on run-off, and the potential for bushfires to reduce the water yield for supply systems is not significant. Water corporations will continue to assess risks to water quality from bushfires, and the Department of Sustainability and Environment will review protocols for fuel-reduction burns to minimise water quality risks (see Section 3.4.4, page 98).

The Department of Sustainability and Environment is also undertaking a pilot study in the Otway Ranges to improve understanding about how to optimise strategic planned burning to provide the best overall outcome – including the protection of human life, property, biodiversity, timber production and water quantity and quality.

Acid sulfate soils

Acid sulfate soil (ASS) is found in a variety of inland and coastal environments. Left undisturbed, it is harmless. However if drained, excavated or exposed to air, the iron sulfides in ASS react with oxygen and form sulfuric acid. The acid is harmful to the aquatic environment and can trigger the release of heavy metals, particularly aluminium, and other contaminants.

As ASS is a natural phenomenon, land and resource managers need to understand the characteristics in the landscape that increase the likelihood of ASS and the potential environmental, social and/or economic consequences of acidification. The main cause of acidification of coastal acid sulfate soils is drainage of wetlands for farming or subdivision. In inland areas, the main risk is believed to be drying of previously waterlogged landscapes during prolonged drought. Decreases in rainfall due to climate variability may contribute to a general drying of the landscape and wetland areas in particular. This may increase the likelihood of acidification of ASS.

Most assessment of ASS has focused on coastal areas and the Murray River corridor, and the risks in other areas of the State are poorly known. The Corangamite Catchment Management Authority identified ASS as a potential threat in its regional Soil Health Strategy. Since 2009, government agencies have been investigating ASS in the area. Research is continuing to better understand the occurrence of ASS and the potential risks to the environment, community and infrastructure.

Other policies and actions to provide certainty and improve flexibility

Action 3.4 Monitoring and tracking water use outside the entitlement framework. Page 60

Policy 3.3 and Action 3.5 Developing more responsive local management plans. Page 61,63

Policy 3.4 Developing statutory management plans where needed. Page 65

Action 3.7 Improving information sharing about climate variability and risks. Page 68

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.10 Investigating the potential to harvest high flows. Page 72

Action 3.11 Extending the reticulated supply network. Page 73

Action 3.12 Improving opportunities for water trading. Page 75

Action 3.13 Encouraging fit-for-purpose use alternative water supplies. Page 79

Action 4.1 Aligning groundwater management boundaries to aquifer systems. Page 107

Action 4.6 Strategic groundwater resource assessments. Page 117

Action 5.1 State-wide recording of water use by land use changes. Page 132

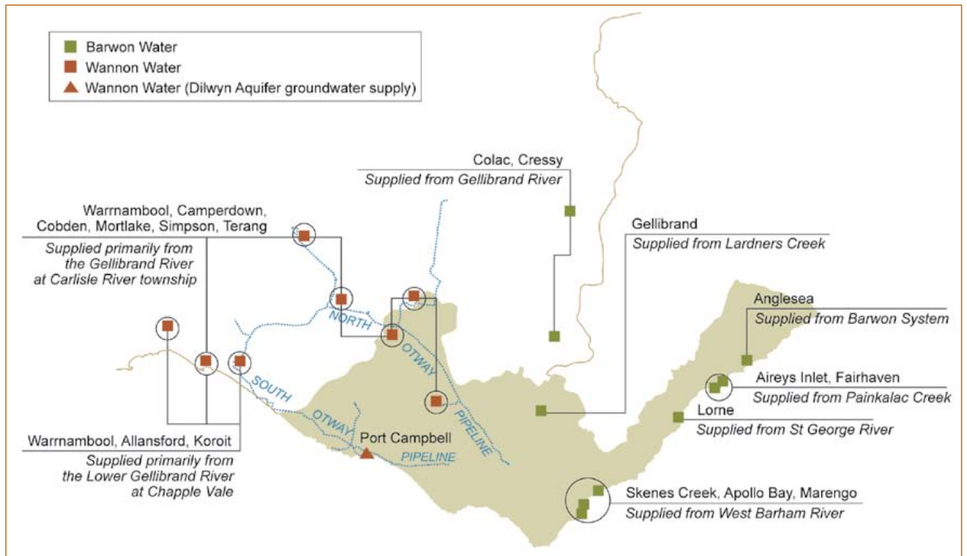
Action 5.3 Declaring areas to control water intensive land use changes. Page 134

Action 5.5 Considering cumulative impacts of land use in decisions on water use. Page 140

7.2.2 Improving reliability of supply for urban and industrial users

The water supply systems in the Otways are shown in Figure 7.5 (see also Section 3.3.1, page 83).

Figure 7.5 Water supply systems in the Otways



Water corporation	Supply system	Towns supplied	Main source(s) of supply	Population served[1]
Barwon Water	Aireys Inlet	Aireys Inlet, Fairhaven	Painkalac Reservoir, Painkalac Creek	1,337
	Lorne	Lorne	Allen Reservoir, St George River	1,787
	Apollo Bay	Apollo Bay, Skenes Creek, Marengo	Barham River	2,479
	Colac[2]	Colac, Cressy	West Gellibrand Reservoir and Olangolah Reservoir, Gellibrand River	15,190
	Gellibrand	Gellibrand	Lardners Creek	74
	Geelong[3]	Anglesea, Jan Juc and Torquay	-	-
Wannon Water	North Otway system[4]	Warrnambool, Allansford, Koroit, Camperdown, Lismore, Derrinallum, Cobden, Mortlake, Simpson, Purnim, Terang, Noorat, Glenormiston	Arkins Creek and Gellibrand River (supplemented with groundwater from the Carlisle borefield in dry periods)	47,700
	South Otway system[4]	Warrnambool, Allansford, Koroit	Lower Gellibrand River and shandy of local groundwater in Warrnambool	
	Timboon – Port Campbell system	Peterborough, Port Campbell, Timboon	Dilwyn Aquifer – groundwater bore in Port Campbell	2,100

Note:
1. Figures about the population served are estimates provided by each water corporation.
2. The Colac system supplies several towns in the Western District (see Chapter 9).
3. The Geelong supply system was considered in the Central Region Sustainable Water Strategy.
4. These systems include towns located in the South-west (Chapter 8) and Western District (Chapter 9).

The Otway systems supply about 10,000 ML per year to towns in the Otway, South-west Coast and Western District sub-regions, as well as about 1,300 farms and dairy processing industries.

As a result of the recent prolonged dry conditions, the water corporations have implemented demand management measures and approved major infrastructure investments to improve the reliability of water supplies and the resilience of the supply systems including:

- A new $16 million 250 ML water storage basin, with associated pipelines and pump station, will be built between 2012 and 2014 to eliminate the need for summer water restrictions in Apollo Bay, Marengo and Skenes Creek (Barwon Water).
- Showerhead exchange, rebates for water-wise products and permanent water saving rules (Barwon Water).
- The first phase of an urban roof water capture system that allows all water on the growing urban roof catchment to be harvested and mixed with other raw water, treated and then supplied to the City of Warrnambool. This will allow a significant growth corridor of Warrnambool to be water neutral – no additional demand for water from the Gellibrand River to service this growth corridor (Wannon Water).
- Showerhead exchange program, save water publicity, household water audits, permanent water saving rules and working with industry and councils reduced demand by about 19 per cent from 2005/06 levels (Wannon Water).

Barwon Water is also investigating the potential of the aquifer to the north of Anglesea to store water for later use (see Section 4.3.1, page 113).

Urban water supply planning

All urban water corporations in Victoria are required to undertake long-term planning to develop water supply-demand strategies, which aim to ensure there is adequate supply reliability in the future. These strategies consider all risks to water supplies as well as options to manage demand or improve supply. They assess the need for, and timing of, future supply augmentations. The risks considered include the potential climate impacts on runoff and increased water demand from growing populations. These strategies will be revised with the lessons learnt from the prolonged dry period from 1997 to 2009 and heavy rainfall in 2010 and 2011 (see also Section 3.3.1, page 83).

The water efficiency and supply augmentation measures already implemented or planned by Barwon Water and Wannon Water will secure urban supplies (see Appendix 4). Further supply augmentations are not expected to be needed for some time. The requirement and timing for augmentations and demand management will be reassessed periodically through the water supply-demand strategy process and future reviews of this Strategy.

Action 7.2 Revising urban water supply-demand strategies

Who: Barwon Water, Wannon Water **Timeframe:** March 2012

Barwon Water and Wannon Water will revise their water supply-demand strategies by March 2012, taking into consideration experience and information gathered from the prolonged dry period and heavy rainfall over the past 14 years.

The updated strategies will incorporate the findings from the review of permanent water savings rules.

Barwon Water's summer awareness campaign

Over the holiday periods – and particularly over the hot summer months – the population that Barwon Water supplies grows from 280,000 to more than 510,000. This significantly increases demand for drinking water. Barwon Water has developed a summer campaign to remind visitors that saving water is just as important on holiday. This includes educating holiday-makers about restrictions and water-use habits.

During the 2009/10 summer, Barwon Water's youth environment ambassadors Joel Corey (Geelong AFL player) and Kelly Cartwright (Paralympian) helped to deliver this message through various advertisements.

Other actions in the Strategy to improve reliability of supply for urban users

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.13 Encouraging fit-for-purpose use of alternative water supplies. Page 79

Action 3.16 Updating water supply-demand strategies. Page 84

Action 3.17 Review of the Victorian Uniform Drought Water Restriction Guidelines and Permanent Water Savings Rules. Page 85

Action 3.18 Facilitating integrated water planning. Page 85

7.3 Protecting waterways, aquifers, wetlands and estuaries

Major waterways in the Otways include the Gellibrand, Curdies, Aire, Barham and Carlisle rivers. Given the good condition of many of these streams, protecting their high environmental values is a key environmental management objective, supported through the 2006 Corangamite River Health Strategy.

Lakes Purrumbete and Ellingamite are also important. Lake Purrumbete is a large, deep freshwater lake that will remain a permanent, fresh body of water under a possible drier future. Lake Ellingamite is also likely to remain permanent because it is in an area of good rainfall. The regional environmental significance of these lakes will increase in future, with other freshwater lakes in the Western Region likely to be more susceptible to extended and more frequent dry periods.

The Otways' estuaries have high environmental values that partly depend on flows of freshwater from rivers. Several of these estuaries, in particular the Anglesea, Erskine and Barham rivers and Painkalac Creek, support recreation and a major tourism industry, providing high economic value that relies on the health of these catchments.

Healthy estuaries support the health of riverine ecosystems further upstream. About two-thirds of fish species native to southern Victoria have to migrate between fresh and saltwater to complete their life cycle. The Gellibrand estuary, for example, contains 19 fish species and provides important habitat necessary to complete the life cycle of several of these species. The threatened Australian grayling (listed under the Commonwealth *Environment Protection and Biodiversity Act 1999*), tupong, common galaxias and short-finned eel are among the species that migrate between the river, the estuary or the sea as part of their life cycle.

Any potential sea level rises and increases in storm surges are likely to affect all estuaries and inlets by increasing coastal erosion and flooding. Climate variability will affect the amount of streamflow entering the wetlands and estuaries, altering the location of the freshwater-saltwater interface in the estuaries.

The most significant environmental risks to each of these systems are reduced flows due to climate variability and/or water extraction, and poor water quality from nutrient and sediment in run-off. The prolonged dry period from 1997 to 2009 stressed the environmental values of the Otways' waterways. This was particularly the case during dry summers when there was a greater impact from consumptive uses.

Options will be investigated to improve summer environmental flows in the Gellibrand River (see Action 7.3). A balanced approach will be taken when releasing unallocated water for consumptive use (see Action 7.1). The health of waterways in the Otways will be improved by investing in best practice catchment management activities, complementary works, water quality programs and a management approach that adapts to a changing environment.

7.3.1 Environmental flows for the Gellibrand River

The Gellibrand River has high environmental values and is a regionally significant source of water for urban communities (see Section 7.2.2), as well as providing irrigation and domestic and stock supplies. Arrangements for sharing water between the environment and the urban water corporations, such as passing flows at reservoirs, are specified in Wannon Water's and Barwon Water's Gellibrand River bulk entitlements and reflected in the draft Gellibrand River streamflow management plan prepared in 1998.

Southern Rural Water manages irrigation extraction, predominantly for dairy farming, using the draft streamflow management plan. The plan sets out a system of rosters and bans on licensed diversion when river flows drop to 22 ML per day in the lower Gellibrand River.

Recent environmental flow studies found the recommended summer low flows, during dry conditions such as from 1997 to 2009, are likely to be met in 74 per cent of years due to a range of pressures. Such low summer flows put the ecological values of the river, such as the river blackfish, at risk. This impact becomes greater in the lowest reach of the river – the estuary.

Painkalac Creek Estuary Photo: Corangamite CMA

Action 7.3 Improving environmental flows in the Gellibrand River

Who: Corangamite Catchment Management Authority, Wannon Water, Southern Rural Water and Department of Sustainability and Environment **Timeframe:** 2013

The Corangamite CMA, Wannon Water and the Department of Sustainability and Environment, in consultation with Southern Rural Water, will assess a preferred water supply augmentation option and implementation process to improve critical flows in the Gellibrand River through the summer low flow period.

Wannon Water will undertake detailed assessments of the preferred augmentation options to better understand the supply security benefits, costs and risks of each option, and the change in demand for Gellibrand River water.

Corangamite CMA will quantify the environmental benefits of maintaining summer baseflows to levels below the recommendations in the Assessment of Environmental Flow requirements for the Gellibrand River.

Resourcing of this option will be investigated and documented in the regional strategy for healthy rivers and wetlands and water supply-demand strategies of the relevant agencies.

These risks can be addressed partly by clarifying minimum summer low flow requirements. These could be included in Wannon Water's bulk entitlement, which allows all available flows below 12 ML per day to be taken from the Gellibrand River at Carlisle River. However, changes to the passing flow rules without suitable substitution options could seriously erode the current reliability of water supplies from the Otway system.

Management options for the Gellibrand River

The Corangamite Catchment Management Authority, Wannon Water and Southern Rural Water have formed a partnership to investigate supply substitution options for improving supply security and addressing summer flow stress in the Gellibrand River.

Five options for supply augmentation were identified. These options included various types of groundwater substitution to be taken up via the North or South Otway pipeline; or winter-flow harvesting and construction of an off-stream storage. Further investigations into all options are needed before deciding the best course of action.

7.3.2 Complementary works and programs

Providing adequate environmental flows and protecting or restoring riparian habitat and water quality will sustain healthier waterways. Complementary river restoration works and better management of the catchment maximise the benefits of environmental flows.

The Corangamite Catchment Management Authority will continue to implement complementary in-stream and streamside works based on its regional River Health Strategy. In 2011/12, the Corangamite CMA will invest up to $2 million in river health activities in the Otways (see also Section 3.4.2, page 94).

Action 7.4 Investing in integrated catchment management to improve Otway waterways

Who: Department of Sustainability and Environment, Corangamite Catchment Management Authority **Timeframe:** Ongoing

The Government will continue to invest in integrated catchment management to protect and improve the ecological condition of waterways in priority areas of the Otways and enhance environmental resilience to extended dry periods. This will be done through on-ground actions including revegetation, fencing of riparian areas and removing willows. Improvements in catchment management will help to improve the water quality of in downstream reaches and estuaries.

Gellibrand River Restoration Program

Many of the Gellibrand's upper reaches are in very good environmental condition. However, a number of them are in poor condition and threaten the health of the estuary. The Gellibrand River Restoration Program was launched in 2000 to improve the health of the river and its estuary by protecting and restoring:

- threatened native vegetation and nationally threatened flora and fauna;
- important fish communities, for example by removing barriers to fish passage; and
- water quality in designated water supply catchments.

The program is supported by the Victorian and Australian governments, Wannon Water and local landholders.

Restoration has been carried out on 81 km (52 per cent) of priority waterways including: 65 km of fencing to exclude stock, 154 ha of riparian revegetation, 76 km of willow management, 154 ha of riparian weed management and the removal of four fish barriers.

Following these works, the threatened Australian grayling was found in the upper river for the first time in 28 years. As well, bank erosion has reduced, water quality has improved and the river is no longer in danger of being choked by weeds.

Gellibrand River project site before restoration (November 2002)

Gellibrand River project site during restoration (December 2002)

Project site 3 years later, following restoration (December 2005)

Project site 8 years following restoration (April 2010)
Photos: Corangamite CMA

7.3.3 Protecting the environment's share

The balanced approach to issuing any new water entitlements for consumptive use (see Policy 3.7, page 80) will help to ensure new water allocations occur only where there is a relatively low risk to environmental values.

The volume of water available under the caps in some unregulated waterways has been revised based on the likely future demand (see Action 7.1). This will contribute to environmental flows as well as protecting recreational and cultural values and supply reliability for existing water users.

Great Ocean Road Estuary Restoration Project

The project aims to improve the condition of key coastal rivers and their estuaries by reducing nutrient and sediment loads. An associated objective is to improve community awareness and understanding of estuary management, involving local communities and key stakeholders.

On-ground activities in 2009/10 included working with the community to fence off river frontages, providing alternate stock watering and stock crossings, controlling willows and other weeds, protecting remnant vegetation and revegetating. This project also included community based water quality monitoring through the Corangamite EstuaryWatch and Waterwatch programs. These activities will continue to be delivered through local partnerships with landholders, Landcare, water corporations and local councils. Works have been undertaken in the Anglesea, Aire, Gellibrand, Barham and Curdies rivers, the Painkalac and Wild Dog creeks, and other high value estuaries and waterways of the Great Ocean Road.

One of the key activities undertaken is the roll out of the Estuary Entrance Management Support System, which is a tool used to inform decisions about artificial estuary mouth openings. This risk-based system informs estuary management agencies of the risks of artificially opening estuary mouths, taking in account the impacts to built assets and social and environmental values. Further policy on estuary entrance openings and estuary management will be detailed under the Victorian strategy for healthy river, estuaries and wetlands.

Other policies and actions in the Strategy to protect the environment

Action 3.14 Balanced approach to managing unallocated water on unregulated rivers. Page 81

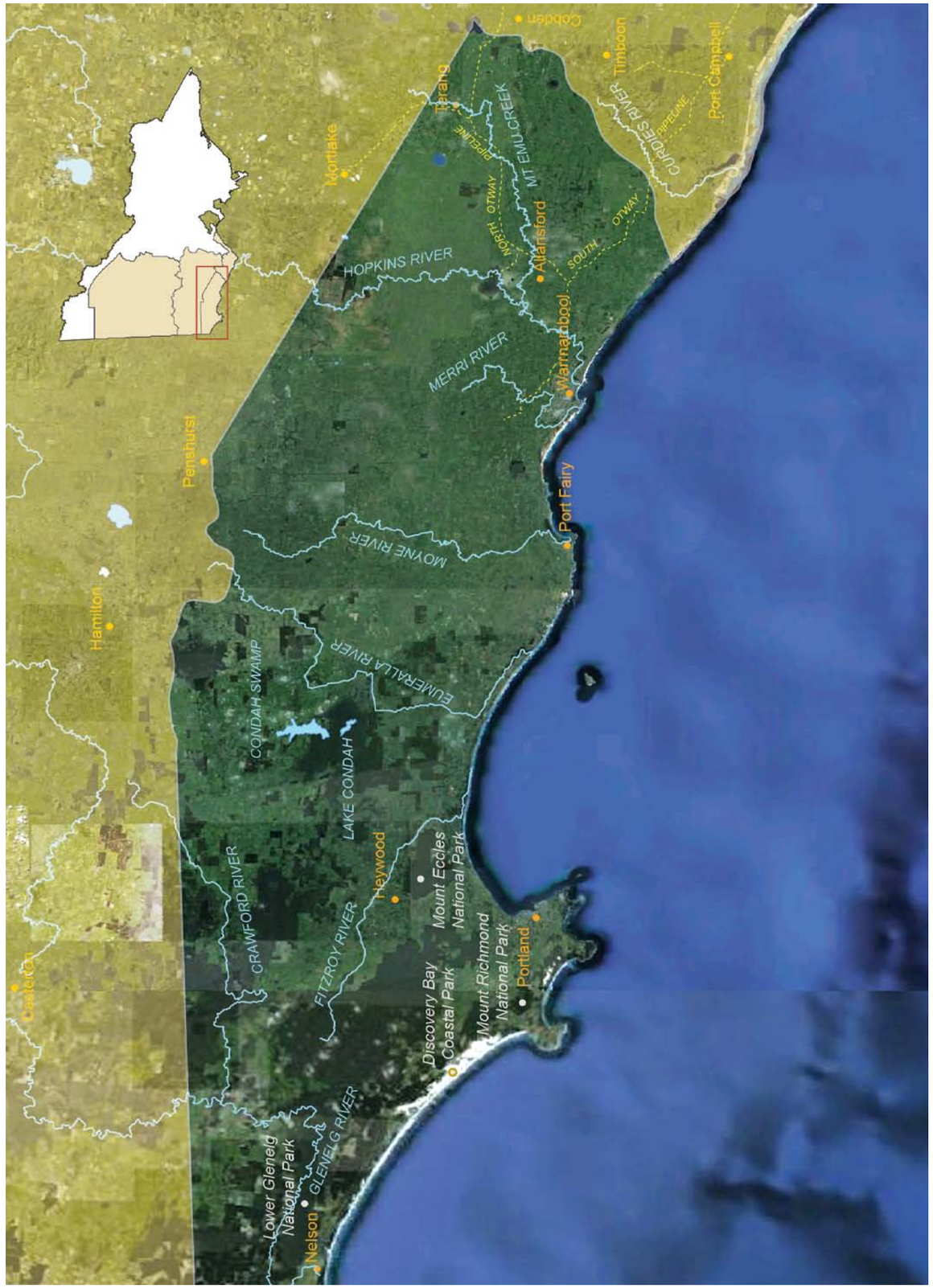
Policy 3.9 Structural works to maximise the benefits of environmental watering. Page 92

Action 3.21 Managing riparian land. Page 95

Policy 3.12 Exploring opportunities for multiple benefits through local water planning. Page 95

Policy 4.3 and Action 4.11 Risk-based approach to managing groundwater dependent ecosystems. Page 123

Figure 8.1 The South-west Coast



The South-west Coast

The actions presented in this chapter aim to meet the specific water needs of the South-west Coast. They focus on enhancing and protecting the reliability of supply for existing and future consumptive water users and enhancing environment values. Together with region-wide actions, they aim to provide a strong and flexible framework that will enable water managers and users to respond to existing and potential pressures along the South-west Coast.

Guide to this chapter

8.1 Water availability and use

- Surface water
- Groundwater
- Environmental values
- Pressures on water resources

8.2 Promoting sustainable use of water

- Providing certainty and improving flexibility for water users
  - Local management plans
  - Implementation of the new groundwater management framework
  - Significant land use changes
  - Water for new entitlements
  - Water trading
  - Managing other pressures on future water availability
  - Other actions and policies
- Improving reliability of supply for urban and industrial water users
  - Urban water supply planning
  - Other actions
- Managing the Dilwyn Aquifer
- Restoring Lake Condah

8.3 Protecting waterways, aquifers, wetlands and estuaries

- Environmental flows for the Merri River
- Complementary works and programs
- Protecting the environment's share
- Other policies and actions

8.1 Water availability and use

The South-west Coast (Figure 8.1) contains the Portland Coast River Basin and the lower parts of the Hopkins and Glenelg river basins. It has relatively plentiful water, with significant demand and a growing population.

The sub-region extends from the Otway Coast to South Australia and includes the towns of Warrnambool, Port Fairy and Portland, as well as Mt Eccles, Mt Richmond and Lower Glenelg national parks and Lake Condah.

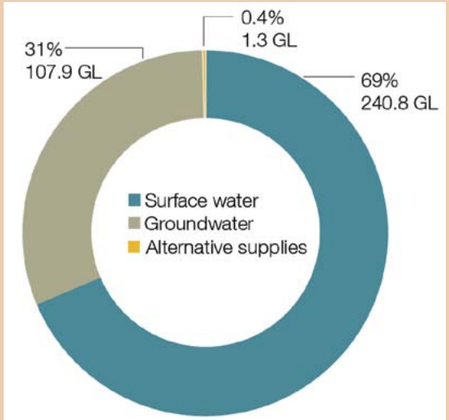
The South-west Coast's water resources support important agricultural production including dairying, grazing, cropping and forestry. This area is Australia's most productive milk region, providing a quarter of the nation's milk. The manufacturing sector generates $4 billion a year, a quarter of which is derived from dairy products. Value adding to primary products occurs via milk processing in Warrnambool, Allansford, Koroit, Colac, Cobden and Simpson, meat processing in Warrnambool and Colac, and timber processing in Portland and Colac.

Other significant manufacturing includes aluminium production near Portland and wind turbine systems fabrication and assembly in Portland. Forestry is a major industry – the harvesting of 180,000 hectares of blue gum plantations over the next few years will make the Port of Portland Australia's largest hardwood chip handling port. Almost 20 per cent of the nation's forestry plantations are in, or near, the South-west Coast. Many of the forestry plantations are in areas of high rainfall.

In recent years, natural gas reserves have been discovered off the coast near Port Campbell. These reserves are being harvested, with several gas processing plants established and gas-fired power stations are planned. The gas-fired Mortlake Power Plant is under construction and will be commissioned by the end of 2011. Wannon Water will supply recycled water to meet the process water needs of the plant. Two further gas-fired power plants are planned for construction and one will be supplied with recycled water.

The water resources of the South-west Coast provide reliable supplies to the surrounding area. Most water is available for extraction from surface water (69 per cent), followed by groundwater (31 per cent) (see Figure 8.2).

Figure 8.2 Proportion of water available for extraction in the South-west Coast



Notes:
- The surface water data are based on long-term modelling and Victorian Water Accounts (VWA) information and is the water available under current entitlements and caps. The surface water volumes also include farm dams which account for a large proportion of total surface water available for use in some areas. This figure includes all of the Glenelg and Hopkins basins, parts of which are not in the South-west Coast.
- The groundwater volume is the total of permissible consumptive volumes as at 14 July 2011.
- The volume for alternative sources is from VWA 2009/10.

The predominant agricultural and rural water users are domestic and stock and a relatively small number of licensed diverters on unregulated streams and groundwater users.

The major sources of supply include the Arkins Creek tributaries, and the Gellibrand and Carlisle rivers (from the Otway system), the deep Dilwyn Aquifer and other local aquifers (see Section 8.2.3).

Groundwater is used more widely along the South-west Coast than other parts of the Western Region and supports towns and the main primary industries – grazing and dairying. Groundwater resources range from the massive, deep and nationally important Dilwyn Aquifer to modest shallow systems. Groundwater is extracted to meet all the needs of towns (including Portland, Heywood and Port Fairy), and to supplement surface water supplies for the Hamilton and Otway systems.

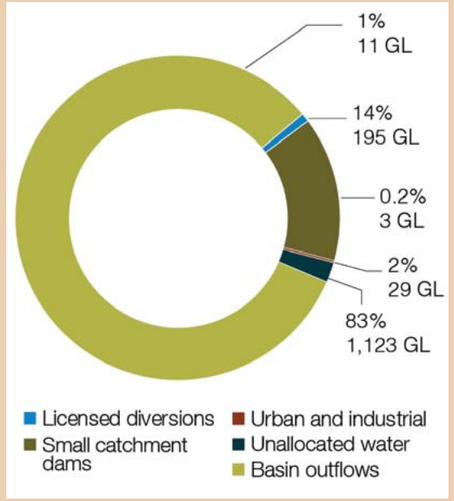
8.1.1 Surface water

This part of the Western Region has moderate, reliable rainfall, typically 600 mm to 1,000 mm per year. The historic average surface water availability for the Glenelg, Hopkins and Portland Coast river basins is about 1,400 GL per year (see Figure 8.3 and Appendix 2). Figure 8.3 indicates the maximum volume that can be taken for agriculture, towns and local industry. While Figure 8.3 indicates that on average most surface water is available for the environment, rivers in this sub-region can be subject to significant stress over the drier summer months.

Surface water is transferred from the Otways for urban and domestic and stock use (see Chapter 7). This supplies Warrnambool, Camperdown, Cobden, Mortlake Simpson, Terang, Koroit and Allansford. Dilwyn Aquifer supplies Portland, Port Fairy, Heywood, Dartmoor and Paaratte, and there are many smaller supply systems.

Large volumes of recycled water are potentially available along the coast for new economic activity in Warrnambool (5,300 ML per year), Portland (1,600 ML per year) and Port Fairy (1,000 ML per year).

Figure 8.3 Surface water available for differernt users in the South-west Coast



Notes:
- Water transferred to the North-west from the Glenelg River is not included. The figures include the whole of Hopkins and Glenelg basins. The upper sections of these basins are in the Western District. Figures are sourced from REALM models, Victorian Water Resource Data Warehouse, Victorian Water Accounts 2009/10, and water corporation annual reports. These sources may have different timeframes and methods of calculation, and are compiled for indicative purposes only.
- The small catchment dams volume includes licensed and unlicensed farm dams.

Figure 8.4 Groundwater management units in the South-west Coast

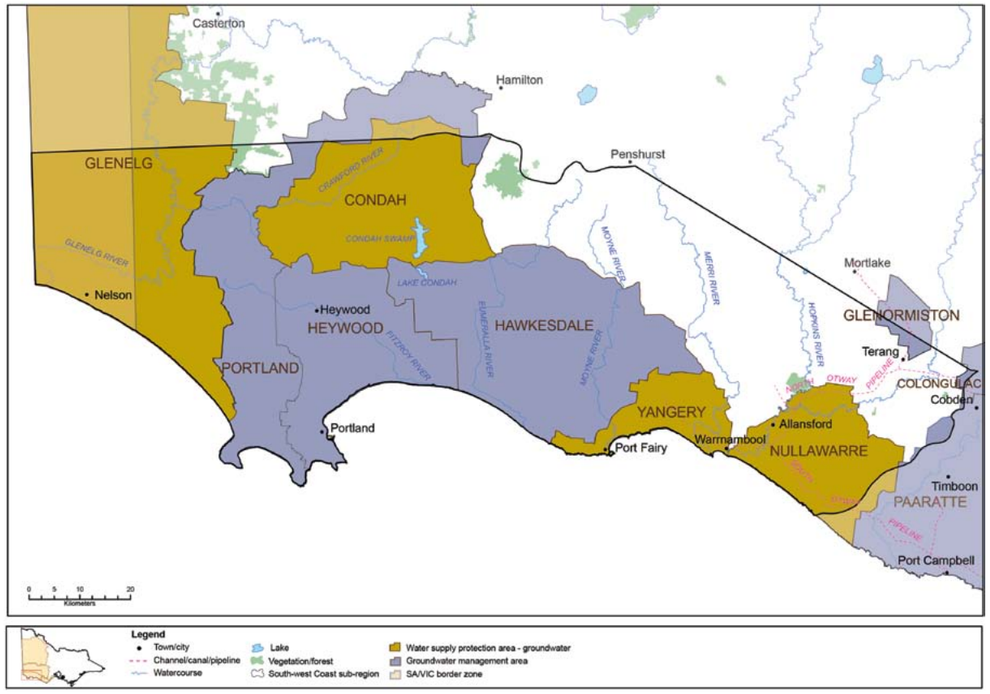


Table 8.1 Groundwater availability and use in 2009/10[a] (ML)

Groundwater management unit[b]	Permissible consumptive volume[c]	Entitlements	Available volumes	No. Licenses	Metered use	Estimated non-metered use	No. D&S bores	Estimated D&S use[d]	Licensed and D&S use
Nullawarre WSPA	21,280	21,279	1	210	9,859	0	1,014	2,028	11,887
Yangery WSPA	14,103	14,101	2	162	4,026	0	1091	2182	6,208
Condah WSPA	7,437	7,436	1	39	2,628	0	83	166	2,794
Glenelg WSPA[e]	32,660	32,660	0	81	7,759	0	1,205	2,410	10,169
Hawkesdale GMA[f]	16,161	11,753	0	109	5,214	0	1,105	2,210	7,424
Heywood GMA	8,500	6,564	1,936	94	1,578	0	1,661	3,322	4,900
Portland GMA[7]	7,795	7,794	1	7	2,726	0	51	102	2,828
TOTAL	**107,936**	**101,587**	**1,941**	**702**	**33,790**	**0**	**6,210**	**12,420**	**46,210**

GMA – Groundwater management area. WSPA – Water supply protection area.

a. The groundwater allocations, licences and usage figures are those to be published in the Victorian Water Accounts 2009/10. This table includes information for the whole of each groundwater management unit.
b. Some groundwater management units are only partly in the South-west Coast. Colongulac, Paaratte and Glenormiston GMUs have not been included because of the small amount of surface area included in this sub-region. See Chapter 7 for Colongulac and Paaratte, and Chapter 9 for Glenormiston.
c. Permissible consumptive volumes (PCV) are as at 14 July 2011, as published in the Government Gazette. Where a PCV has not been established, the volume is the sum of licensed entitlements. The total PCV includes areas in each groundwater management unit outside the sub-region.
d. Domestic and stock bore use is estimated at 2 ML/bore/year.
e. The Glenelg WSPA appears in this and the Western District tables.
f. No more licences are likely to be issued in the Hawkesdale GMA due to a June 2010 VCAT decision.

8.1.2 Groundwater

The South-west Coast has substantial groundwater resources and the most intensive groundwater use in the region. There are seven groundwater management units (GMUs) wholly or partially within the area with a total permissible consumptive volume (PCV) of 107,936 ML per year (see Table 8.1 and Figure 8.4). These units are spread across the three main aquifers of this region: the shallower Newer Volcanics, the Port Campbell Limestone and the deeper Dilwyn. There is 101,587 ML of licensed groundwater entitlements in the seven GMUs.

Metered use accounts for about 33.8 GL with about 2 GL of unallocated water under the PCVs. An estimated further 12.4 GL is extracted by domestic and stock users.

Groundwater is generally extracted from the Port Campbell Limestone Aquifer, which extends across the south of the South-west Coast and is typically 100 to 250 metres thick. This aquifer supports dairy irrigation areas such as Nullawarre, and supplements urban supply to Warrnambool, Koroit and Allansford.

The basalt (Newer Volcanics) consists of an unconfined rock aquifer, up to 120 metres thick but generally less than 70 metres. Uses for water extracted from this aquifer include stock watering, irrigation, and domestic use.

The Dilwyn Aquifer is a thick aquifer that surfaces around Merino but in other places is up to 1,000 metres below the surface. It is used mainly to supply the towns of Portland, Port Fairy and Heywood.

8.1.3 Environmental values

The South-west Coast contains critical biodiversity values supporting ecosystem services for the maintenance of high value rivers, coastal ecosystems, wetlands, and remnant vegetation across public and private land. The area is one of Australia's 15 nationally listed biodiversity hotspots. The South-west Coast's waterways support several threatened plant and animal species and communities, including the Glenelg spiny crayfish, Yarra and Ewens pygmy perch, orange-bellied parrot and the red-tailed black cockatoo. The Glenelg River estuary between Dartmoor and the sea is listed as a heritage river, and with Long Swamp is part of the Discovery Bay Coastal Park and the East Asian-Australasian Shorebird Site Network. The lower Glenelg River and Discovery Bay are nationally recognised high ecological value aquatic ecosystem sites. Lake Yambuk, an estuarine lagoon fed by the Eumeralla and Shaw rivers, the Glenelg River and its estuary, and the lower Merri River wetlands are listed as nationally significant in *The Directory of Important Wetlands in Australia*.

8.1.4 Pressures on water resources

There will be significant pressures on future water use due to climate variability and population growth, as well as other pressures on environmental values. Droughts remain a significant risk (see Section 2.2 and Appendix 3). During the dry conditions from 1997 to 2009, average annual streamflows in the Hopkins, Portland Coast and Glenelg basins fell by 40, 56 and 65 per cent respectively.

The populations of urban centres and coastal towns are expected to continue to increase, with the population served by the Wannon Water Otway water supply system predicted to rise by about 40 per cent by 2055[29]. Peri-urban growth may also increase the number and volume of farm dams intercepting run-off. The population in surrounding rural areas is projected to decline.

On-shore and off-shore gas is produced from the deep groundwater formations in the Port Campbell Limestone Aquifer. Although this can reduce groundwater availability and cause land subsidence, there is no indication this has occurred along the South-west Coast (see Section 4.4.3, page 125). Agricultural water use may increase in higher rainfall areas of the Portland, Hopkins and to a lesser extent the Glenelg basins, due largely to expansion of the dairy industry (see Section 3.3.2, page 86). Future peri-urban development may increase demand for domestic and stock supplies.

8.2 Promoting sustainable use of water

8.2.1 Providing certainty and improving flexibility for water users

Rocklands and Moora Moora reservoirs capture water in the Upper Glenelg catchment for use in the Wimmera-Mallee supply system, and diversions are made from Grampians streams to supply Hamilton. These storages have passing flow rules and do not affect flows in the lower reaches of the Glenelg River. No other waterways along the South-west Coast have any significant flow regulation.

In unregulated flow catchments, water is allocated to:

- water corporations with bulk water entitlements to access surface water and groundwater;
- individuals with a licence under section 51 of the Water Act to take and use surface water; and
- individuals and water corporations with a licence under section 51 of the Water Act to take and use groundwater.

If water is available, it can be taken and used in accordance with the licence or bulk water entitlement conditions. If there is not enough for all needs, water use is restricted to share the available water between existing users and the protection of the environment, as well as domestic and stock water users and the long-term use of the resource.

Local management plans

In many areas, management of licensed water use needs to be more responsive and adaptable to local conditions and the characteristics of each groundwater or unregulated river system. Local management plans will be used in the catchments and groundwater systems of the South-west Coast where there are a significant number of licensed water users (see Policy 3.3, Action 3.5 and Tables 8.2(a) and (b)).

These plans will clearly define the rules for how water is managed on unregulated systems and groundwater management units to meet the needs of licensed water users and the environment. They are operating plans that address all significant issues in an area and define water sharing and management arrangements, particularly during times of shortage (see also Section 3.1.3, page 60).

Table 8.2(a) Local management plans for surface water

	River Basin	Unregulated river system	Timeframe
Areas where existing rules will be documented as local management plans	Glenelg	Glenelg River Crawford River Stokes River Wannon River Grange Burn	Mid 2012
	Hopkins	Hopkins River/Mt Emu Creek/Brucknell Creek	
	Portland Coast	Condah Drain Fitzroy River Moyne River Shaw River Surrey River Eumeralla Creek	
Areas where existing rules will be reviewed or improved[a]	Hopkins	Merri River[b]	End 2012

Note: A local management plan will be developed for each river basin. Where needed, plans for specific unregulated rivers within each basin will be developed and attached as a schedule to the local management plan for the basin.

[a]Existing rules will continue to apply in these areas until they are reviewed/revised and incorporated in a new local management plan.

[b]The Merri River will be managed based on a local management plan that will include changes to rules outlined in Action 8.4. A statutory streamflow management plan will not be prepared.

Table 8.2(b) Local management plans for groundwater

	Management Area	Timeframe
Areas where existing rules will be documented as local management plans	Hawkesdale GMA Portland GMA Heywood GMA Unincorporated areas	Mid 2012
Areas where existing rules will be reviewed or improved	Nullawarre WSPA[a] Yangery WSPA[a]	End 2012

[a]WSPAs proposed to be undeclared (see Table 4.2, page 112); once undeclared, existing management plans will be revised and documented as local management plans.

Aligning groundwater management boundaries with aquifer systems

Over time, groundwater management boundaries in the South-west Coast will be adjusted to be based on groundwater systems. This will ensure that all users of the same groundwater system are subject to consistent rules. This will better protect the resource, existing users and the environment (see also Section 4.2.1, page 107).

The rights of existing licence-holders to take and use groundwater will be protected throughout this process, and transition arrangements will be developed to help users with the management changes.

Managing significant land use changes

Major land use changes have created pressures on water availability in some areas, particularly in the south-west of Victoria (see Chapter 5, page 129). In the past 14 years, this has mainly been due to the development of plantation forestry. In future, it is expected that more land will be covered by vegetation with higher water requirements, which will generally decrease water availability. Further expansion of plantations may be driven by the introduction of a price on carbon.

This Strategy sets out a state-wide approach for managing adverse impacts of land use change on water resources that enables rural water corporations to control new forestry developments in 'hotspot' areas declared under the *Water Act 1989* (see Section 5.1, page 130). Based on available information, the highest priority areas for a regional committee to assess are all or parts of the Crawford and Stokes River catchments and Glenelg Water Supply Protection Area (see Section 5.6, page 141). If these areas are declared, most landholders will not be affected. They will be able to plant 20 ha or 10 per cent of a property, whichever is greater, to farm forestry or native revegetation without restriction.

Water for new entitlements

The Portland Coast River Basin has 28.8 GL of unallocated surface water available for the winter-fill period under existing sustainable diversion limits (SDLs). However, several of the catchments in this basin have significant areas of plantation development on previous pasture, and this increase in water use was not taken into account when the SDLs were determined. Present demand for additional water is low partly because of reliable groundwater resources and drainage problems in some areas.

In the Hopkins River Basin, 590 ML of unallocated winter-fill water is available under the SDL for the Merri River (see Section 8.3.1). No other unallocated water is available in the other waterways in the Hopkins and Glenelg basins.

The Government supports a balanced approach to making new water available having regard to the principles in Policy 3.7 (page 80). A key issue for the Strategy is determining how these unallocated resources should be shared so that there is an appropriate balance between water consumption and the environment. Water not extracted for consumptive use provides environmental, recreational and cultural benefits to the community and supports the supply reliability for existing water users.

Studies were completed recently of the likely demand for, and availability of, water along the South-west Coast (Technical Reports 3 and 4). The likely future demand was determined from discussions with regional industries. The upper limits of these estimates were used as a guide to adjusting the volume of water available under the caps in each catchment. Unallocated water remains available in catchments identified as likely to support further agricultural development or intensification – dairying is likely in the next 10 years between Port Fairy and Portland, and further demand may occur in the Merri catchment. For several catchments, the volume of unallocated water available for use was revised (see Action 8.1) based on the:

- expected increase in demand;
- large increase in unaccounted catchment water use by plantation forestry since the mid-1990s;
- lack of suitable land for intensification of agriculture in some areas; and
- environmental, cultural, recreational and tourism values of specific catchments, waterways and estuaries (for example, Lake Condah).

Action 8.1 Revised caps on the amount of unallocated surface water available for winter-fill diversions in the South-west Coast

Who: Department of Sustainability and Environment, Southern Rural Water, Glenelg Hopkins CMA **Timeframe:** End 2012

Consistent with the principles outlined in Policy 3.7 (page 80), the following caps will be placed on the amount of unallocated surface water that remains available for new winter-fill (July to October) diversions from unregulated waterways:

- 2,500 ML in the Fitzroy River, Darlots Creek, Condah and Louth Drain catchments;
- 500 ML in the Surrey River catchment;
- 500 ML in the Eumeralla and Shaw river catchments;
- 300 ML in each of the six small coastal catchments between the Eumeralla River and Darlots Creek, and around Portland and Cape Bridgewater;
- 590 ML in the Merri River (see Section 8.3.1, page 199); and
- 680 ML in two small coastal areas of the Hopkins Basin (Buckley Creek, Nullawarre, and south of Tower Hill Lake)

The Moyne, Hopkins and Glenelg rivers will be capped at the current level of allocation. The availability of water within each catchment will depend on location and the access conditions imposed on the licences.

Not all of the remaining water will be made available immediately. A staged approach will be taken to allocate this water, with Southern Rural Water determining how this water will be allocated in each catchment – which may occur initially through expressions of interest, auctions or through allocations based on a reserve price.

The amounts of water available for new entitlements in the South-west Coast will be reviewed as part of the review of this Strategy in 10 years.

This balanced approach will help to protect the reliability of supply to existing users as well as protecting environmental values. It will also enable new allocations to be made as knowledge of the resource improves over time. This approach will allow flexibility to adapt over time, with volumes to be evaluated again in 10 years as part of the review of the Strategy.

New groundwater entitlements are available under existing permissible consumptive volumes in the Heywood (1,936 ML) Groundwater Management Area (see Table 8.1). In this area, groundwater will continue to be allocated case by case, depending on potential impacts on existing users and the environment as defined in the Water Act. The Government supports additional water being made available where a resource appraisal shows this can be done sustainably (see also Section 3.2.5, page 80).

Water trading

In those parts of the South-west Coast where no new water entitlements are available, the only way to obtain more water is to buy it from other water users unless an alternative source (such as recycled water) is available.

An investigation into water trading in unregulated catchments including those in the South-west Coast was undertaken as part of this Strategy. The conclusions and consequent actions to improve the ability to trade surface and groundwater entitlements throughout the region are presented in Section 3.2.3 (page 68). Actions include:

- improving information about water markets and trading;
- increasing the potential for trade in unregulated surface water and groundwater systems;
- developing a risk-based approach to approving water trades; and
- facilitating limited-term transfers or leases, or leases in unregulated surface water and groundwater systems.

Managing other pressures on future water availability

The South-west Coast contains some small areas from Port Fairy to Portland and Nelson with coastal acid sulfate soils. These areas are mapped in the Victorian Acid Sulfate Soils Strategy, and these soils are managed under the Coastal Acid Sulphate Soils Strategy. To date, there have been no reports of acid sulfate problems in the South-west Coast. This may change as urban development expands around coastal centres. The best management is to leave these soils undisturbed.

Other policies and actions to provide certainty and improve flexibility

Action 3.4 Monitoring and tracking water use outside the entitlement framework. Page 60

Policy 3.3 and Action 3.5 Developing more responsive local management plans. Page 61,63

Policy 3.4 Developing statutory management plans where needed. Page 65

Action 3.7 Improving information sharing about climate variability and risks. Page 68

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.10 Investigating the potential to harvest high flows. Page 72

Action 3.11 Extending the reticulated supply network. Page 73

Action 3.12 Improving opportunities for water trading. Page 75

Action 3.13 Encouraging fit-for-purpose use alternative water supplies. Page 79

Action 4.1 Aligning groundwater management boundaries to aquifer systems. Page 107

Action 4.6 Strategic groundwater resource assessments. Page 117

Action 5.1 State-wide recording of water use by land use changes. Page 132

Action 5.3 Declaring areas to control water intensive land use changes. Page 134

Action 5.5 Considering cumulative impacts of land use in decisions on water use. Page 140

8.2.2 Improving reliability of supply for urban and industrial water users

The Gellibrand River and Arkins tributaries supply about 10,000 ML per year to towns in the South-west Coast, Otway and Western District sub-regions, including Warrnambool, Camperdown, Terang, Koroit, Cobden, Simpson, Mortlake, Allansford, Lismore and Derrinallum. About 1,300 farms are supplied from this system, as well as large dairy processing industries.

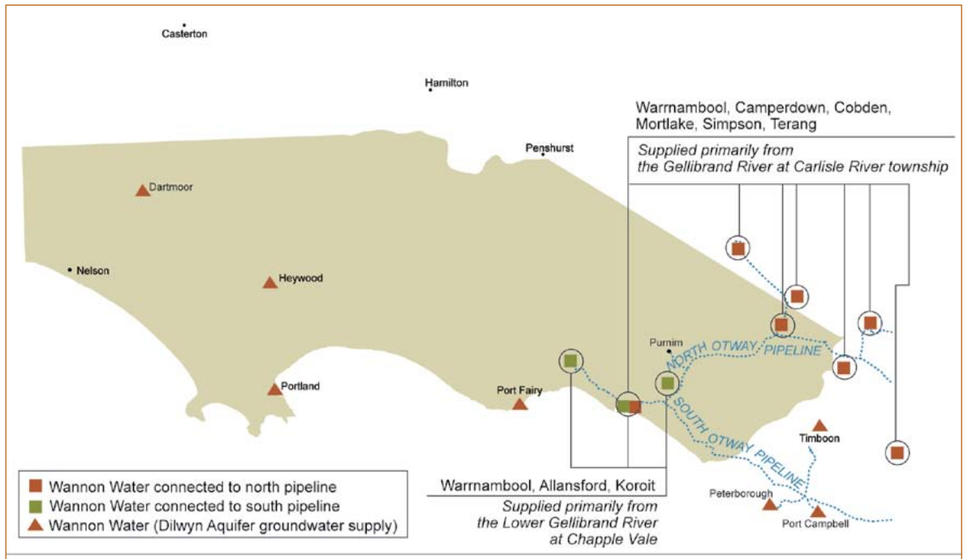
Wannon Water manages the three main water supply systems (see Table 8.3) along the South-west Coast: the Otway supply systems (see Section 7.2.2, page 176), the Dilwyn supply system, and local shallow groundwater systems, such as Macarthur, Penshurst and Caramut.

As a result of the recent prolonged dry conditions, Wannon Water has implemented demand management measures and major infrastructure investments to improve the reliability of water supplies and the resilience of the supply systems. These include:

- Leakage detection and reduction within the reticulated water network.
- Municipal water use plans, a showerhead exchange program and education and community awareness.
- An alternative water source project to replace demand for potable supplies, such as the use of recycled dairy condensate to irrigate the Warrnambool golf course.
- The first phase of an urban roof water capture system that enables water from house roofs to be harvested and mixed with other raw water, treated and then supplied to the City of Warrnambool. This will allow a significant growth corridor of Warrnambool to be 'water neutral' with no additional demand from the Otways.
- A behaviour change program run by Deakin University, Portland Aluminium and the Victorian Water Trust aimed at reducing customer demand for water.
- An investigation by Warrnambool City Council, Brauerander Park Foundation and the Victorian Water Trust of managed aquifer recharge to store stormwater for later use. The proposed scheme harvests and treats stormwater captured from the roofs of Brauer College, injects it into an aquifer for storage for later extraction to irrigate sporting fields and parkland.

Future opportunities for greater efficiency will be considered by comparing the costs and potential benefits. For example, improvements at the Warrnambool Water Reclamation Plant will allow about 2,000 ML to be reused each year. This plant treats household sewage as well as trade waste from several large commercial and industrial customers. The reclaimed water from this process is treated to meet Environment Protection Authority standards and then released to the ocean. Depending on the economic viability and benefits of potential uses, this water could be used for new development or to substitute water currently extracted from waterways.

Table 8.3 Wannon Water supply systems in the South-west Coast



Supply system	Towns supplied	Main source(s) of supply	Population served[a]
North Otway[b]	Noorat/Glenormiston, Mortlake, Simpson, Cobden, Camperdown, Lismore, Derrinallum, Purnim, Terang, Warrnambool, Allansford, Koroit	Arkins Creeks and Gellibrand River catchment, groundwater flow- extracted from bores near Carlisle River	47,7000
South Otway[b]	Warrnambool, Allansford, Koroit	Lower Gellibrand River and shandy of local groundwater in Warrnambool	
Dilwyn	Dartmoor, Heywood, Port Fairy, Portland	Dilwyn Aquifer	17,400

Note:
a. Figures about the population served are estimates provided by each water corporation.
b. The North and South Otway systems include towns in the Otways and Western District sub-regions.

Urban water supply planning

All urban water corporations in Victoria are required to undertake long-term planning to develop water supply-demand strategies which aim to ensure adequate supply reliability in the future. These strategies consider all risks to water supplies as well as options to manage demand or improve supply. They assess the need for, and timing of, future supply augmentations. The risks considered include the potential climate impacts on run-off and the increased water demand from growing populations. These strategies will be revised with the lessons learnt from the prolonged dry period from 1997 to 2009 and heavy rainfall in 2010 and 2011 (see also Section 3.3.1, page 83).

The water efficiency and supply augmentation measures already implemented or planned by Wannon Water will secure urban supplies in the South-west Coast even with a possible reduction in run-off due to climate change (see Appendix 4).

Further supply augmentations are not expected to be needed for some time. The requirement and timing for augmentations and demand management will be reassessed periodically through the water supply demand strategy process and future reviews of the Western Region Sustainable Water Strategy.

Action 8.2 Revising urban water supply-demand strategies

Who: Wannon Water **Timeframe:** March 2012

Wannon Water will revise its water supply-demand strategies by March 2012, taking into consideration experience and information gathered from the prolonged dry period and heavy rainfall over the past 14 years.

The updated strategies will incorporate the findings for the review of permanent water savings rules.

Other actions in the Strategy to improve reliability of supply for urban users

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.13 Encouraging fit-for-purpose use of alternative water supplies. Page 79

Action 3.16 Updating water supply-demand strategies. Page 84

Action 3.17 Review of the Victorian Uniform Drought Water Restriction Guidelines and Permanent Water Savings Rules. Page 85

Action 3.18 Facilitating integrated water planning. Page 85

8.2.3 Managing the Dilwyn Aquifer

The Dilwyn Aquifer (also known as the Lower Tertiary Aquifer) is the deepest water supply aquifer in south-west Victoria and is used mainly to provide towns in the region with drinking water.

In 2011, the Department of Sustainability and Environment, Southern Rural Water and Wannon Water completed the first part of a study to better understand the aquifer. The first part of the study looked at understanding the flow patterns into, out of and within the Dilwyn Aquifer.

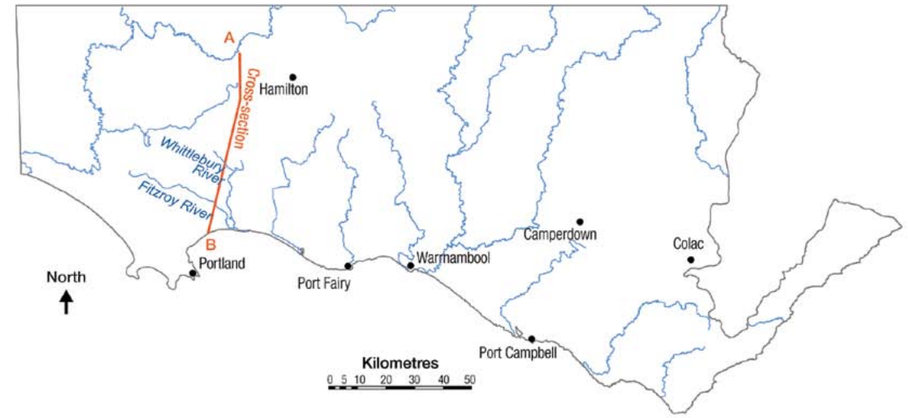
The study described five zones where groundwater flow could be considered continuous. The findings and improved understanding of the aquifer will be used in revising the management boundaries through the Secure Allocation Future Entitlements project (see Section 4.2.1, page 107).

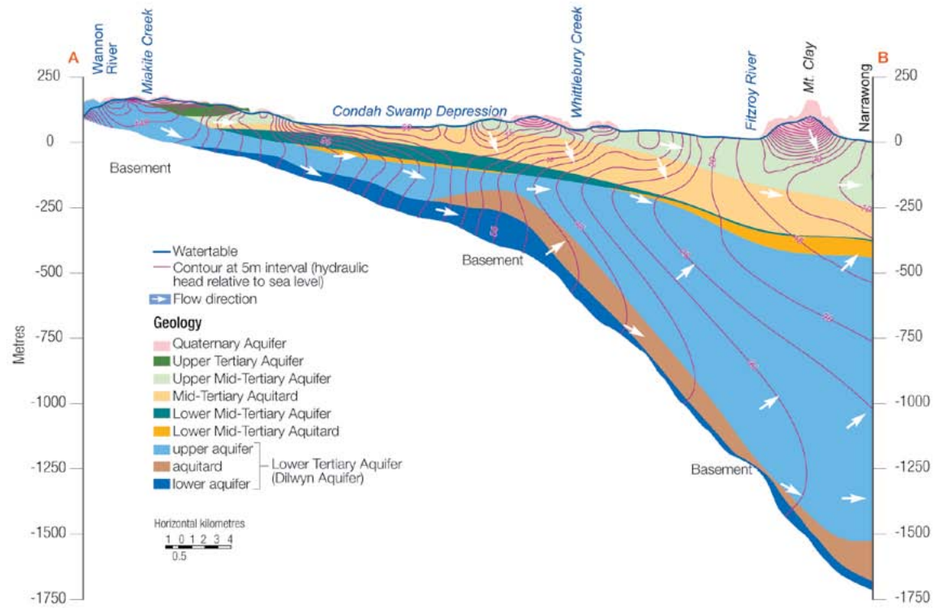
Findings from the study include:

- Areas where rainfall can directly recharge the Dilwyn Aquifer have been mapped. In general, the aquifer is at, or near, the surface in the north and east of the aquifer (around Dartmoor, Hamilton and in the Otway Ranges), and becomes thicker and deeper towards the coast (more than 1 km deep at Port Fairy). Rainfall recharge, plant water use and discharge to streams are significant processes in the recharge areas, while leakage from the aquifers above and below forms the major inflow in the deep, confined coastal areas. Significant outflows occur off-shore from all zones.
- Changes in land use and climate are expected to affect recharge to the aquifer where it is near the surface. Water from the Dilwyn flows into some upper reaches of the Gellibrand and Glenelg rivers and will need to be considered as part of any management framework.
- In the deeper, confined areas, water movement from layers above and below the Dilwyn is significant and is a priority for further assessment. This part of the aquifer is less sensitive to changes in land use and climate, so management approaches can be considered over much longer timeframes.
- Major gaps exist in the State Observation Bore Network for the Dilwyn. In addition, many of the current State and private bores are old and in poor condition.
- The groundwater salinity is mostly low (<1,000 mg/L) in the Otway Ranges and coastal areas but much higher (>3,500 mg/L) in the northern and central confined areas (eg. Camperdown and north of Warrnambool). Salinity also varies with depth, but without clear trends.
- The location of the Dilwyn's discharge zone and seawater interface are estimated to be at the continental shelf, about 50 km off-shore. The risk of seawater intrusion affecting onshore users is therefore low.

Stage 2 of the assessment is due to be completed by early 2012. It will address some of the remaining key knowledge gaps, such as the capacity of the aquifer to provide more water without significant risks to users and the environment.

Figure 8.5 Cross section of the Dilwyn Aquifer





8.2.4 Restoring Lake Condah

The Gunditjmara people of south-west Victoria built a vast and complex network of channels and ponds to harvest eels at Lake Condah. This aquaculture system was maintained over thousands of years and enabled the Gunditjmara to establish a permanent settlement believed to be one of the earliest of its kind in the world.

Restoration of the lake has been the aspiration of the Gunditjmara for the past 30 years. In 2002, the Windamara Aboriginal Corporation, for the Gunditjmara people, launched the Lake Condah Sustainable Development Project aiming to restore the lake and surrounding heritage features. Restoration will revitalise the biodiversity and ecology of the area and enable reuse of the traditional eel trapping and harvesting systems. The local community and economy will benefit from sustainable primary industries and cultural tourism. The Gunditjmara are once again key players in caring for their Country.

The successful partnership between the Gunditjmara and government agencies has highlighted the cultural significance of the area and contributed to the recognition of the Budj Bim National Heritage Landscape. Lake Condah was returned to the Gunditjmara in March 2008.

A weir was completed in 2010 to counteract the effects of past drainage and improve flows to the lake. A vital component of the construction was the employment of local Gunditjmara and other Aboriginal and Torres Strait Islander people on the construction team. The Lake Condah Project won the Earth Award, conducted by the Civil Contractors Federation of Victoria, for the successful construction of the weir. The heavy rains in June 2010 reflooded Lake Condah. Subsequent heavy rain into 2011 has maintained water levels in the lake.

Currently, there are no formal management arrangements for sharing water between Lake Condah and other water users. Water management arrangements could be established to provide greater certainty and accountability for the restoration project, downstream environment and existing users. Management arrangements would need to:

- cap water use in the catchment;
- clarify and formalise existing water-sharing rules, including flow requirements downstream of the lake for domestic and stock use and environmental objectives;
- incorporate weir design criteria and minimum passing flows recommended in environmental flows studies; and
- improve water metering and accounting (if possible within financial constraints).

The preferred option for formalising management arrangements is developing a local management plan.

Action 8.3 Preserving cultural values of Lake Condah

Who: Department of Sustainability and Environment, Southern Rural Water **Timeframe:** Mid 2012

Water management arrangements for the Lake Condah restoration project will be formalised through a local management plan.

Lake Condah Photo: DSE

8.3 Protecting the South-west Coast waterways, aquifers, wetlands and estuaries

The South-west Coast includes the lower reaches of the Hopkins and Glenelg rivers, as well as several smaller streams such as the Merri, Moyne, Surrey, Eumeralla and Fitzroy rivers. With the exception of the Glenelg estuary, the condition of these waterways is generally moderate to poor, which is consistent with the cleared landscape and highly modified patterns of flow. The estuaries along the South-west Coast range in condition. Some estuaries, such as the Hopkins estuary at Warrnambool, suffer from poor water quality and occasional algae blooms. These rivers and estuaries support significant tourism and recreation values for the area. The Lower Glenelg River is listed as a heritage river.

The environmental flow regimes for the Merri River, the Glenelg River, and the Darlots Creek/Fitzroy River system have been determined with the aim of protecting and improving the health of these river systems.

Many wetlands are suffering from cumulative pressures of disturbances and reduced water quality from agricultural activities, and altered flow regimes including drainage.

Healthy estuaries support the health of riverine ecosystems further upstream. About two-thirds of fish species native to southern Victoria have to migrate between fresh and saltwater to complete their life cycle. The Lower Merri River wetlands including Kellys and Saltwater swamps, and the estuaries and wetlands associated with Eumerella and Glenelg rivers are listed as a nationally important wetland due to their high habitat values. They contain significant habitat for rare species such as the orange-bellied parrot and are breeding grounds for the hooded plover and other ground nesting birds.

Estuaries in the region naturally close intermittently. The Glenelg Hopkins CMA protects estuaries using the Estuary Entrance Management Support System. This system considers the risks of artificially opening estuary mouths at different water levels and times of the year, and possible impacts on infrastructure and natural assets. The CMA will continue to implement this system across the eight estuaries to ensure they are managed appropriately.

The most significant environmental risk to each of these river systems is reduced flows due to climate variability and/or water extraction, and poor water quality from nutrients and sediment in run-off. The prolonged dry period from 1997 to 2009 stressed the environmental values of the South-west Coast's waterways. This was particularly the case during dry summers when there is a greater impact from consumptive uses. These impacts on water quality and streamflows will continue to put pressure on environmental values.

A balanced approach will be taken when releasing unallocated water for consumptive use and setting interim caps (see Action 3.14, page 81). The health of the South-west Coast's waterways will be improved by investing in best practice catchment management activities, complementary works, water quality programs, and a management approach that is adaptive to a changing environment.

8.3.1 Environmental flows for the Merri River

Water extraction and farm dams have reduced streamflows in the Merri River, especially in dry years. This has adversely affected riverine habitat and environmental values, including significant species such as platypus, mountain galaxias, blackfish and the threatened Yarra pygmy perch. River health is also affected by extensive agriculture development in its catchment with only 0.9 per cent of native vegetation remaining and urbanisation affecting hydrology and water quality in the lowest sections of the river through Warrnambool.

Management of the river since 1998/99 has been based on a draft streamflow management plan – the first to be developed in the State for an unregulated river. The draft plan was developed by a committee with broad representation and went through a public consultation process. It aimed to find better ways to balance water use and environmental water needs. The draft plan recommended improved environmental flows to maintain river health, with the potential to reduce water availability for some consumptive allocations in the upper catchment.

The Merri River is split into two reaches for diversions management – upstream and downstream of Woodford. Downstream of Woodford, the river consists primarily of two long pools. Environmental flows were recommended to provide in-stream habitat and prevent water quality decline, algal blooms and the dominance of pond weed in the lower reach particularly during summer. Nutrients in rural catchment run-off and urban stormwater from Warrnambool contribute to these problems.

Rosters, restrictions and bans on water extraction have been implemented frequently since 1998/99 due to drought and increases in environmental flows.

Future management

The community and water managers have put in considerable effort over the past 10 years to finding appropriate flow management arrangements for the Merri River. Using the latest information, all stakeholders collaborated to find the best approach to achieve the desired environmental objectives and allow equitable sharing of water between users in different parts of the river.

The current flow management rules:

- consider environmental flow recommendations and water use patterns along the river;
- identify suitable flow requirements for the two river reaches in summer and winter;
- resolve operating rules that protect river health and allow sustainable water use and define the conditions for summer and winter-fill diversions;
- allow more equitable access to water along the river system; and
- clearly document operating arrangements and environmental objectives so that water users understand how those rules will affect their businesses.

These rules provide greater flexibility for upstream water users, and some environmental benefits in the downstream reach.

There are no new all-year licences available, and winter-fill (July to October inclusive) diversion rules have been modified to reflect the minimum recommended flow of 43 ML per day at the Woodford gauge. This revised flow means that a winter-fill volume of 590 ML per year is available to new users under the sustainable diversion limit. This improves access to water for consumption and is consistent with current state-wide practices and best science.

Any future water recovery for the environment will be based on an assessment of the costs and benefits.

Action 8.4 Improved environmental flows for the Merri River

Who: Department of Sustainability and Environment, Glenelg Hopkins CMA, Southern Rural Water, local water user representatives **Timeframe:** End 2012

A local management plan will formalise diversion rules from the Merri River. Key points for the plan include:

- maintaining a minimum summer flow of 10 ML per day, over a five-day rolling average at Woodford and Bromfield;
- a trigger for a ban on diversions if the minimum instantaneous summer flow (November-June) falls below 8 ML per day at Woodford and Bromfield;
- a trigger for a ban on diversions if the minimum instantaneous winter flow (July-October) falls below 43 ML per day at Woodford;
- the year-round licence volume is capped at the current allocation; and
- 590 ML is available under a winter-fill (July-October) licence cap.

8.3.2 Complementary works and programs

Providing adequate environmental flows and protecting or restoring riparian habitat and water quality will sustain healthier waterways. Complementary river restoration works and better management of the catchment maximise the benefits of environmental flows.

The Glenelg Hopkins Catchment Management Authority (CMA) will continue to implement complementary in-stream and streamside works based on its regional strategy. In the South-west Coast in 2011/12, the Glenelg Hopkins CMA will invest up to $7.5 million in river health activities (see also Section 3.4.2, page 94).

8.3.3 Protecting the environment's share

The balanced approach to issuing any new water entitlements for consumptive use (Policy 3.7, page 80) will help to ensure new water allocations occur only where there is a relatively low risk to environmental values.

The volume of water available under the caps in some unregulated waterways has been revised based on the likely future demand (Action 8.1). This will contribute to environmental flows in these streams as well as protecting recreational and cultural values and supply reliability for existing water users.

Action 8.5 Investing in integrated catchment management to improve South-west waterways

Who: Department of Sustainability and Environment, Glenelg Hopkins Catchment Management Authority **Timeframe:** Ongoing

The Government will continue to invest in integrated catchment management to protect and improve the ecological condition of waterways in priority areas of the South-west Coast and enhance environmental resilience to dry periods. This will be done through on-ground actions including revegetation, fencing of riparian areas and reducing dryland salinity. Improvements in catchment management will help to improve water quality in estuaries.

Other policies and actions in the Strategy to protect the environment

Policy 3.9 Structural works to maximise the benefits of environmental watering. Page 92

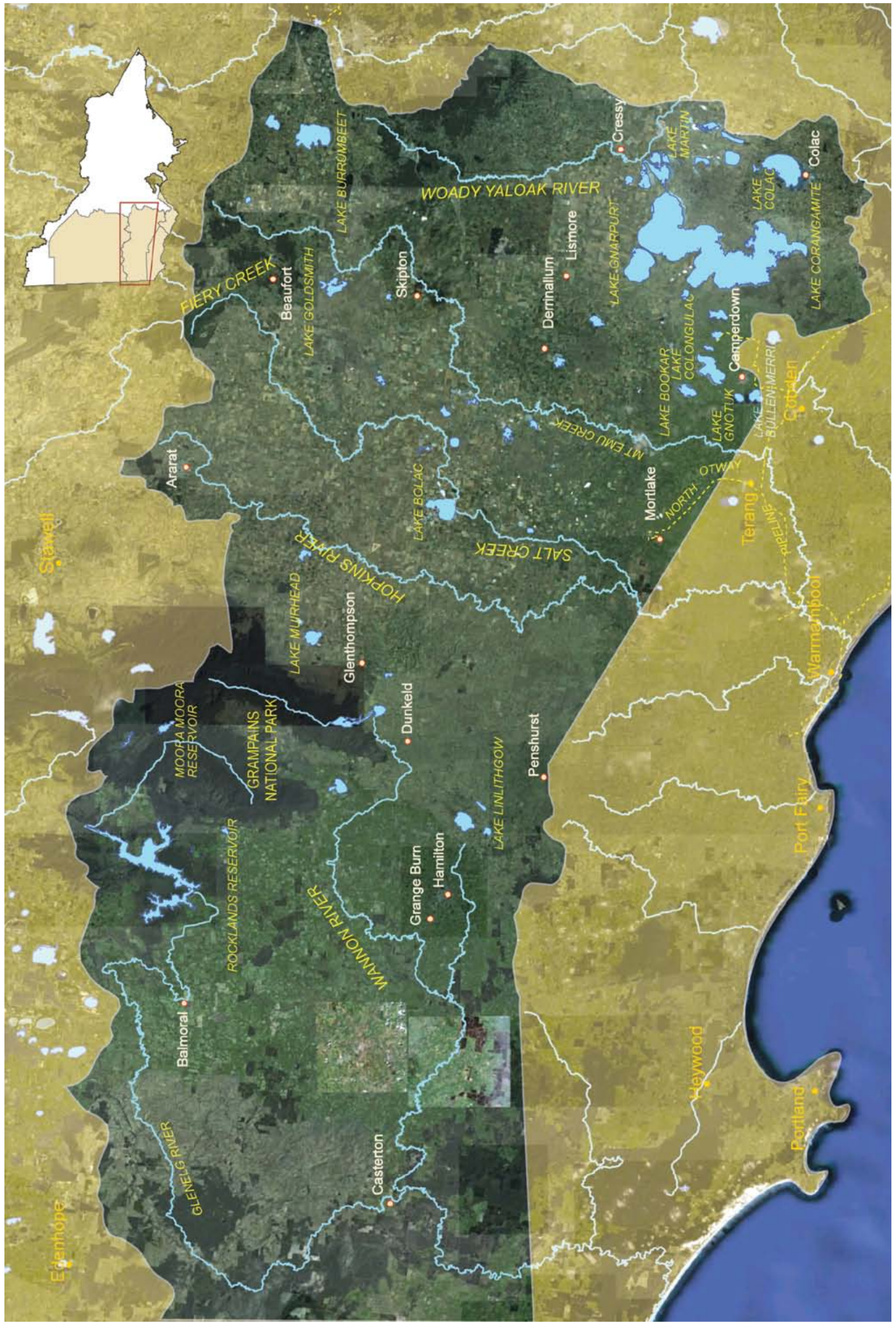
Action 3.21 Managing riparian land. Page 95

Policy 3.12 Exploring opportunities for muliple benefits through local water planning. Page 95

Action 3.14 Balanced approach to managing unallocated water on unregulated rivers. Page 81

Policy 4.3 and Action 4.11 Risk-based approach to managing groundwater dependent ecosystems. Page 123

Figure 9.1 The Western District



The Western District

The actions presented in this chapter aim to meet the specific water needs of the Western District. They focus on enhancing and protecting the reliability of supply for existing and future consumptive water users while protecting the needs of the environment. Together with region-wide actions, they aim to provide a strong and flexible framework that will enable water managers and users to respond to demographic, land use and climatic changes in the Western District.

Guide to this chapter

9.1 Water availability and use

The Western District contains the Corangamite Basin, the upper parts of the Glenelg and Hopkins basins and the southern tip of the Millicent Coast Basin (see Figure 9.1). Major towns include Hamilton, Ararat, Colac and Casterton. The Grampians National Park is a major regional attraction. The sub-region contains many lakes and wetlands, including Lake Bolac and Lake Corangamite, Victoria's largest natural lake. Rainfall is moderate – typically 600 to 800 mm per year.

The major rural activities are beef and sheep (for meat and wool), dairy, timber, cropping and some horticulture. Beef and prime lamb production remain integral to the regional economy, and food and fibre producers have diversified into cropping, plantation forestry, vegetables and nurseries. Western Victoria is the fastest growing dairy region in Australia, and of the dairy regions, it produces the second largest volume of milk.

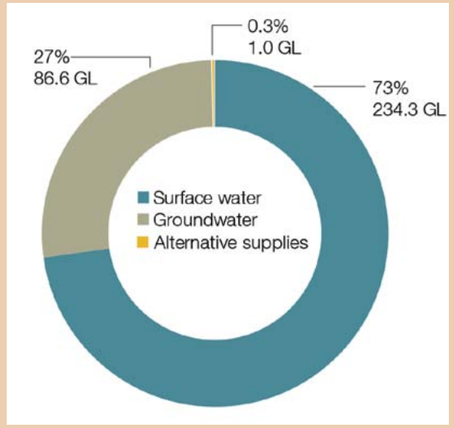
Surface water provides the most water available for extraction (73 per cent) with groundwater providing 27 per cent (see Figure 9.2). Most water is used for rural and agricultural purposes. Salinity is an issue for surface water and groundwater use across the Western District.

9.1.1 Surface water

Major rivers in the Western District include the Upper Glenelg, Wannon, Upper Hopkins and Woady Yaloak rivers. The Corangamite Basin lies between the Great Dividing Range and the Otway Ranges and drains to Western District lakes at its centre rather than to the sea.

Annual streamflow for the Glenelg, Hopkins and Corangamite basins is 1,300 GL on average, but this varies greatly. In the Hopkins Basin, for example, streamflow was less than 25 per cent of the annual average in half the years on the historical record. In years with the highest 10 per cent of rainfall, streamflow is almost 350 per cent of annual average flow. This variability explains why surface water in most catchments is fully committed, even though only a relatively small proportion of total streamflow is used (see Figure 9.3).

Figure 9.2 Proportion of water available for extraction in the Western District



Notes:
- The surface water data is based on long-term modelling and Victorian Water Accounts (VWA) information and is the water available under current entitlements and caps. The surface water volumes also include farm dams, which account for a large proportion of total surface water in some areas. This figure includes all of the Glenelg and Hopkins basins, parts of which are not in the Western District.
- The groundwater volume is the total of permissible consumptive volumes as at 14 July 2011.
- Alternative sources have been taken from VWA 2009/10.
- Water supplied to the Wimmera-Mallee system is included in the surface water volume.

Small catchment dams are the main source of water, with about 194 GL used almost entirely for domestic and stock water. There are particularly high densities of farm dams in the Upper Hopkins and Glenelg catchments.

The major storages are Rocklands Reservoir on the Upper Glenelg River and Moora Moora Reservoir in the Grampians. More than 60 per cent of the flow in the Upper Glenelg catchment is diverted to the Wimmera-Mallee supply system from these storages.

East of the Grampians, in the Hopkins and Corangamite basins, urban water supplies are generally sourced from other basins due to the higher salinity of local water and relatively low, unreliable streamflow. Some towns are supplied from the Wimmera-Mallee system by GWMWater, others are supplied from the Ballarat system by Central Highlands Water, and from the Otway Ranges by Barwon Water and Wannon Water (see Section 9.2.2). Some town water supplies are complemented by local groundwater bores.

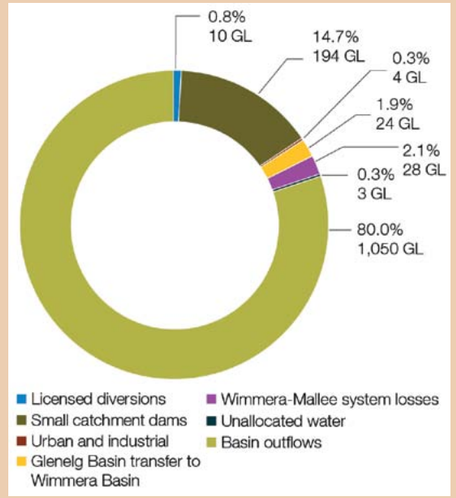
Licensed diverters take relatively small volumes of water from streams including Mt Emu Creek and the Hopkins River in the Hopkins Basin; Lake Tooliorook in the Lake Corangamite Basin; and the Glenelg River, Grange Burn Creek and Wannon River in the Glenelg Basin.

Most urban wastewater in the upper Hopkins and Glenelg basins is recycled. In the Corangamite Basin, about 1,730 ML per year is available for recycling from the Colac Wastewater Treatment Plant[a].

Sharing between the Wimmera and Glenelg rivers

Water for environmental flows has been recovered by constructing the Wimmera-Mallee Pipeline (see Chapter 6). These flows are split between the Wimmera (60 per cent) and the Glenelg (40 per cent) river systems. The regulated environmental allocation for the Glenelg River of about 12,000 ML on average each year provides much needed summer baseflow, summer freshes and contributes to winter/spring flushes. The Glenelg River can also receive flows between July and November as passing flows – a proportion of inflows into Rocklands Reservoir – are allowed to pass downstream. These flows aim to mimic natural flow patterns and reduce the impact of the reservoir on river ecology. These flows also provide downstream communities with domestic and stock supply which would otherwise be greatly diminished.

Figure 9.3 Surface water available in an average year for different uses

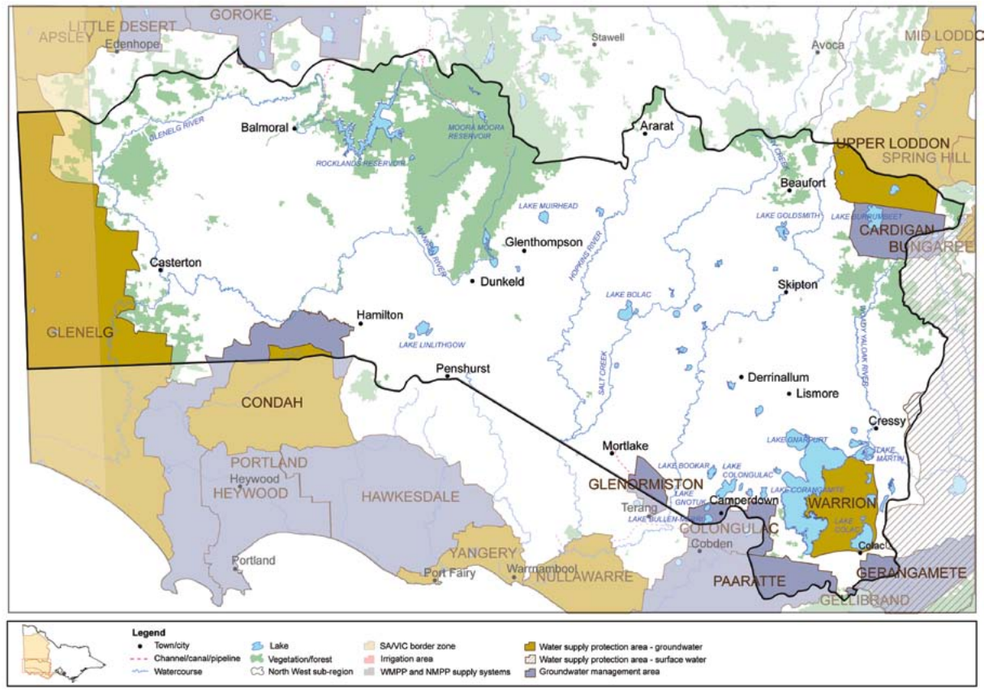


Notes:
- The figures include the whole of Hopkins and Glenelg basins. The lower sections of these basins are in the South-west Coast sub-region. They also include water transferred to the Wimmera-Mallee supply system in the North-west sub-region. Figures are sourced from REALM models, Victorian Water Resource Data Warehouse, Victorian Water Accounts 2009/10, and water corporation annual reports. These sources may have different timeframes and methods of calculation, and are compiled for indicative purposes only.
- The volume for small catchment dams includes licensed and unlicensed farm dams.

Baseflow for domestic and stock supply downstream of the reservoir is also provided by the Glenelg River compensation flows – 3,300 ML each year on average which also helps to dilute salinity downstream to Harrow. The Glenelg Hopkins Catchment Management Authority, with the Storage Manager and Victorian Environmental Water Holder, manages the releases of this water with environmental flows (see Section 6.2.2, page 148).

[a] From Victorian Water Accounts, average 2003/04 to 2006/07

Figure 9.4 Groundwater management units



9.1.2 Groundwater

Most aquifers in the Western District consist primarily of fractured rock, and their low yields and marginal quality result in minimal extraction for commercial purposes. As a result, lower volumes of groundwater are used in this sub-region than elsewhere in the Western Region.

Six groundwater management units are at least partly within the Western District (see Figure 9.4), with a total permissible consumptive volume of 86,676 ML per year (see Table 9.1). In 2009/10, about 29,534 ML was used from 388 licences. Domestic and stock use was small in comparison – about 4,486 ML each year from 2,243 bores.

Several towns throughout the sub-region are supplied with groundwater. Casterton, Coleraine, Sandford, Merino and Penshurst are solely supplied by groundwater from the Port Campbell Limestone Aquifer. Local groundwater augments supplies for Mortlake, Skipton, Willaura, Lake Bolac, Moyston, Glenthompson and Wickliffe (see Section 9.2.2).

The major groundwater development in the Western District is in basalt aquifers around Warrion, north-east of Colac. Currently there are 132 licences to extract groundwater, accounting for a total entitlement of 14,000 ML. Annual groundwater use is about 3,000 ML.

9.1.3 Environmental values

The Western District consists of a variety of bioregions with the most predominant being the Victorian Volcanic Plain. This area is listed as one of 15 National Biodiversity Hotspots. The western part of the district has significant stands of remnant vegetation and predominant forests, and this area is also part of a national biodiversity hotspot.

The Western District has rich environmental assets on public and private land. It contains the Grampians National Park and the internationally significant Western District Lakes centred on Lake Corangamite (see Section 9.3.1). It includes several nationally significant wetlands, although many of these are threatened by declines in groundwater and drainage, cropping and grazing. The Glenelg, Wannon and Hopkins rivers and Fiery and Mt Emu creeks have significant environmental, social and economic values. The Glenelg River is one of the most important waterways and a key focus for restoration activities and environmental flows.

Table 9.1 Groundwater availability and use in 2009/10[a] (ML)

Groundwater management unit[b]	Allocation limit[c]	Entitlements	Available volumes	No. licences	Metered use	Estimated non-metered use	No. D&S bores	Estimated D&S use[d]	Licensed and D&S use
Cardigan GMA	3,967	3,887	80	25	722	0	111	222	944
Gerangamete GMA[e, f]	20,000	20,000	0	1	12,692	0	3	6	12,698
Glenormiston GMA	2,565	2,463	102	32	658	0	110	220	878
Upper Loddon WSPA[e]	13,648	13,266	382	117	4,922	0	392	784	5,706
Glenelg WSPA[g]	32,660	32,660	0	81	7,759	0	1,205	2,410	10,169
Warrion WSPA	13,836	13,835	1	132	2,781	0	422	844	3,625
Total	**86,676**	**86,111**	**565**	**388**	**29,534**	**0**	**2,243**	**4,486**	**34,020**

GMA – Groundwater management area. WSPA – Water supply protection area.

Note:
a. The groundwater allocations, licences and usage figures are those to be published in the Victorian Water Accounts 2009/10.
b. Some groundwater management areas are only partly in the Western District.
c. Permissible consumptive volume (PCV), as at 14 July 2011, as published in the Government Gazette. Where a PCV has not been established, the volume is the sum of licensed entitlements. The total PCV includes areas in each groundwater management unit outside the sub-region.
d. Domestic and stock bore use is estimated at 2 ML/bore/year.
e. The Cardigan, Gerangamete and Upper Loddon groundwater management units are only partly in the Western Region, and their management is dealt with in other sustainable water strategies.
f. The PCV for Gerangamete is as follows: In the period of 100 years, 400,000 ML; in any one year, 20,000 ML and in any consecutive 10 years, 80,000 ML. The management of this GMA was considered in the Central Region Sustainable Water Strategy, and is not dealt with in this Strategy.
g. The Glenelg WSPA appears in this and the South-west Coast tables. The figures relate to the whole area.

The Western District supports several threatened species including the brush-tailed rock wallaby, Corangamite water skink, striped legless lizard, Glenelg spiny crayfish, red-tailed black-cockatoo, orchid and grass species and the Victorian Volcanic Plains grassland ecological vegetation class.

The lakes and other wetlands historically supported large eel populations that were traditionally an important food for Indigenous people and more recently, a commercial eel fishery. Lakes in the Western District also support important recreational values such as for swimming, fishing and water-skiing.

9.1.4 Pressures on water resources

Climate variability and land use changes, as well as other pressures on environmental values, will place significant pressures on the Western District's future water use.

Hopkins, Glenelg and Corangamite basins fell by 40, 56 and 84 per cent, respectively. Major land use changes have created pressures on water availability in some areas (see Chapter 5, page 129). In the past two decades, plantation forestry replaced pastures in several higher rainfall sub-catchments. Cropping and more water-intensive perennial pastures also expanded, particularly in dry years. The Western District has a stable or slightly declining population. Long-term urban water demand may increase slightly due to a trend to fewer people per household.

9.2 Promoting sustainable use of water

9.2.1 Providing certainty and improving flexibility for water users

Most of the waterways in the Western District do not have any significant flow regulation. The major exceptions are the waterways downstream of the Rocklands and Moora Moora reservoirs on the upper catchment of the Glenelg River.

In unregulated flow catchments, water is allocated to:

- water corporations with bulk water entitlements to access surface water and groundwater;
- individuals with a licence under section 51 of the Water Act to take and use surface water; and
- individuals and water corporations with a licence under section 51 of the Water Act to take and use groundwater.

Water can be taken and used in accordance with licence or bulk water entitlement conditions. If there is not enough for all needs, water use is restricted to share the available water between existing users and the protection of the environment, as well as domestic and stock water users and the long-term use of the resource.

Water in Rocklands and Moora Moora reservoirs is allocated through bulk entitlements to supply the Wimmera-Mallee area, regional centres and towns, and environmental flows (see Chapter 6, page 145).

Local management plans

In many areas, management of licensed water use needs to be more responsive and adaptable to local conditions and the characteristics of each groundwater or unregulated river system. Local management plans will be used in the Western District's unregulated streams and groundwater systems where there are a significant number of licensed water users (see Policy 3.3, Action 3.5 and Tables 9.2(a) and (b)). These plans will clearly define the rules for how water is managed to meet the needs of licensed water users and the environment. They are operating plans that address all significant issues in an area and define water sharing and management arrangements, particularly during times of shortage (see also Section 3.1.3, page 60).

Better aligning groundwater management boundaries with aquifer systems

Over time, groundwater management boundaries in the Western District sub-region will be adjusted to be based on groundwater systems. This will ensure that all users of the same groundwater system are subject to consistent rules. This will better protect the resource, existing users and the environment (see also Section 4.2.1, page 107).

The rights of existing licence-holders to take and use groundwater will be protected throughout this process, and transition arrangements will be developed to help users with management changes.

Table 9.2(a) Local management plans for surface water

	River Basin	Unregulated river system	Timeframe
Areas where existing rules will be documented as local management plans	Lake Corangamite	All relevant river systems in the basin	Mid 2012
	Glenelg	Glenelg River Crawford River Stokes River Wannon River Grange Burn Creek	
	Hopkins	Hopkins River/Mt Emu Creek/Brucknell Creek Cudgee Creek	
Areas where existing rules will be reviewed or improved	None	None	None

Note: A local management plan will be developed for each river basin. Where needed, plans for specific unregulated rivers within each basin will be developed and attached as a schedule to the local management plan for the basin.

Table 9.2(b) Local management plans for groundwater

	Management Area	Timeframe
Areas where existing rules will be documented as local management plans	Glenormiston Unincorporated areas	Mid 2012
Areas where existing rules need to be reviewed or improved	None	Not applicable

Significant land use changes

Some land use changes can reduce water availability for other water users and the environment. This Strategy sets out a state-wide approach for managing these impacts (see Chapter 5, page 129). Where needed, areas under pressure from land use changes will be declared under the Water Act to allow more intensive management including controlling new forestry developments.

Based on available information, the highest priority areas to be considered for declaration are all or parts of the Crawford and Stokes river catchments and Glenelg Water Supply Protection Area (see Section 5.6, page 141). If these areas are declared, most landholders in them will not be affected. They will be able to plant 20 ha or 10 per cent of a property, whichever is greater, to farm forestry or native revegetation without restriction. Land-holders outside declared areas will not be affected by this policy.

The impacts of land use changes on water resources will be monitored to identify the need for more intensive management in the future.

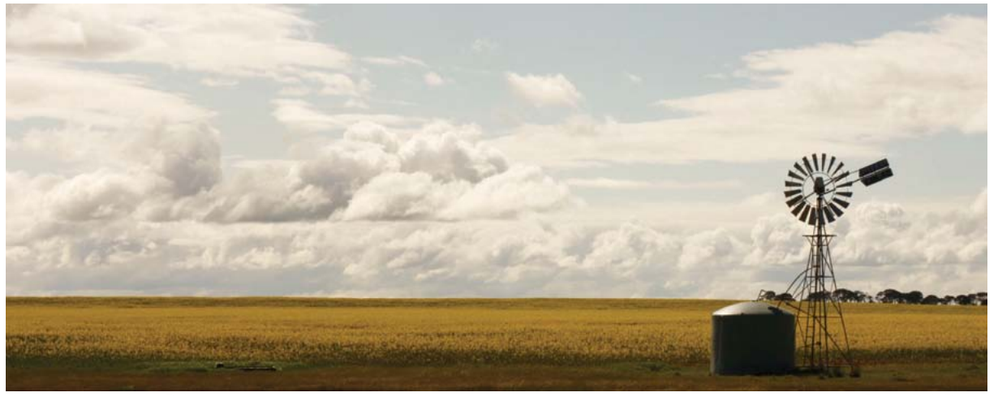
The sub-region includes several recharge areas for groundwater systems such as the Dilwyn Aquifer that supply existing water users. Particular attention will be paid to land use changes in these sensitive areas.

Water for new entitlements

Licences to take and use water from the unregulated waterways in the Western District are equal to or exceed sustainable diversion limits. New surface water licences cannot be issued in the Hopkins and Glenelg rivers, or in the catchments draining to Lake Corangamite because they are fully allocated (see also Section 3.2.5, page 80)

There is 2,600 ML of unallocated surface water available for winter-fill licences in the Lake Colac catchment – surface water in this catchment does not flow to Lake Corangamite. This volume remains available for new development.

A small volume is available for new groundwater entitlements in the Glenormiston Groundwater Management Area (see Table 9.1), and this will remain available depending on potential impacts on existing users and the environment as defined in the Water Act (see Action 3.15, page 82).



Canola crop near Lake Bolac Photo: Deb Brown

Water trading

The only way to obtain more water in the parts of the Western District that are fully allocated is to buy it from other water users unless an alternative source (such as recycled water) is available.

An investigation into water trading in unregulated catchments including those in this sub-region was undertaken as part of this Strategy. The conclusions and consequent actions to improve the ability to trade surface and groundwater entitlements throughout the region are presented in Section 3.2.3 (page 68). Actions include:

- improving information about water markets and trading;
- increasing the potential for trade in unregulated surface water and groundwater systems;
- developing a risk-based approach to approving water trades; and
- facilitating limited-term transfers or leases, or leases in unregulated surface water and groundwater systems.

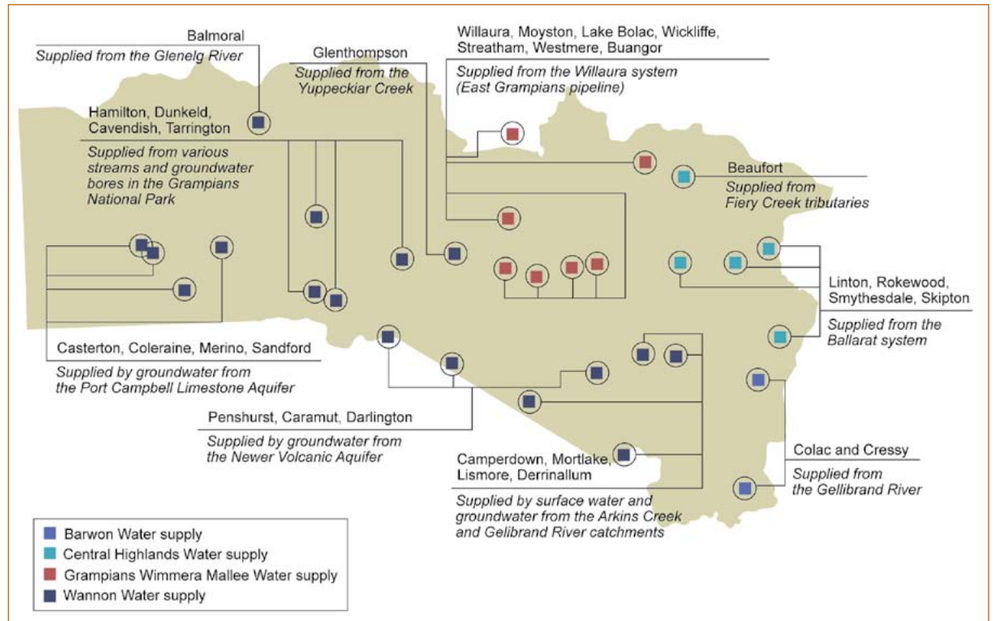
Other policies and actions to provide certainty and improve flexibility

Action 3.4 Monitoring and tracking water use outside the entitlement framework. Page 60
Policy 3.3 and Action 3.5 Developing more responsive local management plans. Page 61,63
Policy 3.4 Developing statutory management plans where needed. Page 65
Action 3.7 Improving information sharing about climate variability and risks. Page 68
Action 3.8 Promoting water conservation and efficiency. Page 69
Action 3.10 Investigating the potential to harvest high flows. Page 72
Action 3.11 Extending the reticulated supply network. Page 73
Action 3.12 Improving opportunities for water trading. Page 75
Action 3.13 Encouraging fit-for-purpose use alternative water supplies. Page 79
Action 4.1 Aligning groundwater management boundaries to aquifer systems. Page 107
Action 4.6 Strategic groundwater resource assessments. Page 117
Action 5.1 State-wide recording of water use by land use changes. Page 132
Action 5.3 Declaring areas to control water intensive land use changes. Page 134
Action 5.5 Considering cumulative impacts of land use in decisions on water use. Page 140

9.2.2 Improving reliability of supply for urban and industrial users

There are several urban water supply systems in the Western District managed by different water corporations (see Figure 9.5). More information about improving reliability of supply for urban and industrial users is provided in Section 3.3.1, page 83.

Figure 9.5 Urban supply systems



Water Corporation	Towns supplied	Main source(s) of supply	Poulation served[a]
Barwon Water	Colac, Cressy	West Gellibrand Reservoir and Olangolah Reservoir, Gellibrand River	15,190
Central Highlands Water	Beaufort	Musical Gully Reservoir – from Cave Hill, Glut and Side Spring creeks (Fiery Creek tributaries)	1,100
	Linton, Rokewood, Smythesdale, Skipton	Ballarat system (Upper West Moorabool and Yarrowee River catchments - east of Ballarat)	1,200
Grampians Wimmera Mallee Water	Streatham, Westmere, Harrow	Supplied by groundwater	904
	Willaura, Moyston, Lake Bolac, Wickliffe, Buangor	Willaura system (East Grampians pipeline) Stoney Creek, Mt. William Creek and Masons Creek	
Wannon Water	Hamilton, Dunkeld, Cavendish, Tarrington	Various steams and groundwater bores in Grampians National Park (stored in Hayes, Cruckoor and Hartwichs reservoirs), pipeline from Rocklands Reservoir.	12,180
	Casterton, Coleraine, Merino, Sandford	Groundwater extracted at Tullich borefield, 30 km west of Casterton, from the Port Campbell Limestone Aquifer	3,715
	Camperdown, Mortlake, Lismore, Derrinallum	Arkins Creek catchment, Gelibrand River catchment and groundwater extracted from bores near Carlisle River. Newer Volcanic Aquifer at Mortlake mixed with Otway water.	47,670
	Glenthompson	Yuppeckiar Creek catchment, Railway Reservoir catchment, Willaura pipeline	245
	Penshurst, Caramut, Darlington	Groundwater extracted at bores in local systems from the Newer Volcanic Aquifer	820
	Balmoral	Rocklands Reservoir, Glenelg River	280

Note: a. Popultion estimates provided by water corporations

The Otway systems supply about 10,000 ML per year to towns in the Otways, South-west Coast and Western District, as well as about 1,300 farms and dairy processing industries.

As a result of the recent prolonged dry conditions, the water corporations have implemented demand management measures and major infrastructure investments to improve the reliability of water supplies and the resilience of the supply systems including:

- Wannon Water bought about 2,000 ML from the water savings achieved from the Wimmera-Mallee pipeline and constructed the Hamilton-Grampians pipeline to secure supply for Hamilton and surrounding towns beyond 2055.
- Wannon Water has reduced evaporation from the Glenthompson water storage basins using a retardant and is in the process of securing additional water for the town from the Willaura system.
- The new Mortlake power station is supplied with recycled wastewater from the Mortlake Tertiary Water Reclamation Plant. Back-up supply is available from the Newer Volcanic Aquifer.

Urban water supply planning

All urban water corporations in Victoria are required to develop water supply-demand strategies that aim to ensure adequate supply reliability in the future. These strategies consider all risks to water supplies as well as options to manage demand or improve supply. They assess the need for, and timing of, future supply augmentations. The risks considered include the potential climate impacts on run-off and the increased water demand from growing populations. These strategies will be revised with the lessons learnt from the prolonged dry period from 1997 to 2009 and heavy rainfall in 2010 and 2011 (see also Section 3.3.1, page 83).

The water efficiency and supply augmentation measures already implemented or planned by urban water corporations will secure urban supplies in the Western District (see Appendix 4). Further supply augmentations are not expected to be needed for some time. The requirement and timing for augmentations and demand management will be reassessed periodically through the water supply-demand strategy process and future reviews of the Western Region Sustainable Water Strategy.

Action 9.1 Revising urban water supply-demand strategies

Who: Barwon Water, Wannon Water, Central Highlands Water, GWMWater **Timeframe:** March 2012

Barwon Water, Wannon Water, Central Highlands Water and GWMWater will revise their water supply-demand strategies by March 2012, taking into consideration experience and information gathered from the prolonged dry period and recent heavy rainfall over the past 14 years.

The updated strategies will incorporate the findings from the review of permanent water savings rules.

Water recycling at Hamilton

Wannon Water operates two sewage effluent water reclamation plants in Hamilton. All effluent from the Hamilton reticulated sewage system is initially treated at the secondary water reclamation plant, and the treated effluent is then transferred to winter storages. The tertiary water reclamation plant draws water from the winter storages and uses innovative ultrafiltration technology to recycle water for the Iluka Mineral Sands processing plant. Completed in 2005, this plant was the first of its kind in Victoria. The rest of the secondary-treated effluent is used commercially to irrigate pasture for cattle and sheep grazing, a turf farm, a golf course and two sporting ovals.

Other actions in the Strategy to improve reliability of supply for urban users

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.13 Encouraging fit-for-purpose use of alternative water supplies. Page 79

Action 3.16 Updating water supply-demand strategies. Page 84

Action 3.17 Review of the Victorian Uniform Drought Water Restriction Guidelines and Permanent Water Savings Rules. Page 85

Action 3.18 Facilitating integrated water planning. Page 85

9.3 Protecting waterways, aquifers and wetlands

The environmental condition of rivers and wetlands in the Western District reflects the cleared landscape and highly modified patterns of water movement. The condition of rivers is generally moderate to poor, with the exception of the Crawford and Upper Glenelg rivers and the upper reaches of Little Woady Yaloak and Kuruc-A-Ruc creeks, which are in good condition.

The Western District contains many wetlands. The Corangamite area alone contains more than 1,500 wetlands, covering 65,000 hectares. As well as Lake Corangamite, major lakes in this basin include Lake Colac, Lake Martin, Lakes Gnotuk and Bullen Merri, and Lake Gnarpurt. Major lakes in the Hopkins Basin include Lake Bolac, Lake Bookar, Lake Burrumbeet and Lake Keilambete.

More than 75 per cent of the shallow freshwater wetlands in the Victorian Volcanic Plains bioregion have been modified or destroyed. This increases the importance of protecting the remaining wetlands from continuing threatening processes such as drainage. Most wetlands are less than 10 hectares in area and on private land, including vulnerable shallow freshwater wetlands.

High priority wetlands in the Western District that are more resilient to dry conditions and support aquatic biodiversity include deep lakes such as Lake Gnotuk, Lake Bullen Merri and Lake Keilambete. There may also be scope to make lakes Martin and Corangamite more resilient to climate variability with improved management of flows from the Woady Yaloak Diversion Scheme at Cundare Pool (see Section 9.3.1, page 214).

Opportunities may also exist to modify other drainage schemes to improve the resilience and environmental values of some high value wetlands.

Dry wetlands have ecological value because they provide seed banks (that can remain dormant for many years) that allow vegetation to re-establish rapidly with the return of water. Even in their dry phase, they can retain important vegetation communities and fauna habitat that will require ongoing protection. This is particularly so for the wetlands of the Victorian Volcanic Plains that support several important rare and threatened ecological communities. Ongoing projects and measures will be required to protect wetlands in their dry phases from modification through activities such as drainage and cropping.

The Victorian strategy for healthy rivers estuaries and wetlands will consider opportunities to better manage wetlands, and this together with new regional strategies for healthy rivers and wetlands will guide future planning and management activities by the Corangamite and Glenelg Hopkins catchment management authorities.

Revitalising the Glenelg River

The Glenelg River is the largest and most significant waterway in the Western District and boasts some of Victoria's best river reaches. The Glenelg Hopkins CMA is seven years into an eight-year Large Scale River Restoration project to address some of the major threats to the health of the Glenelg River, most notably, severe erosion and sedimentation. The project has funded fencing to protect 396 km of riparian areas with 2,371 ha under riparian management agreements. A further 44 km (334 ha) of waterway is targeted for protection in 2011/12. The project has also funded erosion control structures, removal of fish barriers and sand extraction in the river. Over time the river system will be healthier to support high environmental, social and economic values.

The project has directly injected $7.4 million into the regional economy, through direct employment and on-ground works. It also helped farmers during the long drought and more recent floods with about $2.5 million in incentive payments to improve fencing, stock management and water management.

Drying lakes in South-west Victoria

Recent drought has affected lakes central to the lifestyle of many towns. Many lakes in the Western District dried out, sometimes for extended periods. Rain during 2010 refilled many of these lakes, but the need to quickly and accurately identify responsible agencies for issues associated with drying lakes remains.

Since 2008, the Department of Sustainability and Environment has worked closely with many organisations to respond to issues associated with drying lakes in Victoria (see Section 3.4.3). The project produced several documents to guide dry lake management, and was completed in November 2010. These include:

- a management guide to help co-ordinate the activities of the different agencies responsible for managing drying lakes and their impacts on communities; and
- three case studies for lakes in the south-west of Victoria (Lake Colac, Lake Burrumbeet and Lake Terangpom).

The case studies highlighted the social, environmental and economic impacts and management implications of drying wetlands, such as movement of sediment, fairy grass infestations and associated fire risks, recreational impacts and the protection of ecological values.

Many lakes are re-emerging as hubs of rural recreational activity. In the event of a new drying cycle these documents will provide useful information to managers, Government agencies, customer service staff and the community.

For more information on the drying lakes project, see:
www.dse.vic.gov.au > Parks and Reserves > About Parks and Reserves > Drying Lakes Project

9.3.1 Restoring Lake Corangamite

The Woady Yaloak Diversion Scheme was constructed in the late 1950s to reduce water levels in Lake Corangamite to alleviate the flooding of surrounding freehold land. The scheme diverts water from Lake Corangamite via an artificial drainage channel into a tributary of the Barwon River.

Lake Corangamite is the largest 'permanent' inland lake in Australia, located between Colac and Camperdown (see Figure 9.6). It is fed primarily from the north by the Woady Yaloak River system, with other inflows from the Gnarkeet Chain of Ponds, Haunted Gully and Browns Waterholes.

Under natural conditions, the lake rarely spilled overland other than in extreme floods. The lake's levels and salinities fluctuated naturally with very high salinity levels occurring when levels fell as a result of low inflows and high evaporation losses.

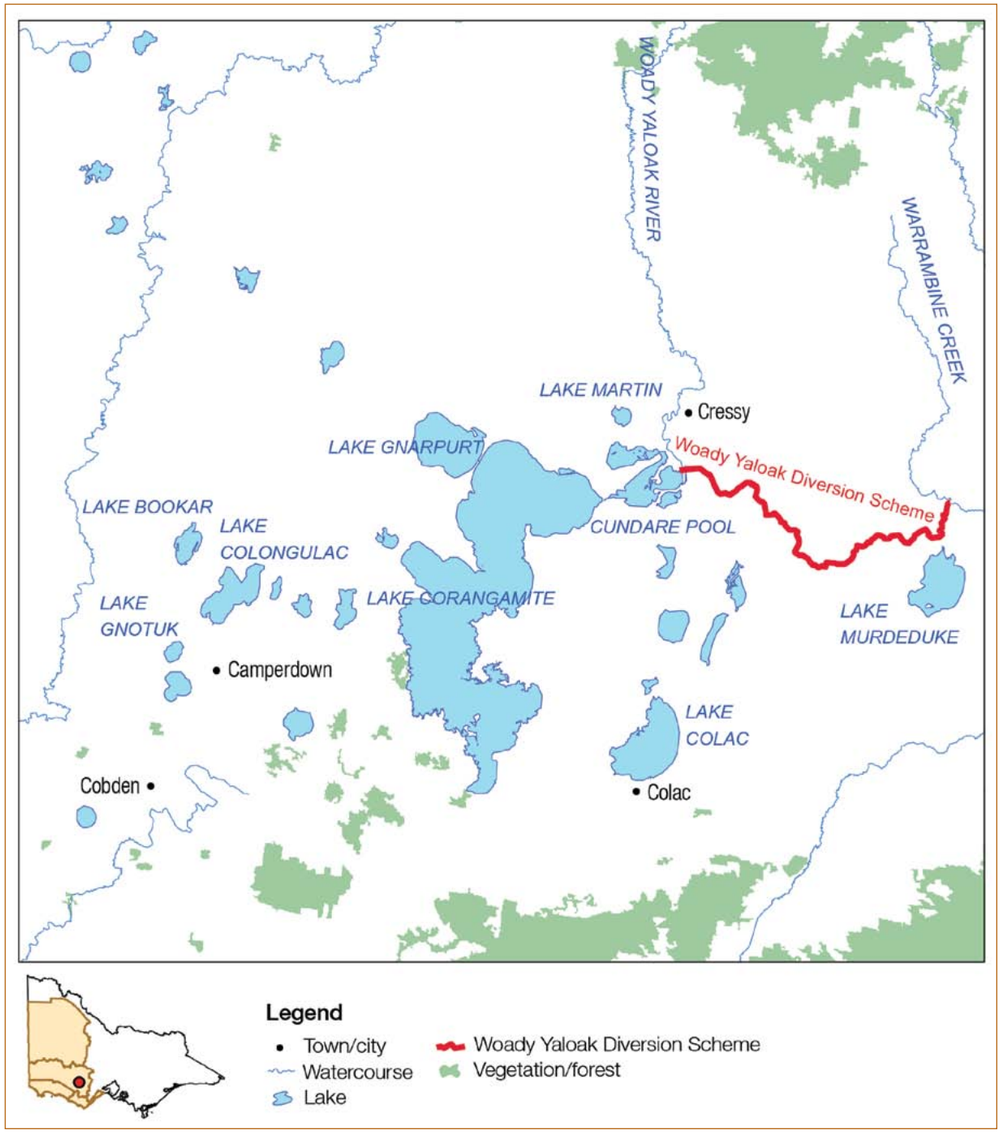
The scheme has been effective in reducing water levels by diverting water from the lake. This has protected large areas of adjoining freehold grazing land from flooding but has increased the frequency of low water levels and high salinity levels in the lake.

In 1982, Lake Corangamite was listed as a wetland of international significance under the Ramsar Convention as part of the Western District lakes system. It is a high value wetland for its ecological, scientific, educational, cultural and scenic features.

It supports 53 species of water bird, with 14 species breeding. Island refuges (Wool Wool and Vaughan Island) support large breeding colonies. The lake is also important for supporting several Japan-Australia Migratory Bird Agreement and China-Australia Migratory Bird Agreement-listed migratory waders.

Lake Corangamite also provides habitat for several fish species, including the nationally listed Yarra pygmy perch. The nationally endangered Corangamite water skink can be found in isolated populations around the lake margins. The lake surrounds also feature diverse plants communities and extensive areas of saltmarsh.

Figure 9.6 The Western District Lakes and Woady Yaloak Diversion Scheme



During the prolonged dry period between 1997 and 2009, falling water levels and the corresponding rise in salinity had a major impact on the composition of the lakes biota. The previously moderately saline lake became highly saline. Some species of shrimp-like crustaceans (amphipods), snails (gastropods), a fish (Common jollytail) and an aquatic grass (Ruppia) almost disappeared. The loss of these species greatly decreased the value of the lake to waterbirds, and had the potential to further compromise its overall environmental values.

Potential for restoring Lake Corangamite

A recent planning process for the Ramsar site highlighted altered flow regimes as one of the highest priority threats to Lake Corangamite. This threat has also been nominated as a high priority risk in the 2006 Corangamite River Health Strategy.

Modelling the impact of the Woady Yaloak Diversion Scheme indicates that it has lowered the median level of Lake Corangamite by 0.9 m (from 116.3 to 115.4 m AHD) and has raised median lake salinities from 45,000 to 60,000 EC.

Studies conducted in the early 1990s recommended that the water level should be above 116 m AHD to maintain the lake at 50,000 EC (35 g per litre, similar to seawater) or less. This would allow an improvement in the condition of the lake and its ecosystem. To maximise the environmental outcomes in Cundare Pool and Lake Corangamite, the operating rules for the scheme will be amended so that more water can flow to the lake via Cundare Pool.

Currently, the Cundare barrage culverts, which form part of the scheme, limit the amount of water that can be transferred to Lake Corangamite due to their elevation and insufficient size. Before these operating rules can be changed, the Cundare culverts need to be lowered and enlarged to help restore the natural outflow at the Cundare barrage, and allow greater capacity and flexibility to transfer water to Lake Corangamite.

To support this work, the Corangamite CMA will undertake an environmental flows investigation of Lake Corangamite, Cundare Pool and Lake Martin to detail and prioritise their ecological water requirements. This study will guide the upgrade of the Cundare Barrage outlet, changes to the operating rules for the system and effective management of inflows, taking into consideration the risks associated with flooding private land.

Table 9.3 Estimated change in water availability in the Lake Corangamite catchment under different climate scenarios (1990 to 2041)

Change in	Potential low impact climate scenario	Potential medium impact climate scenario	Potential high impact climate scenario
Mean annual flow	-10.5 %	-22.6 %	-36.4 %
Rainfall	-2.6 %	-5.7 %	-9.5 %
Potential evaporation	2.5 %	4.6 %	6.2 %

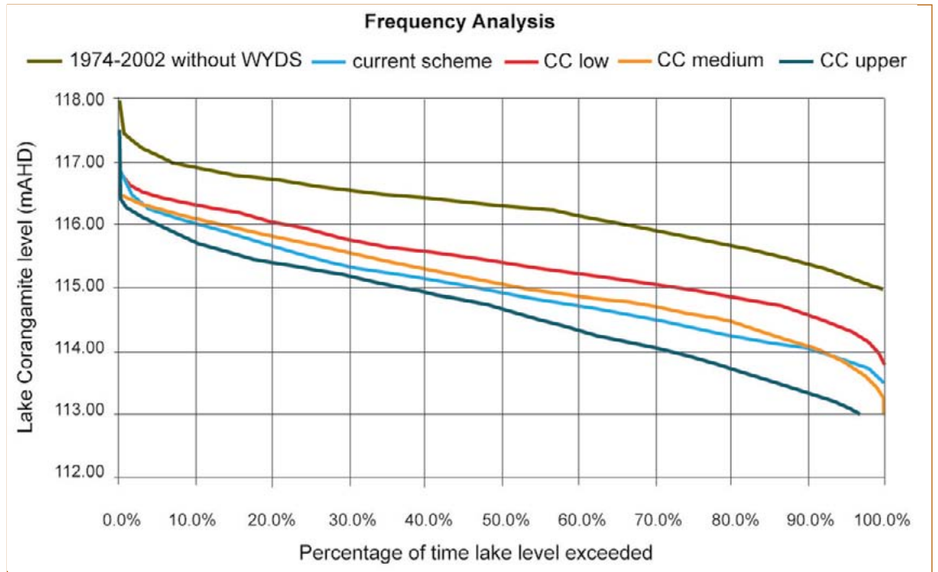
Action 9.2 Restoring Lake Corangamite

Who: Corangamite CMA, Department of Sustainability and Environment **Timeframe:** 2013

The Corangamite Catchment Management Authority will manage the Woady Yaloak Diversion Scheme by:

1. enlarging the Cundare Barrage outlet and amending the operating rules for the drainage scheme based on environmental flow investigations aimed at maximising the ecological benefit to Lake Corangamite and the adjoining Cundare Pool and Lake Martin;
2. maintaining the drainage scheme assets at a low operational level, enabling them to be easily brought back to full operation if required during wet years; and
3. reviewing the operation and continuation of the scheme in 2022, following a detailed analysis of the environmental impact of system operation and predicted and observed climate patterns.

Figure 9.7 Frequency of water levels in Lake Corangamite under different climate and management scenarios



Notes:
- WYDS – Woady Yaloak Diversion Scheme, CC – Potential climate change scenarios

Managing future climate variability

The recent prolonged dry period and subsequent heavy flooding in many parts of the region demonstrated that water management needs to address climate variability. Infrastructure that allows more flexible management of flows to Lake Corangamite will allow better management responses to different conditions. It will also help to manage the potential risks from climate change. Detailed modelling of different future climate scenarios (see Section 2.2.2, page 44) shows that the risks from climate change for the lake are significant (see Table 9.3). Under the potential medium climate change impact scenario, the decrease in inflows and lake water levels would be the same as the drainage scheme operating over the past 50 years. Figure 9.7 highlights the modelling results, showing the percentage of time the lake level is exceeded. If these climate scenarios occur, as much flow as possible from the Woady Yaloak River catchment will be required to flow to the lake to protect its environmental values.

The potential risk of flooding of freehold land adjoining the lake may remain in the future. As a consequence, the drainage scheme will not be decommissioned until better information is available about future climate patterns and their potential impacts on inflows to the lake.

The infrastructure to be constructed at Cundare Pool will provide greater flexibility to deal with different circumstances. In dry years, particularly if the climate is drier in the future, it will allow more water to reach the lake and maintain its high environmental values. When high flows occur, inflows to the lake can be managed to mitigate flooding of private land.

9.3.2 Complementary works and programs

Providing adequate environmental flows and protecting or restoring riparian habitat and water quality will sustain healthier waterways. Complementary river restoration works and better management of the catchment maximise the benefits of environmental flows.

Catchment management authorities will continue to implement complementary in-stream and streamside works based on their regional river health strategies. In the Western District in 2011/12, the Glenelg Hopkins and Corangamite CMAs will invest up to $8 million in river health activities (see also Section 3.4.2, page 94).

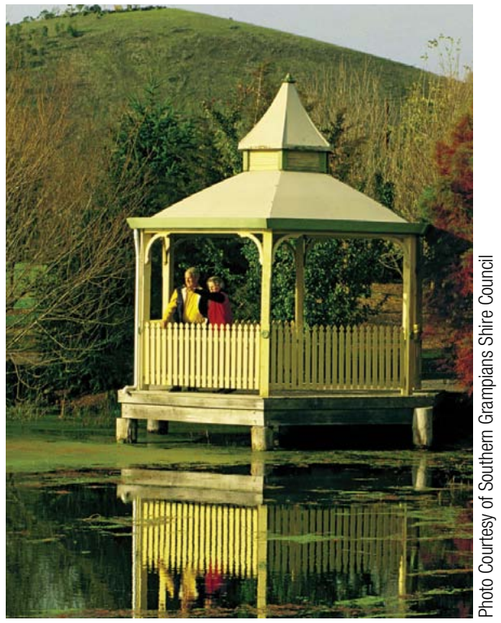


Photo Courtesy of Southern Grampians Shire Council

Penshurst Wetland Gardens

Action 9.3 Investing in integrated catchment management to improve Western District waterways

Who: Department of Sustainability and Environment, Corangamite and Glenelg Hopkins catchment management authorities

Timeframe: Ongoing

The Government will continue to invest in integrated catchment management to protect and improve the ecological condition of waterways and wetlands in priority areas of the Western District and to enhance environmental resilience to dry periods. This will be done through on-ground actions including revegetation, fencing of riparian areas and improved river bank management. Improvements in catchment management will help to improve the water quality.

Wetland management in the Western District

The Corangamite and Glenelg Hopkins CMAs are implementing Australian and State government funded projects to protect, restore or manage important wetlands in this area.

Wetland Protection on the Volcanic Plains

Wetland Tender uses a market-based approach to protect wetlands on private land on the Victorian Volcanic Plains in the Corangamite and Glenelg Hopkins CMA areas. It aims to protect up to 700 hectares of wetlands under four-year management contracts.

Restoration of the Western District Lakes

The Borrell-a-kandelop project, a partnership between Greening Australia, the Corangamite CMA and Parks Victoria for the past nine years, aims to protect and enhance the ecological values of the Western District Lakes Ramsar site and associated wetlands and drainage lines. It has fenced and developed buffer strips, controlled pest plants and animals, revegetated areas and helped landholders protect the area. The project has also helped protect threatened species, particularly migratory shorebirds, the Corangamite Water Skink and Brolga.

Other policies and actions in the Strategy to protect the environment

Action 3.14 Balanced approach to managing unallocated water on unregulated rivers. Page 81

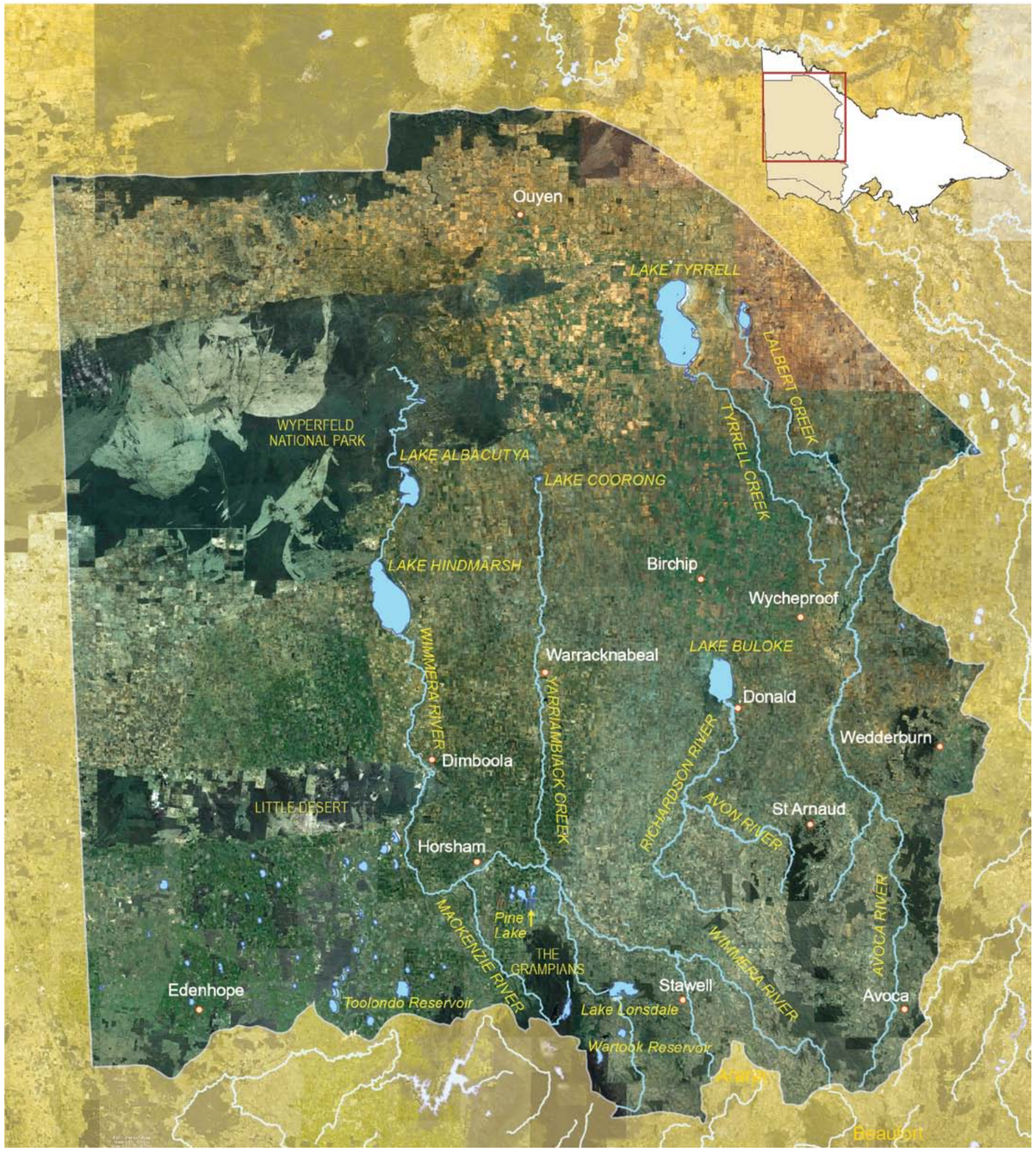
Policy 3.9 Structural works to maximise the benefits of environmental watering. Page 92

Action 3.21 Managing riparian land. Page 95

Policy 3.12 Exploring opportunities for multiple benefits through local water planning. Page 95

Policy 4.3 and Action 4.11 Risk-based approach to managing groundwater dependent ecosystems. Page 123

Figure 10.1 The North-west



The North-west

The policy and actions presented in this chapter aim to meet the specific water needs of the North-west. They focus on enhancing and protecting the reliability of supply for existing and future consumptive water users and enhancing environmental values. Together with region-wide actions, they aim to provide a strong and flexible framework that will enable water managers and users to respond to existing and potential pressures in the North-west.

Guide to this chapter

10.1 Water availability and use

- Surface water
- Groundwater
- Environmental and cultural values
- Pressures on water resources

10.2 Promoting sustainable use of water

- Providing certainty and improving flexibility for water users
  - Local management plans
  - Implementation of the new groundwater management framework
  - Significant land use changes
  - Water for new entitlements
  - Water trading
  - Managing extraction of saline groundwater
  - Managing extraction from groundwater reserves with negligible recharge
  - Managing other pressures on future water availability
  - Other policies and actions
- Improving reliability of supply for urban and industrial users
  - Wimmera-Mallee supply system
  - Urban water supply planning
  - Other actions

10.3 Protecting waterways, aquifers and wetlands

- Management of the Upper Wimmera River
- Complementary works and programs
- Other policies and actions

10.4 Interstate water-sharing arrangements

- The Murray-Darling Basin Plan
- The Border Groundwater Agreement
- Millicent Coast Basin – Mosquito Creek

10.1 Water availability and use

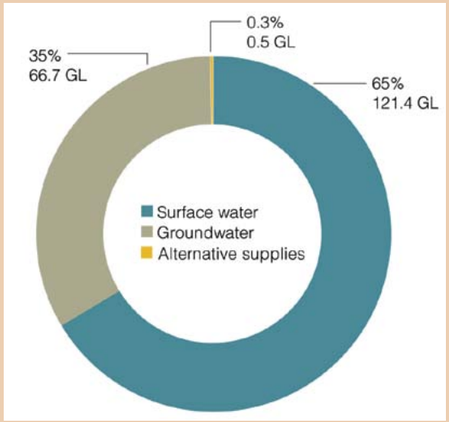
The North-west extends north from the Pyrenees and Grampians Ranges to encompass much of the semi-arid Wimmera-Mallee (see Figure 10.1). The waterways include the Wimmera, MacKenzie, Avon-Richardson and Avoca rivers and Yarriambiack Creek. The North-west has a diverse array of natural assets including more than 3,000 wetlands, making up about one quarter of Victoria's wetlands including the Ramsar-listed Lake Albacutya. The Grampians, Little Desert and Wyperfeld national parks are also in this sub-region. All of these assets support a diverse range of plants and animals.

The Wimmera River is the North-west's largest waterway, rising on the north-eastern slopes of Mount Buangor in the south-east Wimmera and terminating in lakes Hindmarsh and Albacutya and the Wyperfeld floodplain in the southern Mallee. A large number of tributaries from the Pyrenees and Grampians ranges drain into the river. When its flow is higher, the Wimmera River feeds the Dunmunkle and Yarriambiack creeks, which flow north into the Mallee.

Victoria's grain farms are predominantly in western and northern Victoria, with most located in the Mallee and Wimmera. It is Australia's best performing grain-growing area and produces 70 per cent of Victoria's harvest[31]. Health and community services and manufacturing are also strong sectors in the North-west.

Most water is available for extraction from surface water (65 per cent) with groundwater providing 35 per cent (Figure 10.2).

Figure 10.2 Proportion of water available for extraction in the North-west



Notes:
- Surface water data is based on long-term modelling and Victorian Water Accounts (VWA) information and is the water available under current entitlements and caps. The surface water volumes also include farm dams which account for a large proportion of total surface water in some areas.
- The groundwater volume is the total of permissible consumptive volumes as at 14 July 2011.
- Alternative sources have been taken from VWA 2009/10.

The main agricultural and rural users in the North-west are numerous domestic and stock users (the predominant water use) and a relatively smaller number of licensed diverters on unregulated streams and groundwater users.

Streams flow from the south to the north into lakes and wetlands. Flows are ephemeral across much of the North-west and groundwater recharge is limited.

The recent prolonged dry conditions and subsequent severe floods took a toll on the North-west. However, the community in towns such as Stawell, Horsham, Avoca and Ouyen has proven resilient.

10.1.1 Surface water

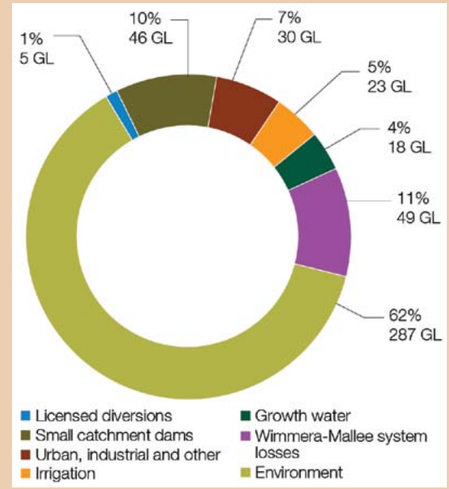
The rainfall over the North-west is comparatively light, varying from an average of 890 mm over the Grampians to as low as 310 mm in the northern Mallee. The rainfall fluctuates widely from year to year.

The historic average annual streamflows in the North-west is about 446 GL (see Appendix 2). This is used for agriculture, towns and local industry. It is the maximum that can be taken and varies from year to year. Figure 10.3 indicates a large proportion of surface water is available for the environment on average, but rivers can be subject to significant stress in dry years and over summer.

Definitions
- Wimmera-Avon River Basin (Wimmera-Avon) is the surface water catchment of the Wimmera and Avon-Richardson river systems including tributaries such as Yarriambiack Creek.
- Wimmera-Glenelg river system (Wimmera-Glenelg) comprises the reaches of the Wimmera and Glenelg rivers that can receive regulated flows from storages in the Wimmera-Mallee supply system and Upper Glenelg catchment.
- Wimmera-Mallee supply system (Wimmera-Mallee) is the extensive pipelined water supply system (see Chapter 6, page 145).

Much of the Wimmera and Mallee has little or no reliable surface water flows. The Wimmera-Mallee supply system (the largest supply system in the Western Region) provides water to many urban and rural communities in areas where the groundwater quality is poor. The recently completed pipeline has reduced the large transmission losses of the former channel network. The pipeline now provides reliable supply for these communities and the environment (see Chapter 6, page 146). The Glenelg River provides significant volumes of water to this supply system from the Rocklands and Moora Moora reservoirs.

Figure 10.3 Surface water available in an average year for different uses



Notes:
- Figures are sourced from REALM models, the Victorian Water Resource Data Warehouse, Victorian Water Accounts 2009/10, and water corporation annual reports. These sources may have different timeframes and methods of calculation, and are compiled for indicative purposes only.
- Wannon Water purchased 2 GL of growth water in 2009.
- The small catchment dam volume includes licensed and unlicensed farm dams.
- The urban and industrial volume includes Wimmera-Mallee Pipeline domestic and stock, supply by agreements, recreational lakes and the Northern Mallee Pipeline supply.
- The environment volume includes water in the Avoca River that flows to floodplains and the Lalbert and Tyrell creeks.

10.1.2 Groundwater

The quality of groundwater in the North-west varies significantly from east to west. The shallow limestone aquifer along the western fringe of the sub-region, which borders South Australia, has good quality and high yielding groundwater. This aquifer is an important water source for irrigation and domestic and stock use and also supplies the townships of Murrayville, Cowangie, Lillimur, Kaniva, Miram, Nhill, Edenhope, Apsley and Goroke.

Other major groundwater systems in the North-west include the Parilla Sand and Tertiary Confined Sand aquifers. The Parilla Sands Aquifer is generally brackish and in some areas not suitable for consumptive purposes, but is used in other areas for stock watering. The Tertiary Confined Sand Aquifer is much deeper, and therefore costly to pump from, and in much of the region of limited availability.

The North-west's groundwater resources are managed in 10 groundwater management units (GMUs) (Figure 10.4 and Table 10.1), although several of these extend beyond the sub-region. Implementing the West Wimmera Groundwater Management Strategy, developed by GWMWater together with a community reference group, will result in several of these GMUs being amalgamated. Table 10.1 provides groundwater availability and usage figures based on current management.

Table 10.2 (page 227) shows these figures re-distributed between the zones of the West Wimmera Groundwater Management Area.

In 2009/10, metered groundwater use in all GMUs in the North-west was about 23.5 GL, which is only 35 per cent of the current permissible consumptive volume (PCV) (Table 10.1). About 1,000 ML was extracted for domestic and stock use.

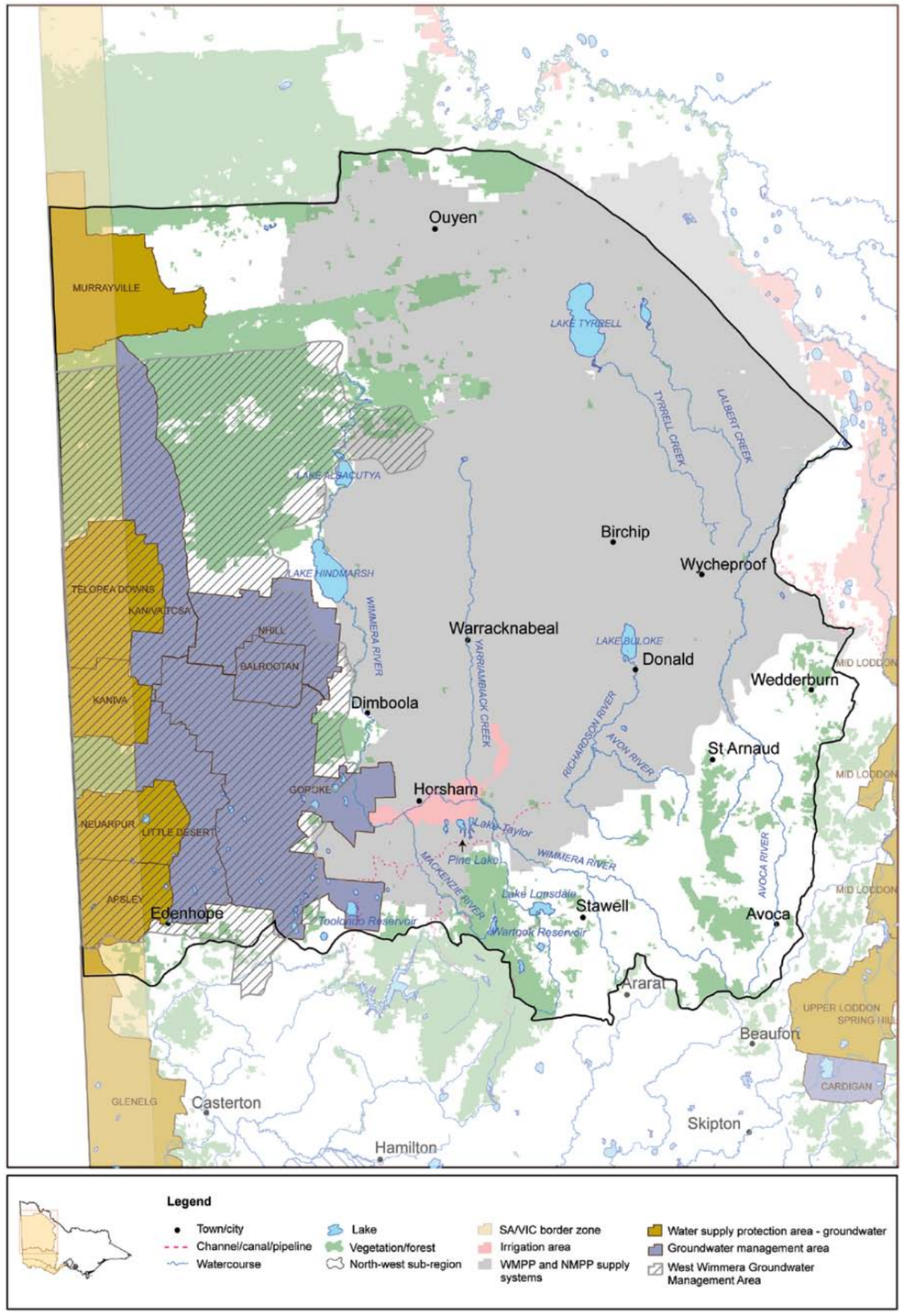
Table 10.1 Groundwater availability and use in 2009/10[a]

Groundwater management unit	PCV[b]	Entitlements	Available volumes	No. licences	Metered use	Estimated non-metered use	No. D&S bores	Estimated D&S use[c]	Licensed and D&S use
Murrayville WSPA	10,883	9,634	1,249	37	5,123	292	216	432	5,847
Apsley WSPA[d]	5,591	5,591	0	32	1,356	0	102	204	1,560
Balrootan GMA[d]	1,522	1,522	0	13	746	0	20	40	786
Goroke GMA[d]	2,200	0	2,200	0	0	0	0	0	0
Kaniva WSPA[d]	7,659	7,659	0	23	1,383	608	82	164	2,155
Kaniva TCSA GMA[d,e]	1,100	0	1,100	0	0	0	0	0	0
Little Desert GMA[d]	1,100	0	1,100	0	0	0	0	0	0
Nhill GMA[d]	1,200	0	1,200	0	0	0	0	0	0
Neuarpur WSPA[d]	24,750	24,691	59	48	12,700	0	37	74	12,774
Telopea Downs WSPA[e]	10,682	10,682	0	14	2,172	140	29	58	2,370
Total	**66,687**	**59,779**	**6,908**	**167**	**23,480**	**1,040**	**486**	**972**	**25,492**

GMA – Groundwater management area. WSPA – Water supply protection area.
TCSA – Tertiary Confined Sand Aquifer. Some groundwater management areas are only partly in the North-west.

a. Groundwater licences and usage figures are those to be published in the Victorian Water Accounts 2009/10.
b. Permissible consumptive volumes (PCVs) as at 14 July 2011, as published in the Government Gazette. Where a PCV has not been established, the volume in the table is the sum of licensed entitlements. PCVs have not been established for Apsley WSPA, Kaniva WSPA or Telopea Downs WSPA.
c. Domestic and stock bore use is estimated at 2 ML/bore/year.
d. The following GMUs will be included in the West Wimmera GMA: Apsley WSPA, Balrootan GMA, Goroke GMA, Kaniva TCSA, Kaniva WSPA, Little Desert GMA, Neuarpur WSPA, Nhill GMA and Telopea Downs WSPA.
e. The Tertiary Confined Sand Aquifer includes the Renmark Group.

Figure 10.4 Groundwater management units in the North-west



The West Wimmera Groundwater Management Area

In the North-west, the following existing groundwater management units (GMUs) will be incorporated into the West Wimmera Groundwater Management Area: Apsley WSPA, Balrootan GMA, Goroke GMA, Kaniva WSPA, Kaniva TCSA GMA, Little Desert GMA, Nhill GMA, Neuarpur WSPA and Telopea Downs WSPA (see Figure 10.4, Figure 10.5 and Table 10.2). This amalgamation will help to implement the new state-wide approach to groundwater management, which includes managing entire groundwater systems (see Section 4.1.2, page 105).

Figure 10.5 Proposed West Wimmera Groundwater Management Area

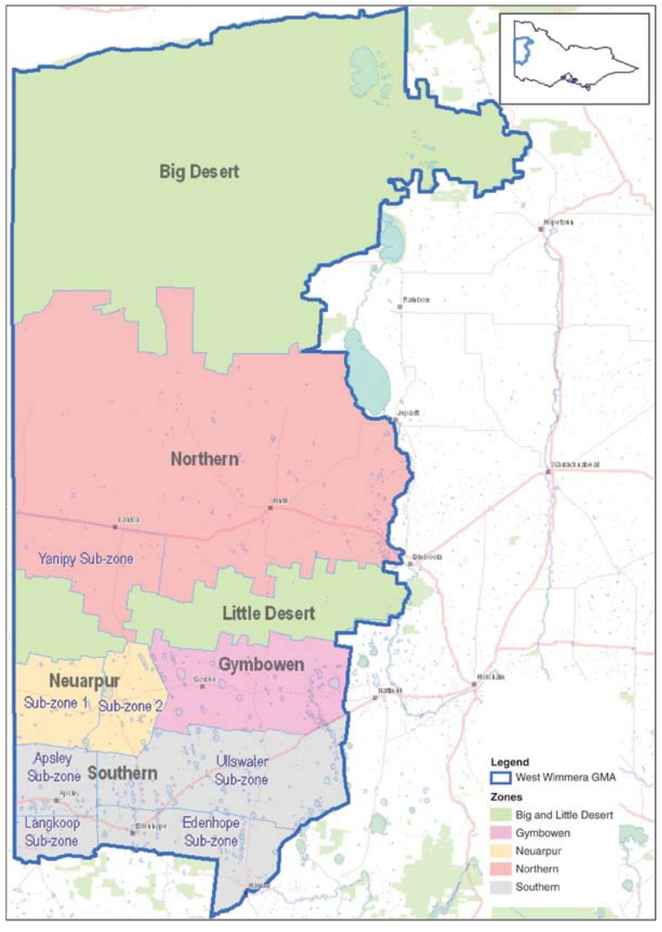


Table 10.2 Groundwater availability and use in the proposed West Wimmera GMA

Zone	Entitlement (ML)	Available Volume	No. licences	Metered use	Estimated non-metered use	No. D&S bores	Estimated D&S use	Licensed and D&S use	PCV TLA (ML)	PCV TCSA (ML)	PCV PSA (ML)
Big Desert	0	25	0	0	0	2	4	4	25	0	0
Northern	22,390	0	79	4,301	1,100	262	524	5,925	22,390	500	50
Little Desert	0	25	0	0	0	2	4	4	25	0	0
Neuarpur	24,691	59	48	12,700	0	37	74	12,774	24,750	400	0
Gymbowen	761	1239	8	0	508	160	320	828	2,000	200	50
Southern	5,769	700	36	1,356	824	196	392	2,572	6,469	450	100
TOTAL	**53,611**	**2,048**	**171**	**18,357**	**2,432**	**659**	**1,318**	**22,107**	**55,659**	**1,550**	**200**

TLA – Tertiary Limestone Aquifer. TCSA – Tertiary Confined Sand Aquifer. PSA – Parilla Sand Aquifer.

Note: These figures are derived from the West Wimmera Groundwater Management Strategy. Also, it should be noted that several of the zones have been sub-zoned and assigned a PCV.

10.1.3 Environmental and cultural values

The Wimmera, Avoca and Millicent Coast river basins contain many diverse wetlands and lakes that provide significant environmental, social and cultural values to the community. In such a dry part of the State, healthy rivers and wetlands provide major amenity, recreational and economic benefits to local communities.

Some of the North-west's environmental values include:

- The reach of Wimmera River from Polkemmet Bridge, and beyond Lake Hindmarsh to Wirrengren Plain, is listed as a heritage river and contains Victoria's only self-sustaining freshwater catfish population.
- Lake Albacutya is recognised under the Ramsar Convention as a wetland of international significance.
- MacKenzie River supports high value fish communities, possibly the last platypus population in the North-west, and a recently discovered species of Wimmera bottlebrush nominated for listing under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.
- Sections of Yarriambiack Creek support healthy riparian vegetation which is significant in a largely cleared, semi-arid landscape.

The creek is also home to significant flora and fauna, such as the growling grass frog and hoary scurf-pea, and provides major recreational values to the community.

The Wimmera River has high environmental values from its upper reaches to the terminal wetlands in the Mallee. Its flows were severely reduced between 1997 and 2009, and it remains at risk from future prolonged dry periods.

The North-west has many cultural and environmental heritage sites with more than 2,000 sites of Indigenous archaeological significance associated within the Wimmera reserves, waterways, floodplains and wetlands. Significant Indigenous cultural values are recognised by the non-exclusive native title over various areas of public land along the Wimmera River, which gives the Wotjobaluk People rights to hunt, fish, gather and camp for their personal, domestic and non-commercial communal needs. Lake Lonsdale has extensive evidence of past Aboriginal occupation. The largest archaeological deposits occur in the north-eastern part of the lake, which is prone to erosion when exposed during periods of lower water levels.

The North-west also provides water to two other Ramsar-listed wetlands. Floodwaters from the Avoca River flow into the Avoca Marshes and the Ramsar-listed Kerang Lakes. Mosquito Creek, in the far west, is the main source of flows to the Ramsar-listed Bool Lagoon in South Australia and contains nationally listed fish species, such as Yarra pygmy perch and dwarf galaxias.

The south-west Wimmera is a hotspot for wetland biodiversity due to the high density and diversity of wetlands – more than 2,000 in a relatively small area. This wetland complex provides important habitat for significant species, including the growling grass frog, brolga, freckled duck, blue-billed duck, ridged water-milfoil, swamp she-oak and swamp diuris. Migratory birds that visit the region include the great egret, Lathams snipe and satin fly-catcher.

The Natimuk-Douglas Saline Wetland System comprises more than 110 saline and brackish lakes including 11 nationally significant wetlands. It provides habitat for significant flora and fauna including 14 migratory bird species listed under international agreements, such as the red-necked avocet and red-kneed dotterel.

The North-west's rivers and wetlands are important to the local and regional community as well as tourists for their natural aspects and recreational opportunities.

Substantial volumes of water are transferred to the Wimmera River system from the Glenelg River. Any consideration of environmental values in the North-west must include those of the Glenelg River because of the impact of these transfers (see Chapter 6, page 146).

10.1.4 Pressures on water resources

There will be significant pressures on the North-west's future water use, particularly from climate variability (see Section 2.2, page 39 and Appendix 3). The sub-region has a variable climate with wide fluctuations in rainfall from year to year. During the dry conditions from 1997 to 2009, average annual streamflows in the Avoca and Wimmera rivers fell by 90 per cent and 77 per cent, respectively. Groundwater supplies were also affected by the dry conditions, which reduced groundwater recharge and caused short-term declines in water levels in some areas. These conditions severely stressed rivers and wetlands, and restricted supplies to licensed users and domestic and stock water users. The lower MacKenzie River and Mt William Creek were the most flow-stressed rivers in the State. Following this long dry period, some of the North-west's waterways experienced their highest flows on record in early 2011. In many areas, groundwater levels have started to recover.

Land use changes in parts of the Wimmera catchment and Millicent Coast River Basin over the past 15 years have increased interception of water that would otherwise have reached streams. For example, land uses around Elmhurst and Warrak in the Upper Wimmera and in some areas of the Mosquito Creek catchment have changed from grazing to forestry, and in the south of the sub-region and the West Wimmera from grazing and mixed farming to dryland cropping. In addition, the number and capacity of farm dams in the Upper Wimmera catchment has increased in recent decades, capturing a greater proportion of run-off before it reaches waterways, wetlands and downstream users.

During the recent dry conditions, saline groundwater discharges to the lower reaches of the Wimmera River caused significant environmental degradation (see before and after photos).

Before and after - Wimmera River at Jeparit

Salinity impacts at Jeparit, early 2009 Photo: David Fletcher

The same location, December 2010 Photo: Paul Lloyd

10.2 Promoting sustainable use of water

10.2.1 Providing certainty and improving flexibility for water users

Water use in the North-west varies in different areas. Large parts of the Wimmera-Mallee are supplied from surface water storages in the Grampians and Upper Glenelg catchment through the Wimmera-Mallee supply system. In the western parts of the sub-region, good groundwater reserves support towns and agriculture. These sources are managed in different ways:

- Water from the Wimmera-Mallee system is managed with bulk entitlements held by water corporations (who supply their urban and rural customers) and the Victorian Environmental Water Holder (see Chapter 6, page 148).
- Individuals and water corporations hold licences under section 51 of the Water Act to take and use groundwater. These licences are managed in accordance with the *Policies for Managing Take and Use Licences*.
- Permissible consumptive volumes (PCVs) limit the amount of water that can be allocated within each groundwater management unit and sustainable diversion limits (SDLs) limit winter-fill diversions within unregulated river sub-catchments.

If water is available, it can be taken and used in accordance with the licence or bulk water entitlement conditions. If there is not enough for all needs, water use is restricted to share the available water between existing users and the protection of the environment, as well as domestic and stock water users and the long-term use of the resource.

Local management plans

In many areas, management of licensed water use needs to be more responsive and adaptable to local conditions and the characteristics of each groundwater or unregulated river system (see also Section 3.1.3, page 60).

Local management plans will be used in the catchments and groundwater systems of the North-west where there are a significant number of licensed water users. These plans will clearly define the rules for how water is managed on unregulated systems to meet the needs of licensed water users and the environment (Policy 3.3, Action 3.5 and Tables 10.3(a) and (b)). They are operating plans that address all significant issues in an area and define water sharing and management arrangements, particularly during times of shortage.

Table 10.3(a) Local management plans for surface water

	River basin	Unregulated river system	Timeframe
Areas where existing rules will be documented as local management plans	Avoca River	Avoca River	Mid 2012
	Wimmera-Avon	Avon-Richardson River	
		Upper Wimmera River[a]	
	Mallee	As needed	
	Millicent Coast	Mosquito Creek	
Areas where rules need to be reviewed or improved	None	None	None

Note: A local management plan will be developed for each river basin. Where needed, plans for specific unregulated rivers within each basin will be developed and attached as a schedule to the local management plan for the basin.

[a] The Upper Wimmera River will be managed based on a local management plan. A statutory streamflow management plan will not be prepared (see Section 10.3.1).

Table 10.3(b) Local management plans for groundwater

	Management area	Timeframe
Areas where existing rules will be documented as local management plans	Balrootan	These GMAs will be incorporated into the West Wimmera GMA and the strategy when finalised will inform the local management plan in 2012
	Kaniva TCSA	
	Goroke	
	Little Desert	
	Nhill	
	Unincorporated areas	
Areas where rules need to be reviewed or improved	None	None

Better aligning groundwater management boundaries with aquifer systems

Over time, groundwater management boundaries in the North-west will be adjusted to be based on groundwater systems. This will ensure that all users of the same groundwater system are subject to consistent rules. This will better protect the resource, existing users and the environment (see Section 4.2.1, page 107)

The rights of existing licence-holders to take and use groundwater will be protected throughout this process, and transition arrangements will be developed to help users with the management changes. The amalgamation of several areas into the Western Wimmera GMA is a key example of this process (see Section 10.1.2).

Managing significant land use changes

Some land use changes can reduce water availability for other water users and the environment. Where needed, areas under pressure from land use changes will be declared under the *Water Act 1989* to allow more intensive management of new forestry developments (see Chapter 5, page 130).

The drier climate and typically deeper groundwater mean that impacts of land use changes on water resources will be limited in the North-west. This sub-region is in the Murray-Darling Basin, and the release of the Murray-Darling Basin Plan in 2012 may have implications for catchments in this area. The Department of Sustainability and Environment will review the Murray-Darling Basin Plan after it is released to confirm the role of the Commonwealth in managing the impact of plantations on water availability in the Murray-Darling Basin, and the implications for these catchments (see Action 5.7, page 143).

Water for new entitlements

The major quantity of water available for new growth is the remaining 18 GL of growth water from the Wimmera-Mallee Pipeline water savings (see Section 6.3.2, page 152)

Some water is likely to be available in the West Wimmera Groundwater Management Area once the management strategy for the area is implemented in 2012.

Water trading

In parts of the North-west where no new water entitlements are available, the only way to obtain more water is to buy it from other water users unless an alternative source (such as recycled water) is available. Water trading can help water users manage their water needs, including getting more water entitlement to improve reliability or grow a new business, or sell water they no longer require.

With the completion of the Wimmera-Mallee Pipeline, there is much scope for water trading in the Wimmera-Mallee supply system. Trade of transferable allowances will develop over time and provide flexibility to water users to manage their supply (see Section 6.3.1, page 151).

During 2009/10, there were 11 temporary groundwater trades (totalling 2,555 ML) and no permanent trades in the North-west. Trading rules in the Murrayville WSPA are used to limit trade into the area where groundwater levels are declining but allow for licences to be transferred out of that area. This is also the case for Neuarpur, where groundwater levels have been declining over the past five years.

Further water trading may be possible in the North-west. Section 3.2.3 (page 75) outlines actions to improve the ability to trade surface and groundwater entitlements including:

- improving information about water markets and trading;
- increasing the potential for trade in unregulated surface water and groundwater systems;
- developing a risk-based approach to approving water trades; and
- facilitating limited-term transfers or leases, or leases in unregulated surface water and groundwater systems.

Managing extraction of saline groundwater

The North-west has significant reserves of brackish to saline groundwater. These reserves are not suitable for consumptive use without desalination. To date the cost of desalination has meant that very little of this water is extracted although more might be in future.

The extraction of this saline water can be managed effectively through the existing licensing regime. However more work is required to develop the regulatory regime for disposal of the desalination by-products (see Policy 3.8, page 81).

Managing extraction from groundwater reserves with negligible recharge

The groundwater resource in the Murrayville WSPA is ancient, and recharge occurs very slowly – over thousands and even tens of thousands of years. The rate of recharge in the proposed West Wimmera Groundwater Management Area (GMA) is also negligible.

A statutory management plan is in place for the Murrayville WSPA based on an agreed rate of extraction and groundwater level drawdown. The agreed volume of extraction is very small compared with the volume in store and will ensure that the groundwater resource is available for use for many hundreds of years. Continuity of supply is assured through periodic reviews of the resource and statutory management plan.

Managing other pressures on future water availability

Bushfires pose risks to the quality of run-off to waterways and storages. The 2006 bushfires in the Grampians followed by heavy rain in 2010 and 2011 contributed to water quality problems in Bellfield Reservoir that affected the quality of water supplied to towns and rural properties.

The catchment of Lake Bellfield and Lake Wartook is managed as a national park by Parks Victoria. GWMWater is investigating options in consultation with Parks Victoria to undertake remedial works and develop a proactive approach to reduce soil erosion impacts on water supplies.

Water corporations will continue to assess risks to water quality from bushfires in the North-west, and the Department of Sustainability and Environment will review protocols for fuel-reduction burns to minimise water quality risks (see Section 3.4.4, page 98).

Policy 10.1 Managing extraction from groundwater reserves with negligible recharge

The Government will allow extraction from non-renewable groundwater resources where agreed management plans are in place that balance the short and long-term water requirements of the community and consider the needs of the environment.

Other policies and actions to provide certainty and improve flexibility

Action 3.4 Monitoring and tracking water use outside the entitlement framework. Page 60

Policy 3.3 and Action 3.5 Developing more responsive local management plans. Page 61,63

Policy 3.4 Developing statutory management plans where needed. Page 65

Action 3.7 Improving information sharing about climate variability and risks. Page 68

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.10 Investigating the potential to harvest high flows. Page 72

Action 3.11 Extending the reticulated supply network. Page 73

Action 3.12 Improving opportunities for water trading. Page 75

Action 3.13 Encouraging fit-for-purpose use alternative water supplies. Page 79

Action 4.1 Aligning groundwater management boundaries to aquifer systems. Page 107

Action 4.6 Strategic groundwater resource assessments. Page 117

Action 5.1 State-wide recording of water use by land use changes. Page 132

Action 5.3 Declaring areas to control water intensive land use changes. Page 134

Action 5.5 Considering cumulative impacts of land use in decisions on water use. Page 140

10.2.2 Improving reliability of supply for urban and industrial users

Wimmera-Mallee supply system

The investment in pipelining the Wimmera-Mallee supply system (see Chapter 6, page 146) has provided much greater security of supply for urban, industrial and rural water users throughout most of the North-west.

The supply and demand for the North-west's cities and towns is outlined in Appendix 4.

Urban water supply planning

All urban water corporations in Victoria are required to undertake long-term planning to develop water supply-demand strategies that aim to ensure there is adequate supply reliability in the future. These strategies consider all risks to water supplies as well as options to manage demand or improve supply. They assess the need for, and timing of, future supply augmentations. The risks considered include the potential climate impacts on run-off and increased water demand from growing populations. These strategies will be revised with the lessons learnt from the prolonged dry period from 1997 to 2009 and the heavy rainfall in 2010 and 2011 (see also Section 3.3.1, page 83).

Action 10.1 Revising urban water supply-demand strategies

Who: GWMWater, Central Highlands Water and Coliban Water **Timeframe:** March 2012

GWMWater, Central Highlands Water and Coliban Water will revise their water supply-demand strategies by March 2012, taking into consideration experience and information gathered from the prolonged dry period and heavy rainfall over the past 14 years.

The updated strategies will incorporate the findings for the review of permanent water savings rules.

Nhill integrated water plan

Nhill, midway between Melbourne and Adelaide on the Western Highway, is an example of how an integrated planning approach to water management based on the principle of 'fit for purpose' can meet environmental, social and economic objectives.

GWMWater, Hindmarsh Shire Council and the Department of Sustainability and Environment, in consultation with the community and Wimmera CMA, developed a draft integrated water plan for the town that will use a range of water sources for the following purposes:

- potable water supply for households and industry is to be provided through a new connection to the Wimmera-Mallee Pipeline with the new supply to be fully treated;
- rainwater tanks will complement the pipeline supply for internal and external urban use;
- stormwater will continue to contribute to recreational and environmental outcomes in Nhill Lake and Nhill Swamp;
- local groundwater will continue to be used for public gardens as well as community and school recreational facilities; and
- treated wastewater will be used for off-site centre pivot irrigation. When the quality of wastewater improves with a treated water supply, this resource can be considered for community and industry benefits.

Hindmarsh Shire Council is reviewing the Nhill integrated water plan and developing similar plans for Dimboola, Jeparit and Rainbow.

Other actions in the Strategy to improve reliability of supply for urban users

Action 3.8 Promoting water conservation and efficiency. Page 69

Action 3.13 Encouraging fit-for-purpose use of alternative water supplies. Page 79

Action 3.16 Updating water supply-demand strategies. Page 84

Action 3.17 Review of the Victorian Uniform Drought Water Restriction Guidelines and Permanent Water Savings Rules. Page 85

Action 3.18 Facilitating integrated water planning. Page 85

10.3 Protecting waterways, aquifers and wetlands

The North-west has a diverse range of natural environments from the Grampians in the south to the semi-arid Mallee in the north. Major waterways include the Wimmera, MacKenzie, Avon-Richardson and Avoca rivers and Yarriambiack Creek. The sub-region also has about one quarter of Victoria's wetlands including the Ramsar-listed Lake Albacutya. In some of the driest parts of the State, these natural assets are a major focus of recreational, social and cultural activities including events such as the Dimboola rowing regatta on the Wimmera River.

During the recent dry period, the waterways and wetlands of the North-west suffered more than the rest of the State. The average annual streamflow between 1997 and 2009 was between 75 and 90 per cent lower than the long-term average. This severely stressed aquatic environments, as well as the amenity, recreation and economic benefits of the waterways to local communities.

Water savings from the Wimmera-Mallee Pipeline (see Chapter 6, page 146) provide greater reliability for environmental flows. However, the potential risks from climate variability may bring additional pressures. Environmental water will need to be used wisely to achieve the best outcomes (see Section 3.4.1, page 155; and Section 6.4, page 90) and to build the ecological resilience of waterways so they can recover from future dry periods.

10.3.1 Management of the Upper Wimmera River

The Upper Wimmera River is unregulated and its environmental values have been under stress for some time, particularly during the dry period from 1997 to 2009.

A committee of key stakeholders began considering the water management issues for the river in 1999. This work indicated that domestic and stock farm dams were the primary cause of flow stress during low-flow periods, rather than pumping from the river under section 51 take and use licences. The annual demand from section 51 take and use licences of 157 ML is minor compared with the annual estimated volume of farm dams of 4,900 ML. However, a recent report found that revegetation planned to reduce salinity impacts could be an additional source of flow stress[32]. A local management plan will be developed to consider ways to manage the pressures on the environmental values of the Upper Wimmera River and improve environmental flows.

Action 10.2 Management of the Upper Wimmera River

Who: GWMWater **Timeframe:** End 2012

Access to water under section 51 take and use licences in the Upper Wimmera catchment will be managed with a local management plan that will protect streamflows by formalising current rules (including rosters and restrictions) and setting caps on water use. The local management plan will be developed as set out in Policy 3.3.

10.3.2 Complementary works and programs

Providing adequate environmental flows and protecting or restoring riparian habitat and water quality will sustain healthier waterways. Complementary river restoration works and better management of the catchment maximise the benefits of environmental flows (see also Section 3.4.2, page 94).

The North Central, Mallee and Wimmera CMAs will continue to implement complementary in-stream and streamside works based on their regional river health strategies. In the North-west in 2011/12, the Wimmera CMA will invest up to $3.3 million in river health activities.

Action 10.3 Investing in integrated catchment management to improve waterways

Who: Department of Sustainability and Environment, Wimmera Catchment Management Authority **Timeframe:** Ongoing

The Government will continue to invest in integrated catchment management to protect and improve the ecological condition of waterways in priority areas of the North-west and enhance environmental resilience to dry periods. This will be done through on-ground actions such as revegetation, fencing of riparian areas and reducing dryland salinity. Improvements in catchment management will help to improve the water quality.

Other policies and actions in the Strategy to protect the environment

Action 3.14 Balanced approach to managing unallocated water on unregulated rivers. Page 81

Policy 3.9 Structural works to maximise the benefits of environmental watering. Page 92

Action 3.21 Managing riparian land. Page 95

Policy 3.12 Exploring opportunities for multiple benefits through local water planning. Page 95

Policy 4.3 and Action 4.11 Risk-based approach to managing groundwater dependent ecosystems. Page 123

10.4 Interstate water sharing agreements

10.4.1 The Murray-Darling Basin Plan

The Wimmera-Avon, Avoca and Mallee basins lie within the Murray-Darling Basin, although these basins do not flow to the River Murray. The Wimmera, Avon and Richardson rivers flow north to terminal lakes (such as lakes Hindmarsh, Albacutya, Buloke and Tyrrell).

The connection with the River Murray is not a consideration for the management of the surface and groundwater resources in the Wimmera-Mallee. Nonetheless, the Murray-Darling Basin Authority will develop the Basin Plan and this will affect how the Wimmera-Avon, Avoca and Mallee river basins are managed in the future. Although the management of groundwater in the North-west is unlikely to have any measurable effects on flows in the River Murray for many centuries, the Basin Plan will also regulate groundwater management in the sub-region.

This Basin Plan will set out sustainable diversion limits – legally enforceable limits on the amount of water that can be taken from surface and groundwater systems – to improve allocations to the environment and protect key environmental assets. The plan will also set out approaches for using environmental water, targets for water quality and salinity and water trading rules. It is expected that the plan will be released by late 2012. Some elements of the Plan will need to be complied with immediately, while others, such as sustainable diversion limits, are not likely to be enforced until 2019.

The Victorian Government is advising the Murray-Darling Basin Authority about how key environmental values in the Murray-Darling Basin can be protected while also recognising the pivotal role that access to secure and reliable water supplies plays in supporting regional communities and economies. The Victorian Government will continue to work with both the Authority and Commonwealth Government to ensure that elements of the Basin Plan that affect the Wimmera region can be implemented with as little disruption to water users as possible (see Action 10.4).

Action 10.4 Development and implementation of the Murray-Darling Basin Plan in the Wimmera and Mallee catchments

Who: Department of Sustainability and Environment **Timeframe:** Ongoing

The Victorian Government will provide advice to the Murray-Darling Basin Authority to promote Basin Plan outcomes for the Wimmera and Mallee catchments that will:

- support agreed environmental, social and economic outcomes;
- be informed by comprehensive evidence and analysis;
- be developed through a transparent and informed community based decision making process;
- set out clear implementation pathways and clearly defined roles and responsibilities; and
- build on existing knowledge, projects and programs, for example the Wimmera-Mallee Pipeline Project and the Murray-Darling Basin Agreement.

10.4.2 Border Groundwaters Agreement

Groundwater along the South Australian-Victorian border is shared between the States under a joint agreement (the Border Groundwaters Agreement). The South Australian Victorian Groundwater Committee has been in place since 1985 and has implemented the agreement. This has included advancing groundwater knowledge, responding to changes in resource condition and threats, and facilitating groundwater management through consultation with Government, agencies and communities.

In its submission to the Murray-Darling Basin Authority about the Basin Plan, the committee noted groundwater in this area is unlikely to affect other parts of the basin. The committee and the Victorian Government consider the best approach for managing these groundwater resources is to maintain the existing, cooperative arrangements between Victoria and South Australia. This will ensure the Murray-Darling Basin Plan can be implemented effectively and integrate with current interstate groundwater management arrangements.

10.4.3 The Millicent Coast Basin – Mosquito Creek

The Millicent Coast River Basin is located in the far west of Victoria and extends eastwards into South Australia (see Figure 1.2, page 21). It lies outside the Murray-Darling Basin. The Millicent Coast Basin generally experiences low rainfall. Surface flows are unreliable and no major surface water storages are in the basin, resulting in a heavy reliance on groundwater resources to meet water needs.

The largest waterway within the Millicent Coast Basin is the ephemeral waterway, Mosquito Creek. Surface water flows in the creek, although intermittent, are important for providing streamflows to support the Ramsar-listed wetlands, Bool and Hacks lagoons, in South Australia.

There is little surface water extraction in the Victorian portion of the basin, though more water is extracted in South Australia. Concerns have been raised about increased water use by plantation developments in the upper catchment since the mid-1990s and the effects this may be having on waterways and the downstream wetlands.

Cross-border management will protect surface water flows in the region, particularly in the Millicent Coast Basin. Several South Australian and Victorian organisations have developed protocols for the cooperative management of shared surface water resources between the States using the Mosquito Creek catchment as a pilot project (see Box 10.1).

In Victoria, a permissible consumptive volume will be set for the Millicent Coast Basin to limit surface water extraction to current volumes to protect the refuge pools, baseflows and groundwater recharge. These rules will be documented in a local management plan for the basin, including Mosquito Creek.

Action 10.5 Protecting flows in the Millicent Coast Basin

Who: Southern Rural Water, GWMWater **Timeframe:** Ongoing

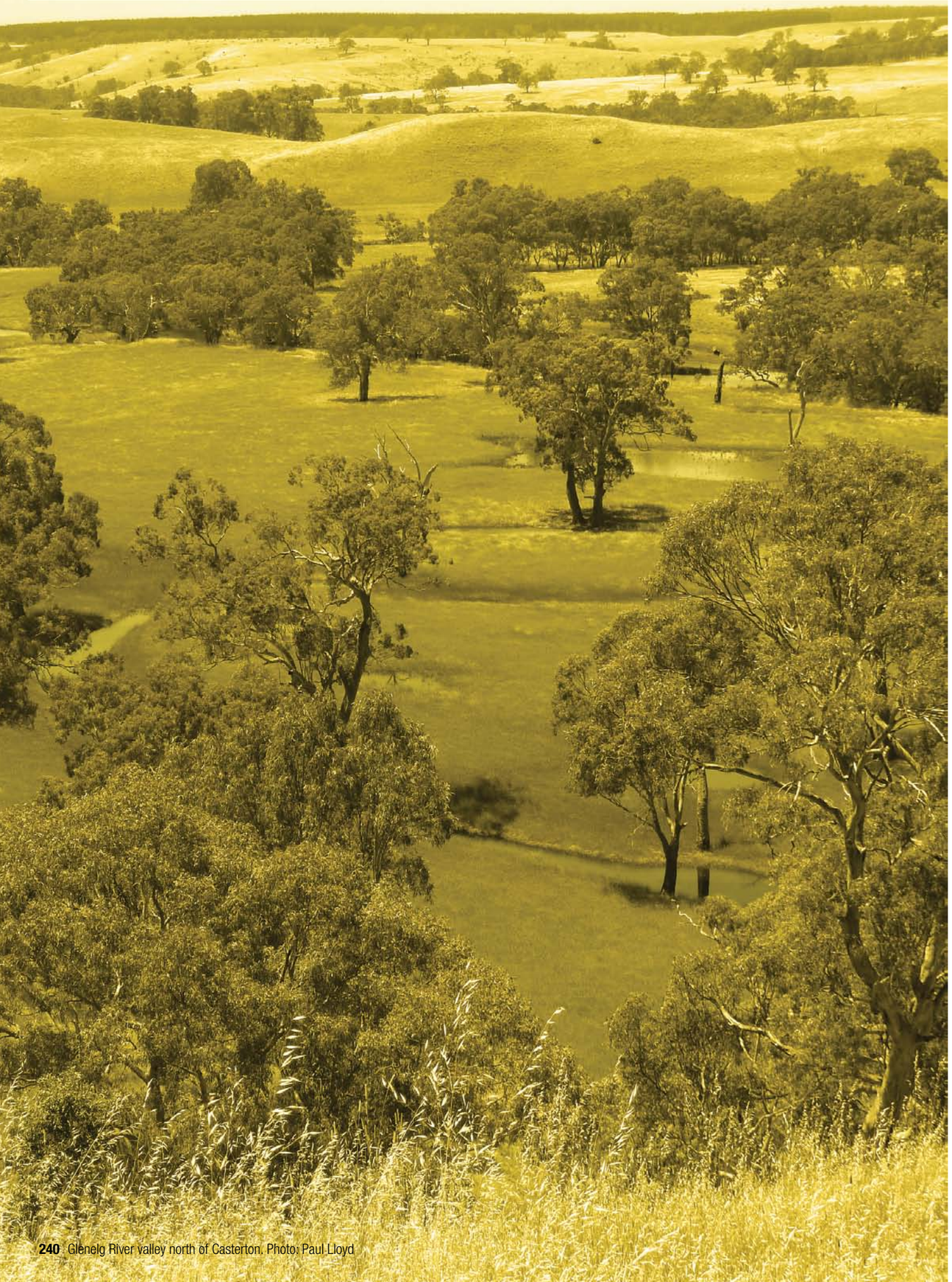
Southern Rural Water and GWMWater will continue to apply a moratorium on issuing new water entitlements in the Millicent Coast Basin. Surface water entitlements in the Victorian part of this basin will be capped at the level of existing entitlements (as at the release date of the Strategy), and will be set as the permissible consumptive volume for streams in the basin. This also depends on South Australia implementing measures to protect the flow in Mosquito Creek and other streams in the basin from any further extraction.

When assessing groundwater applications in the area, the two Victorian water corporations will give careful regard to ensure that downstream flows in the creek are not reduced.

Box 10.1 Connecting the catchments – Mosquito Creek

A memorandum of understanding was signed in 2010 by 10 partner organisations as part of a pilot project to integrate the management of Mosquito Creek. The pilot project is managed by the South East Natural Resources Management Board and funded under the Natural Heritage Trust. The memorandum aims to provide a framework for management authorities to work together to improve cross-border catchment management and wetland values. The areas included in the memorandum include Tatiara, Nalang, Morambro, Naracoorte, Mosquito, Glen Roy/Dorodong creeks and Glenelg River and connected wetlands.

Mosquito Creek Photo: Paul Lloyd



 Glenelg River valley north of Casterton. Photo: Paul Lloyd

Delivering the Strategy

The Western Region Sustainable Water Strategy will secure the region's water future and provide more choice and flexibility for entitlement-holders to manage the risks imposed by drought and climate variability.

Guide to this chapter

Key points of this chapter

- The Department of Sustainability and Environment, rural and urban water corporations and catchment management authorities are responsible for implementing the Strategy.
- No Strategy actions require large capital investment. However, some actions may result in water corporations reviewing their water pricing arrangements.
- Ongoing monitoring and evaluation will allow us to adapt our management approach when the Strategy is reviewed. The first review will be undertaken in 10 years after the release of the Strategy (2021) and will be informed by the long term resource assessment due in 2019.

11.1 Implementation responsibilities

Many organisations are involved in water management in the Western Region (Figure 11.1) and all have a part to play in implementing this Strategy. Key responsibilities rest with the Department of Sustainability and Environment, rural and urban water corporations and catchment management authorities. Responsibilities and timing for implementation are outlined with each of the specific actions in Chapters 3 to 10.

Water corporations and catchment management authorities will incorporate these actions into their water supply-demand strategies and regional strategies for healthy rivers and wetlands (formerly river health strategies), which were being reviewed and updated when the Western Region Sustainable Water Strategy was released.

The Department of Sustainability and Environment has a statutory requirement to report on the implementation of this Strategy in its annual report, which is tabled in Parliament.

Paying for the Strategy

No Strategy actions will require large capital investment; rather, the Strategy establishes or improves water policy and regulatory arrangements. As such, many actions will align with existing responsibilities within the Department of Sustainability and Environment. Actions of a strategic nature, such as the maintenance and renewal of the groundwater monitoring network, may need additional investment, including through the Environment Contribution Levy. Actions involving catchment management authorities will be implemented through existing funding arrangements, or with the assistance of the Department, negotiated on a case-by-case basis. Where actions are delegated to water corporations, costs may be recovered through water pricing arrangements.

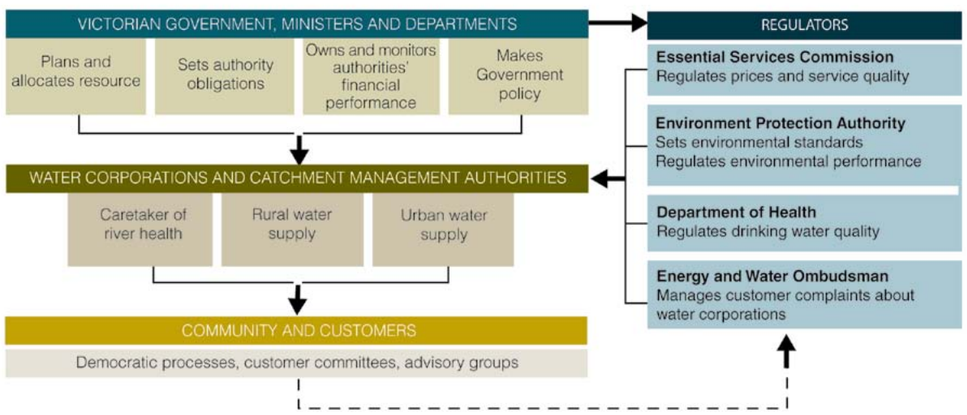
Impacts on water pricing

Water prices must be fair and independently managed.

The Essential Services Commission (ESC), as the independent economic regulator of the water industry, is responsible for protecting the interests of customers. Every five years, each water corporation must submit a water plan to the ESC. The water plan describes how they will deliver projects and service standards, the revenue required to do this, and an outline of proposed customer charges. The ESC publicly reviews these plans and then approves a package of prices and services the businesses must provide. The next review process will begin in mid-2012 to set prices for the period commencing 1 July 2013.

Water corporations in the Western Region will need to review the implementation actions assigned to them in this Strategy and ensure their water plans identify the costs so they can be considered by the ESC as part of the next price review process.

Figure 11.1 Roles and responsibilities in water resource management



11.2 Reviewing the Strategy

Under the *Water Act 1989*, the Minister for Water may review the Strategy at any stage, but it must be reviewed at least every 10 years. The first review will be completed by 2021 and will be informed by the long-term resource assessment due in 2019 and the implementation of the Murray-Darling Basin Plan in Victoria (see Section 10.4.1, page 237).

An adaptive approach is critical to managing future uncertainties about water availability.

Ongoing monitoring and evaluation of the region's water resources and implementation of this Strategy's actions will contribute to the 2021 review of the Strategy. This will allow the approach to implementing this Strategy to be reviewed and amended to suit changing circumstances. This information, together with the review, will give the community the opportunity to consider future water management needs with increased capacity and knowledge.

11.3 Community involvement in water resource planning

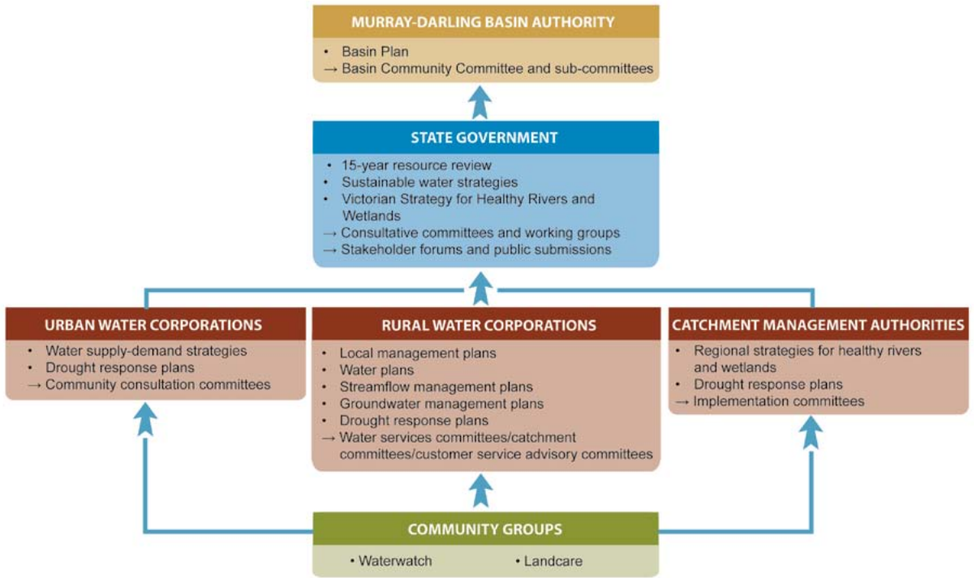
Water affects almost every aspect of our lives; it underpins our health, regional economies and amenity, and the environment. Decisions about its management can affect the very fabric of our communities, and therefore it is critical that community members are involved in water resource management. Community involvement ensures decisions about water resource management reflect community views, which may change over time, and support the values communities deem most important.

There are several processes where community members can contribute to water planning in their area (see Figure 11.2). These processes cover:

- all aspects of water resource management (including rural and urban supplies and the environment);
- a range of timeframes (from one to 50 years); and
- a variety of geographic scales (from specific waterways and groundwater management units to basin-wide arrangements).

To find out how you can get involved, contact your local water corporation, catchment management authority or other relevant organisation. See Further Information on page 246 for contact details.

Figure 11.2 Community involvement in water resource management – key planning and consultation processes



Volunteering

The community can contribute to water management and on-ground activities through volunteering in a range of ways including:

Waterwatch Victoria encourages and trains community volunteers to monitor and care for their local creeks, wetlands, groundwater, rivers and estuaries. Contact the Department of Sustainability and Environment on vic.waterwatch@dse.vic.gov.au, or check the Waterwatch website for local contacts (www.vic.waterwatch.org.au/contact).

Landcare is a local volunteer movement to protect and repair the land, biodiversity and waterways. Since beginning in Victoria in 1986, it has grown to involve thousands of Victorians and more than 700 groups. See www.landcarevic.net.au.

Parks Victoria organises volunteers in national and state parks. Contact 13 1963 or see www.parkweb.vic.gov.au/1volunteers.cfm.

GoVolunteer is a volunteer recruitment website providing free advertising for not-for-profit community organisations looking for volunteers. See www.govolunteer.com.au.

Photo: Corangamite CMA

Dedicated EstuaryWatchers, Painkalac Creek

View of Mt Sturgeon from the Homestead, Dunkeld Photo: Deb Brown

Department of Sustainability and Environment

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www.dse.vic.gov.au
www.water.vic.gov.au/programs/sws/western

Information regarding local water resource planning:

Southern Rural Water
1300 139 510
www.srw.com.au

Grampians Wimmera Mallee Water
1300 659 961
www.gwmwater.org.au

Wannon Water
1300 926 666
www.wannonwater.com.au

Barwon Water
1300 656 007
www.barwonwater.vic.gov.au

Coliban Water
1300 363 200
www.coliban.com.au

Central Highlands Water
(03) 5320 3100
www.chw.net.au

Information regarding regional river and catchment health:

Corangamite Catchment Management Authority
(03) 5232 9100
www.ccma.vic.gov.au

Glenelg Hopkins Catchment Management Authority
(03) 5571 2526
www.ghcma.vic.gov.au

Wimmera Catchment Management Authority
(03) 5382 1544
www.wcma.vic.gov.au

Mallee Catchment Management Authority
(03) 5051 4377
www.malleecma.vic.gov.au

North Central Catchment Management Authority
(03) 5448 7124
www.nccma.vic.gov.au

Information regarding the Border Groundwater Agreement between South Australia and Victoria:

Border Groundwater Agreement (South Australia – Victoria)
http://e-nrims.dwlbc.sa.gov.au/border/Default.aspx

South Australia - Department of Water, Land and Biodiversity Conservation
(08) 8463 6800
www.waterforgood.sa.gov.au

Victoria - Department of Sustainability and Environment
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www.dse.vic.gov.au

Information regarding planning and management in the Murray-Darling Basin:

Murray-Darling Basin Authority
(02) 6279 0100
www.mdba.gov.au

Information regarding climate data (including forecasts and seasonal outlooks):

Bureau of Meteorology
(03) 9669 4000
www.bom.gov.au

Information regarding Government options to reduce greenhouse gas emissions and tackle climate change:

www.climatechange.vic.gov.au
www.seaci.org

Other useful community contacts:

Victoria's Volunteering Portal
(03) 9208 3353
www.volunteer.vic.gov.au

Landcare
www.landcarevic.net.au

Waterwatch Victoria
www.vic.waterwatch.org.au

Parks Victoria
13 19 63
www.parkweb.vic.gov.au

1 Bureau of Meteorology (2011) Monthly climate summary for Victoria, http://www.bom.gov.au/climate/current/month/vic/archive/201101.summary.shtml

2 SEACI Fact Sheet (2011) The Millennium Drought and the 2010/11 Floods (www.seaci.org).

3 Station number 408200 Avoca River at Coonooer – Period of record from 1809 to 2010, long term average annual flow and drought period average annual flow

4 Station number 236205 Merri River at Woodford – Period of record from 1949 to 2010, long term average annual flow and drought period average annual flow

5 Intergovernmental Panel on Climate Change (2007) Fourth Assessment Report: Climate Change 2007, United Nations.

6 For example see:
- Steffen W (2011) The critical decade: Climate science, risks and responses, Climate Commission Secretariat, Australian Government Department of Climate Change and Energy Efficiency, Canberra, Australia.
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Acid sulfate soil Naturally occurring soils formed under waterlogged conditions and containing high quantities of iron sulfides. These soils are benign if left undisturbed below the watertable, but if drained, excavated or exposed to air, the sulfides within them can react with oxygen to form sulfuric acid and release heavy metals into the environment.

Adaptive management Systematic process of continually improving management policies and practices.

Anabranch A section of a waterway that diverts from the main watercourse channel (or main stem) and rejoins the waterway downstream.

Aquifer A layer of underground sediment that holds groundwater and allows water to flow through it.

Aquitard A layer of rock or soil that does not allow water to move through it easily.

Baseflows The component of streamflow supplied by groundwater discharge (or simulated from other environmental water).

Blue-green algal bloom Blue-green algae are commonly found in lakes, ponds and wetlands and usually occur in small numbers. When conditions are favourable (most often during hot, calm weather), algae can increase dramatically into blooms, which can threaten the quality of water for human consumption, recreation and stock use.

Bulk entitlement The right to water held by water corporations and other authorities defined in the *Water Act 1989*. The bulk entitlement defines the amount of water that an authority is entitled to take from a river or storage, and may include the rate at which it may be taken and the reliability of the entitlement.

Capacity share bulk entitlement Provides the entitlement-holder with a share of the storage capacity and inflows of water in the system. It also gives them the right to take water from specified points in the system.

Carryover Allows entitlement-holders to retain ownership of unused water allocated or bought from the current season into the following season (according to specified rules).

Catchment The area of land from which run-off from rainfall drains to a waterway, wetland or estuary.

Catchment management authorities (CMAs) Government authorities established under the *Catchment and Land Protection Act 1994* to manage river health, regional and catchment planning, and waterway, floodplain, salinity and water quality management.

Commonwealth Environmental Water Holder The position established under the Commonwealth *Water Act 2007* to manage the Commonwealth's environmental water holdings to protect or restore environmental assets in the Murray-Darling Basin and other areas.

Consumptive use Water that is provided for all human uses (that is, non-environmental purposes).

Dairy wash Water used to wash down farm dairies.

Dead storage Water in a storage that is below the lowest constructed outlet.

Delivery share An entitlement to have water delivered to land in an irrigation district and a share of the available channel or pipe capacity in a delivery system. It is linked to land and stays with the property if the water share is traded away.

Delivery share bulk entitlement Provides a volume of water each year, subject to defined restrictions during periods of water shortages.

Desalination The process of removing salt from water, often for drinking purposes.

Distribution losses See system operating water.

Diversions The removal of water from a waterway via a pump (also known as extractive use).

Domestic and stock Water use for household purposes, watering pets, cattle and other stock, fire prevention and irrigating a kitchen garden.

Drought response plan Used by urban water corporations to manage water shortages, including implementation of water restrictions.

EC units/level EC stands for electrical conductivity and is a measure used to indicate salinity levels in water.

Ecosystem A complex set of relationships among the living resources, habitats and residents of an area such as water, plants, animals and people.

Effluent Out flows of water following the use or treatment, for example treated sewage that flows out of a sewage treatment plant.

Environmental Contribution Levy An amount payable by urban and rural water corporations under the *Water Industry Act 2004* to promote the sustainable management of water and address adverse water-related environmental impacts.

Environmental flow regime The timing, frequency, duration, magnitude and pattern of flows for the environment.

Environmental water reserve The share of water resources set aside to maintain the environmental values of a water system.

Estuary A body of water formed where freshwater from rivers and streams flows to the sea mixing with the seawater. Estuaries are often opened to the sea, but this connection may close under natural conditions.

Estuary Entrance Management Support System A computer modelling system that considers the risks of artificially opening estuary mouths at different water levels and times of year, and possible impacts on infrastructure and natural assets.

Evapotranspiration Water transfer to the atmosphere through direct evaporation from surfaces and transpiration from plants.

Floodplain Land subject to overflow during floods that is often valuable for its ecological assets.

Fit-for-purpose Water that requires no further treatment for its intended use.

Freshes The first seasonal 'flush' of water through a waterway.

Gigalitre (GL) One billion (1,000,000,000) litres.

Green Triangle This plantation region comprises 17 local government areas throughout south-west Victoria and south-east South Australia and covers about 6 million ha. It is the largest wood fibre-producing region in Australia.

Greywater Household water that is not contaminated by toilet discharge, and can be reused for non-drinking purposes. Typically includes water from bathtubs, dishwashing machines and clothes washing machines.

Groundwater All subsurface water, generally occupying the pores and crevices of rock and soil.

Groundwater dependent ecosystem (GDE) Ecosystems, such as wetlands, streams, estuaries and some terrestrial vegetation, that rely totally or in part on groundwater to provide water.

Groundwater management area (GMA) Groundwater management unit where groundwater resources of a suitable quality for irrigation, commercial or domestic and s tock use are available or are expected to be available.

Groundwater management unit (GMU) Groundwater consumption is managed geographically via management units, which can be groundwater management areas (GMA), water supply protection areas (WSPA) or unincorporated areas (UA).

Groundwater management plans Created for water supply protection areas that have been or are proposed to be proclaimed under the *Water Act 1989* to ensure equitable and sustainable use of groundwater.

Headworks Dams, weirs and associated works used for the harvest and supply of water.

High-reliability water share Legally recognised, secure entitlement to a defined share of water.

Inflows Water flowing into a storage or river.

Influent Flows into a water treatment plant or sewage treatment plant.

In-stream The component of a river within the river channel, including pools, riffles, woody debris, the riverbank and benches along the bank.

Licensing authority Administers the diversion of water from waterways and the extraction of groundwater on behalf of the Minister for Water.

Local management plans Operating plans that include rules for managing surface water or groundwater accessed under section 51 take and use licences (referred to as local management rules in the Draft Strategy).

Low-reliability water share Legally recognised, secure entitlement to a defined share of water. Available after water is provided for high-reliability water share allocations and reserves, and previously known as sales water.

Managed Aquifer Recharge (MAR) A system of replenishing or recharging groundwater through infiltration or injection, and storing the water in aquifers for reuse. Aquifer Storage and Recovery is a specific type of Managed Aquifer Recharge.

Megalitre (ML) One million (1,000,000) litres.

Murray-Darling Basin Plan A high-level plan to ensure the water resources of the Murray–Darling Basin can be managed in an integrated and sustainable way. The plan is being prepared by the Murray-Darling Basin Authority and is due to come into effect in Victoria in 2019.

National Water Initiative (NWI) The NWI, signed by Victorian in 2004, to achieve a more cohesive national approach to the way Australia manages, measures, plans for, prices and trades water.

Outfall A place where a sewer, drain, or stream discharges wastewater into the ocean or other receiving waters.

Passing flows Flows that must be allowed to pass a dam or weir before water can be harvested for later use.

Permanent trade Transfer of a water share or licence.

Permanent Water Saving Rules Part of the Government's demand management and water efficiency initiatives, these rules are in place at all times. These rules are defined in a water corporation's Permanent Water Saving Plan.

Permissible consumptive volume (PCV) The volume of water permitted to be allocated in discrete groundwater management units. Previously called permissible annual volumes (PAVs).

Potable water Water of a quality suitable for drinking.

Qualification of rights When the Minister for Water declares a water shortage and qualifies existing water entitlements to reallocate water to priority uses.

Ramsar-listed wetlands Wetlands listed as internationally significant under the Convention on Wetlands signed in Ramsar, Iran in 1971.

Raw water Water that has not been treated for its intended purpose.

Recharge (to groundwater) The processes, such as infiltration and seepage, by which water enters aquifers and becomes groundwater.

Recycled water Water derived from sewerage systems or industry processes that is treated to a standard appropriate for its intended use.

Regulated systems Systems where the flow of the river is regulated through the operation of large dams or weirs.

Reliability of supply The frequency with which water that has been allocated under a water entitlement is expected to be able to be supplied in full.

Reservoir Natural or artificial dam or lake used for the storage and regulation of water.

Residential use Water use in households.

Reticulation Network of pipelines used to deliver water to end users.

Return flows The portion of an allocation that the entitlement-holder returns to the bulk supply system.

River basin The land drained by a river and its tributaries. The river basins used in this Strategy are consistent with those defined by the Australian Water Resource Council (AWRC).

Run-off Precipitation or rainfall that flows from a catchment into streams, lakes, rivers or reservoirs.

Salinity The total amount of water-soluble salts present in the soil or in a stream.

Seasonal allocation The specific volume of water allocated to a water share in a given season, defined according to rules established in the relevant water plan.

Sewage Wastewater produced from households and industry.

Sewerage The pipes and plant that collect, remove, treat and dispose of liquid urban waste.

Sleeper licences A water use licence which has been allocated but is not being used. Sleeper licences are sometimes referred to as inactive licences.

State Observation Bore Network A network of about 2,500 bores managed by the Department of Sustainability and Environment to monitor Victoria's groundwater resources.

Statutory management plan Prepared under the provisions of the *Water Act 1989* for a water supply protection area or a waterway to manage the water resources of the area.

Stormwater Run-off from urban areas. The net increase in run-off and decrease in groundwater recharge resulting from the introduction of impervious surfaces such as roofs and roads within urban development.

Stranded assets Distribution infrastructure left with too few customers to pay for its maintenance when water entitlements delivered by that asset trade to other systems.

Streamflow Water that runs in streams. This water comes from run-off in a catchment or from rain.

Streamflow management plan A statutory management plan prepared to manage the surface water resources of the area.

Supply by Agreement A commercial legally-binding agreement (contract) between a water user (or holder of water) and a water corporation. It creates an obligation on the water corporation to supply water to the other party in the agreement.

Sustainable diversion limit (SDLs) In this Strategy, SDLs refer to the upper limit on winter-fill diversions in an unregulated river sub-catchment, beyond which there is an unacceptable risk to the environment. They differ markedly from, and should not be confused with, the sustainable diversion limits proposed under the Murray-Darling Basin Plan.

System operating water 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.

Take and use licence A fixed term entitlement issued under section 51 of the *Water Act 1989* to take and use water from a waterway, catchment dam, spring, soak or aquifer, usually for commercial or irrigation purposes.

Temporary trade Transfer of a seasonal allocation.

Termination fee One-off payment made by an entitlement-holder as a condition of surrender of a delivery share.

Unbundling Separation of traditional entitlements into a water share, delivery share and a water-use licence.

Unaccounted water use Water use outside the water entitlement framework, such as domestic and stock use and water used by vegetation. In many cases, unaccounted water use is not recognised formally, measured accurately or managed effectively.

Unincorporated areas (UA) Areas with limited groundwater resources which are not defined as groundwater management areas or water supply protection areas and do not have a defined permissible consumptive volume.

Unregulated systems River systems with no large dams or weirs to regulate flow and all groundwater sources.

Victorian Water Register A public register of all water-related entitlements in Victoria. It records bulk end environmental entitlements, water shares and licences to improve transparency, accounting and management of the State's water resources (www.waterregister.vic.gov.au).

Wastewater Used water discharged from homes, farms, industry and other businesses.

Water corporations Government owned corporations charged with supplying water to urban and rural water users. These corporations, formerly known as water authorities, administer the diversion of water from waterways and the extraction of groundwater

Water market Market in which the trade of permanent and temporary water is allowed under certain conditions.

Water plans Outline of the services water corporations will deliver over a five-year period and the prices they will charge.

Water rights Previously rights to water held by irrigators. As a result of 'unbundling', these have now been separated into a water share, delivery share and water-use licence.

Water share A legally recognised, secure share of the water available to be taken from a water system which can be traded permanently or leased.

Water supply protection area (WSPA) An area declared under the *Water Act 1989* to protect groundwater and/or surface water resources in the area. Once an area has been declared, a statutory water management plan is prepared.

Water table Surface of groundwater below which the soil or rocks are permanently saturated with water.

Water-use licence Authorises the use of water on land for irrigation.

Wetlands Inland, standing, shallow bodies of water, which may be permanent or temporary, fresh or saline.

Wimmera-Avon river basin (Wimmera-Avon) The surface water catchment of the Wimmera and Avon-Richardson river systems including tributaries such as Yarriambiack Creek.

Wimmera-Glenelg river system (Wimmera-Glenelg) The main channels of the Wimmera and Glenelg rivers that can receive regulated flows from storages of the Wimmera-Mallee supply system.

Wimmera-Mallee Pipeline The 9,000 km pipeline network servicing the Wimmera-Mallee supply system, completed in 2010 and replacing 20,000 km of open earth channels.

Wimmera-Mallee supply system (Wimmera-Mallee) The extensive water supply system in north-west Victoria covering about 2.6 million ha.

Winter-fill licence A licence issued which permits taking water from a waterway only during the winter months (July-November).

Yield Quantity of water that a storage or aquifer produces.

ABA allocation bank account

AHD Australian height datum

ASS acid sulfate soil

BE bulk entitlement

BSMS Basin Salinity Management Strategy

CAMBA China-Australia Migratory Bird Agreement

CASS Coastal Acid Sulfate Soils

CCS Carbon capture and storage

CMA catchment management authority

COAG Council of Australian Governments

CRSWS Central Region Sustainable Water Strategy

CSIRO Commonwealth Scientific and Industrial Research Organisation

D&S Domestic and stock

DPI Department of Primary Industries

DSE Department of Sustainability and Environment

EC electrical conductivity units (salinity)

EEA Environmental Effects Act 1978

EEMSS Estuary Entrance Management Support System

EES Environmental Effects Statement

ENSO El Niño – Southern Oscillation

EPA Environment Protection Authority Victoria

ESC Essential Services Commission

EWR environmental water reserve

GDE groundwater dependent ecosystem

GL gigalitre

GMA groundwater management area

GMU groundwater management unit

GRSWS Gippsland Region Sustainable Water Strategy

GWMWater Grampians Wimmera Mallee Water Corporation

IASS Inland Acid Sulfate Soils

IOD Indian Ocean Dipole

IPCC Intergovernmental Panel on Climate Change

IVT inter-valley transfer

HRWS high-reliability water share

JAMBA Japan-Australia Migratory Bird Agreement

LMP local management plan

LRWS low-reliability water share

MAF Mean annual flow

MAR Managed aquifer recharge

MDB Murray-Darling Basin

ML megalitre

N/A not applicable

NRM natural resource management

NRSWS Northern Region Sustainable Water Strategy

NWI National Water Initiative

PCV permissible consumptive volume

RSHRW Regional Strategy for Healthy Rivers and Wetlands (to replace Regional River Health Strategies)

SAFE Secure Allocation, Future Entitlements (groundwater management project)

SAM Southern Annular Mode

SDL sustainable diversion limit

SEACI South East Australia Climate Initiative

SFMP streamflow management plan

SRW Southern Rural Water

TBD to be determined

TCSA Tertiary Confined Sand Aquifer

VCS Victorian Coastal Strategy

VEAC Victorian Environment Assessment Council

VEFMAP Victorian Environmental Flow Monitoring and Assessment Framework

VEWH Victorian Environmental Water Holder

VFF Victorian Farmers Federation

WRSWS Western Region Sustainable Water Strategy

WSPA water supply protection area

WYDS Woady Yaloak Division Scheme

Appendix 1: Independent Panel report on public submissions to the Draft Strategy

The Independent Panel

As outlined in Chapter 1, an Independent Panel considered public submissions and other feedback from the consultation program for the development of the Western Region Sustainable Water Strategy. The Panel was appointed by the Minister for Water on 19 August 2009 under Section 22F(1) of the *Water Act 1989*. Panel members and their credentials are listed below.

Under the Water Act, the Panel reports to the Minister and may include recommendations at its discretion. The Panel reviewed the 272 public submissions to the Draft Strategy. Their final report on the key issues arising from the Draft Strategy and the submissions was submitted to the Minister on 21 September 2010. A copy of the report and all public submissions are available from www.water.vic.gov.au/programs/sws/western.

Table A1.1 summarises the recommendations made by the Independent Panel and provides the Victorian Government's response to these recommendations, including cross references to relevant sections in the Strategy.

Christine Forster (Chair), AM

Ms Forster became a Member of the Order of Australia in 2006 in recognition of her service to the environment in the area of water resource management. She is also a wool producer in western Victoria and has been actively involved with rural adjustment and regional development issues.

Professor John Langford, AM

Professor John Langford has unique system-wide perspective on water management in Australia from 38 years experience in water policy, management, strategic research and reform, including 15 years in chief executive positions.

Barry Steggall

Mr Steggall is the former State Deputy Leader of the National Party, former Member for Swan Hill (1983-2002) and former Shadow Minister for Agriculture, Water Resources and Technology (1999-2000).

Sally Farrier

Ms Farrier is Director of Farrier Swier Consulting, a Director of Hydro Tasmania, and a National Water Commissioner. She was a Director of Western Power between 2006 and 2009.

Table A1.1 Government response to the report of the Independent Panel about the Draft Western Region Sustainable Water Strategy (SWS)

	Recommendation	Response for the Western SWS	Reference
1	**Western Region draft SWS Consultation** The Panel recommends further consultation with the EPA in finalising the Western Region SWS and that future regional Sustainable Water Strategies involve public consultation on a discussion paper as well as the draft SWS.	Agreed. EPA Victoria was invited to become an observer on the Western and Gippsland SWS Consultative Committees. They were not able to provide a representative due to other commitments. The EPA was consulted on the Draft Western SWS and during the completion of the final SWS. They also provided a submission to the Draft SWS. The development of the Gippsland Region SWS included a discussion paper.	Chapter 1, Section 1.4 – page 22. See also: http://www.water.vic.gov.au/programs/sws/western/draft-strategy-submissions
2	**Water Literacy** The Panel recommends that the Government invest in improving "water literacy" to build community understanding of the water cycle, water trading and groundwater management. Particular attention should be given to water interception activities (farm dams and water use by plantations and other vegetation).	Agreed. The final SWS was developed to document and explain key water management arrangements and issues affecting water resources. Chapter 5 and the state-wide policy paper provide an overview of interception activities and processes, and explain the rationale for the approach for managing their water resource impacts. Farm dams will be managed under the arrangements set out in the Northern SWS. Additional measures have been included in Chapter 3 to develop better information about domestic and stock water use.	Reference Guides 1 and 2. Chapter 2 outlines the region's water resources and pressures on them. Chapter 3 outlines broad water management arrangements, including improving information about water interception by farm dams. Chapter 4 outlines the rationale for using groundwater systems as the basis for management. Chapter 5 and the state-wide policy paper outline land use changes and potential impacts on water resources.

	Recommendation	Response for the Western SWS	Reference
3	**The Murray-Darling Basin Plan** The Panel recommends that the Government defer finalising the Western Region SWS until the public consultation phase of the Murray-Darling Basin Plan is complete, this will to allow an opportunity for alignment of both plans.	Noted. The Victorian Government will work with the Murray-Darling Basin Authority to clarify how the Wimmera and Mallee catchments will be incorporated into the Commonwealth's Basin Plan. It is not practical to delay the release of the final Western SWS to align the timing of both plans. However, actions and policies will maintain flexibility to fit in with the outcomes in the MDB Plan. Finalisation of the SWS will contribute to resolution of several issues the Basin Plan.	Section 10.4.1 The Murray-Darling Basin Plan – page 237. Section 5.7.3 The Murray-Darling Basin Plan (land use change) – page 143.
4	**2019 Water Resource Review** The Panel recommends that the Western Region SWS draws greater attention to the 2019 Victorian water resource review and the potential implications of this review.	Agreed. Chapter 3 outlines the broad arrangements for managing water in Victoria including long-term processes for reviewing entitlements such as the 15-year review of water resources.	Section 3.1.4 – page 65.
5	**Growth Water** The Panel recognises that not selling the growth water could have a financial impact on Grampians Wimmera Mallee Water and recommends that the Essential Services Commission consider this impact as part of the price review process.	Agreed in principle. GWMWater has proposed a process for selling the growth water and managing any potential risks to reliability of existing supplies and the environment. The Essential Services Commission will consider pricing implications through the Water Plan process for setting prices for the period 2013/14 to 2018/19.	Section 6.3.2, Action 6.3 – page 152.
6	**Wimmera-Mallee Pipeline - Recreation Water** The Panel recommends that the final SWS identify principles for the management of recreational water, to be applied by water authorities across the State, based on the work of the GWMWater Recreational Water Users Committee.	Agreed. Principles for providing recreational water within the Wimmera-Mallee system are included in the SWS. Further detail will be clarified in specific operating rules for each water body which will be developed in consultation with GWMWater, CMAs and DSE. Region-specific rather than state-wide principles were developed given the range of different circumstances throughout the State.	Section 6.5.1, Policy 6.3 – page 161.

	Recommendation	Response for the Western SWS	Reference
7	**Environmental Water** The Panel strongly recommends that a review of the Wimmera-Mallee Pipeline system Bulk Entitlements should be undertaken with the aim of improving the reliability of the environment's share of the savings under low flow conditions.	Agreed. The operation of the bulk entitlements will be reviewed in 2014. This will allow sufficient time to gain adequate experience in operating the new pipeline system and the environmental entitlements. The reliability of the environment's share of the water savings has been improved by increasing the reliability of the component from the Northern Mallee Pipeline to the highest level.	Section 6.2.2 Managing the new pipeline system – Reviewing operating arrangements. Action 6.1 – page 150.
8	**Governance Issues** The Panel recommends that the Government commit to reviewing the effectiveness of the new arrangement for managing the Grampian's storages in the light of two years operating experience.	Agreed in principle. The operation of the bulk entitlements will be reviewed after 3 years. This was considered by all entitlement holders and other key stakeholders as an appropriate timeframe to allow sufficient operational experience to be gained for review. The SWS includes several actions to allow improved efficiency of operating the system and storages. Operation will be monitored and assessed through processes established in the bulk entitlements. The storage management rules will be reviewed and updated periodically to ensure they remain relevant and clear to all parties. Entitlement-holders can propose amendments to the storage management rules at any time.	Section 6.2.2 Managing the new pipeline system – Reviewing operating arrangements – page 150, Action 6.1. Also Actions 6.2, 6.4, 6.5 and 6.6

	Recommendation	Response for the Western SWS	Reference
9	**Groundwater Monitoring Framework** The Panel recommends that the Victorian Government, in the final SWS, commit to a timetable and investment program for rehabilitating the State Observation Bore network.	Agreed. The SWS includes a policy and actions outlining how the SOBN will be upgraded, maintained and operated to provide adequate and targeted monitoring. These policy and actions have been agreed between DSE, rural water corporations and catchment management authorities to allow clarification of appropriate contributions from all beneficiaries to run the network.	Section 4.4.1 Long-term, viable and cost effective groundwater monitoring – page 118, Policy 4.2, Actions 4.9 and 4.10
10	**Groundwater Pricing** The Panel recommends that following rehabilitation of the bore monitoring network groundwater charges for beneficiaries (users and governments) be reviewed to ensure sufficient funds are raised for the on-going management of groundwater monitoring and compliance programs and for the cost of maintaining the State Observation Bore network.	Agreed. See previous recommendation.	See previous recommendation
11	The Panel believes that Victoria's water accounting system will need to expand over the next decade to include all interception activities if we are to insure against a drier future.	Agreed. The water accounting system will be developed to estimate a range of currently unaccounted water uses. Chapter 5 outlines the framework to account for interceptions by land use changes. Chapter 3 includes actions to improve monitoring and tracking of water use currently outside the entitlement framework, and improve estimation of domestic and stock water use.	Section 5.2 Estimating water use – page 132, Actions 5.1 and 5.2 Section 3.1.2 Strengthening the entitlement framework – page 56. Actions 3.2 and 3.3

	Recommendation	Response for the Western SWS	Reference
12	**Domestic and Stock Water** The Panel recommends that the Western SWS further develop volumetric allocations for stock and domestic water across the Western Region as a pilot for a state-wide system.	Noted. Current government policy does not propose volumetric allocations for domestic and stock water. The Northern Region SWS introduced a state-wide change for new or altered domestic and stock dams (and aesthetic dams) in rural residential areas. Under the changes, property owners in rural residential areas are required to register any new or altered domestic and stock dams with their rural water corporation. It also includes an action to better define reasonable domestic and stock use to improve efficiency. The Western SWS includes actions to improve information about domestic and stock water use. Property owners in rural residential areas will be required to (i) register existing domestic and stock dams on change of ownership, and (ii) obtain an operating licence for new domestic and stock bores, and existing active bores on change of ownership.	Section 3.1.2 Strengthening the entitlement framework – page 59. Actions 3.2 and 3.3 See also: http://www.water.vic.gov.au/programs/sws/northern/updates
13	**Plantations and Plant Water Use** The Panel recommends that the Water Act be the primary legislative instrument for managing land use impacts on water resources.	Agreed. The *Water Act 1989* has been used as the primary instrument for managing the adverse impacts of land use changes on water resources. This was supported by outcomes from the broad consultation for the Draft SWS. The Water Act will be amended to allow areas affected by significant land use changes to be declared for more intensive management.	Chapter 5, Action 5.3 – page 134.

	Recommendation	Response for the Western SWS	Reference
14	**Consistent approach between South Australia and Victoria in managing plantation impacts** The Panel recommends that the final SWS provides a commitment on the part of the Victorian government to collaborate with the South Australian government, before potential SA legislation is enacted, on managing the impact of plantations on water use consistent with sections 55 to 57 of the Intergovernmental Agreement for the National Water Initiative.	Agreed in principle. The SWS notes the need for compatible approaches in both states. The Victorian Government will work with the South Australian Government to ensure land and water management is balanced and equitable between states. South Australian natural resource managers have been actively involved in the working group and Consultative Committee during the discussions about this issue and the development of the approach for the Western SWS.	Section 5.7 What about other jurisdictions? – page 142.
15	**Managing rural drainage** The Panel recommends that the guidelines for local management planning for rural drainage be incorporated into the Victorian strategy for healthy rivers, estuaries and wetlands, currently being prepared by DSE.	Agreed in principle. The SWS defers to the Victorian strategy for healthy rivers, estuaries and wetlands about management of rural drainage.	Box 3.7 – page 90.

Kookaburras Photo: DSE

A2.1 Surface water

The Western Region is comprised of nine major river systems (see Figure A2.1) in the following sub-regions:

Otway – covers the Otway Coast River Basin;

South-west Coast – covers the Portland Coast and the lower parts of the Glenelg and Hopkins river basins;

Western District – covers the upper parts of the Glenelg and Hopkins river basins and the Lake Corangamite River Basin; and

North-west – covers the Wimmera-Avon, Mallee, Millicent Coast and Avoca river basins.

Table A2.1 shows the annual average volumes of surface water available for consumptive water use and remaining as basin outflows. The figures in Table A2.1 are based on long-term annual averages of about 50 years. It is important to note that these estimates do not reflect the volume of water used or the flows in any particular year. Actual use will vary from year to year with climatic variability and the use of entitlements. The estimates in the table reflect the maximum that could be taken rather than historical use.

The Wimmera and Glenelg rivers are the only ones in the region with an explicit volumetric environmental entitlement. Under this entitlement, about 40 GL is held in storages to be shared between the two rivers for environmental purposes. Environmental water in the remaining (unregulated) waterways is provided by passing flow conditions on bulk entitlements, minimum flows set by rural water corporations and flows above consumptive caps (sustainable diversion limits, see Reference Guide 2).

Figure A2.1 River basins and waterways in the Western Region

Table A2.1 Surface water available under entitlements (ML/year)

Basin	A	Water that could be extracted under current entitlements and caps (B-F)									Average flows at basin outlets	J
	Average annual streamflows	Bulk entitlements				Unallocated water[3]	Environmental Entitlements	Total				
		Urban, Industrial & other[1]	Irrigation	Headworks & distribution losses	Licensed diversions on unregulated rivers[2]	Small catchment dams[2]						
		B	C	D	E	F	G	H	I			
Otway												
Otway Coast	838,400[6]	15,100	0	0	4,400	16,200	34,600	0	70,400		802,700[7]	
Sub-total	**838,400**	**15,100**	**0**	**0**	**4,400**	**16,200**	**34,600**	**0**	**70,400**		**802,700**	
South-West Coast and Western District												
Glenelg[4]	668,600[6]	3,100	0	27,900[8d]	830	80,100	0	16,620[8a]	128,600		532,300[8]	
Hopkins[4]	397,700[6]	570	0	0	8,300	94,700	1,300	0	104,800		294,200[7]	
Portland Coast[4]	348,200[6]	0	0	0	1,600	20,600	28,800	0	51,000		326,000[3]	
Lake Corangamite[4]	247,000[6]	0	0	0	920	18,900	2,600	0	22,400		227,200[3]	
Sub-total	**1,661,500**	**3,700**	**0**	**27,900**	**11,600**	**214,300**	**32,700**	**16,620**	**306,800**		**1,379,700**	
North-West												
Wimmera-Avon	306,100[8b]	47,100[8]	22,600[8]	49,000[8d]	2,000	23,000	0	24,940[8a]	168,600		172,900[8]	
Avoca	136,200[2]	250	0	0	2,900	22,500	0	0	25,600		110,600[8c]	
Millicent	4,000[2]	0	0	0	100	0	0	0	100		3,900	
Mallee[5]	0	0	0	0	0	0	0	0	0		0	
Sub-total	**446,300**	**47,400**	**22,600**	**49,000**	**5,000**	**45,500**	**0**	**24,940**	**194,400**		**287,400**	
TOTAL	**2,946,200**	**66,200**	**22,600**	**76,900**	**21,100**	**276,000**	**67,300**	**41,560**	**571,100**		**2,469,800**	

1. Water use for individual towns is summed for each basin from estimates provided by water corporations and DSE, outputs from REALM models if available, a proportion of entitlement volume or metered use.
2. Average annual values taken from the 2009/10 Victorian Water Accounts.
3. Data sourced from Sustainable Diversion Limits project.
4. The Glenelg and Hopkins basins are in both the Western District and South-west sub-regions. The Portland Coast Basin is wholly within the South-west, and Lake Corangamite is wholly within the Western District.
5. There are no water sources in the Mallee Basin and no significant extractions. However water is transferred into the basin from the Murray via the Northern Mallee Pipeline and the Wimmera-Mallee Pipeline for urban and domestic and stock use.
6. These volumes were estimated as a water balance using the other volumes in the table for each basin.
7. Based on modelled outputs if REALM models available and stream gauging data transposed to the basin outlet where there are no models.
8. Figures are mainly averages taken from REALM modelling, but may include estimates of use for small entitlements in the basins in the basin but not included in the models.

[a] Assumes water supplied under the environment's regulated entitlement is split 60:40 between the Wimmera and Glenelg rivers.

[b] Includes water transferred from the Glenelg Basin and water taken by farm dams.

[c] Flow from the Avoca Basin includes water that flows to floodplains and the Lalbert and Tyrell creeks. This has been estimated by subtracting consumptive use from average annual streamflow.

[d] The Wimmera-Mallee system headworks loss has been calculated from REALM modelling. It is the sum of the relevant storage evaporation and channel and river losses. It excludes losses associated with the irrigation system and the distribution network and its balancing storages.

A2.2 Groundwater

Groundwater occurs when rain infiltrates the soil into aquifers – nature's way of storing water underground. Major stores of groundwater in the Western Region are in the Murray and Otway groundwater basins. These groundwater basins are made up of a series of aquifers that are used to provide water for domestic and stock, town, irrigation and industrial use. Groundwater can also provide water to what is known as groundwater dependent ecosystems, which can include streams, wetlands, estuaries and vegetation.

Groundwater within the basins is replenished by recharge – water seeping through the ground from rainfall, streams, flooding and irrigation. The volume and rate of recharge depends on climatic conditions, the depth to the water table, the types of plants that use water in the soil and the types of soil and rock water must pass through.

In some areas, annual recharge contributes significantly to the volume of water in an aquifer, while in other areas it makes up only a small proportion of the volume. In extreme cases, recharge is negligible or occurs over such a long period of time that it does not replenish groundwater resources within practical management timeframes. For example, the groundwater in the West Wimmera area is many thousands of years old.

Types of aquifers

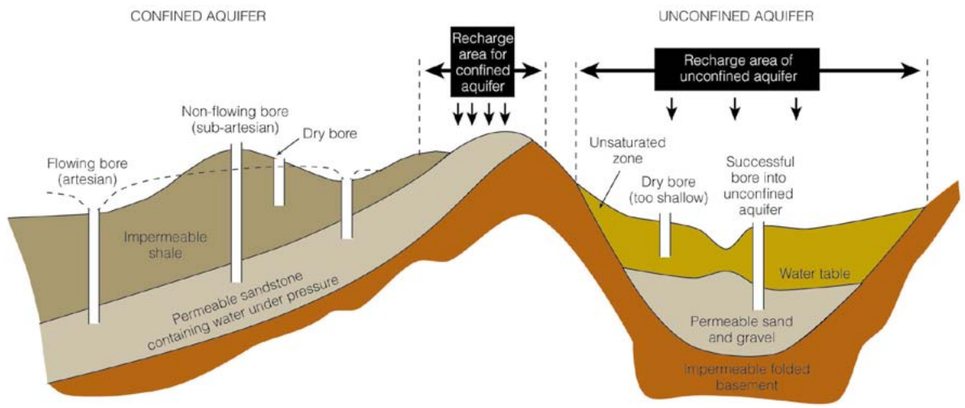
Aquifers may be unconfined or confined (see Figure A2.2).

The water level in an **unconfined aquifer** forms the water table below the soil surface. It behaves like a bucket with the water level varying with recharge and the rate of water use.

In a **confined aquifer,** the groundwater is capped by a layer of rock or soil that does not easily allow the water to move through it. A confined aquifer behaves more like a pipe than a bucket with the groundwater often being under pressure. When a bore reaches the aquifer, the pressure pushes the water level above the top of the aquifer. Where the pressure is high enough, the groundwater rises above the ground. This is commonly called a 'free flowing' or artesian bore.

An unconfined aquifer may have one or more confined aquifers beneath it. This is a **multiple aquifer system**. The groundwater in each of these aquifers may have different water levels and water quality (ie. salinity levels).

Figure A2.2 How aquifer systems work



Groundwater management units

Where aquifers are being used significantly, or have the potential for significant use, groundwater management units (GMUs) have been established to help manage the resource (see Figure A2.3). These groundwater management units are described as groundwater management areas (GMAs), water supply protection areas (WSPAs) or unincorporated areas. GMAs and WSPAs are assigned a permissible consumptive volume (PCV), which caps the amount of water that can be allocated for licensed extraction.

Unincorporated areas are generally areas in which groundwater development is limited by information about resource availability. The Western Region has three unincorporated areas that reflect rural water corporation boundaries. These unincorporated areas generally have no significant groundwater development because the quality or yield of the aquifers limits their use to low volume activities. However, groundwater in unincorporated areas is important for domestic and stock use or specific uses such as industry or mining, and is generally not capped.

The total volume of licences that can be issued for each groundwater management unit has been capped. Table A2.2 shows for each GMU in the Western Region:

- the aquifer characteristics;
- the current water level status;
- the permissible consumptive volume (PCV);
- the volume that has been allocated through licences;
- estimated groundwater use; and
- an indication of whether additional groundwater is available.

Some of the GMUs have stable water levels. The levels of others are declining due to pressures such as extended drought, intensive groundwater extractions and changes in land use. Falling water levels have been well documented. Steps have been taken to manage the impact of declines on users.

Access to groundwater within GMUs is through the groundwater licensing process administered by Southern Rural Water and Grampians Wimmera Mallee Water. In any GMU, licensed entitlement is capped at the PCV, with the exception of Hawkesdale, where the cap has been set at the current entitlement volume, which is below the PCV. In assessing licence applications, the rural water corporation must consider a range of equity and environmental issues. Depending on the area and specific characteristics of the aquifer and groundwater use, this can put additional constraints on where groundwater can be pumped.

Table A2.2 shows that 11 GL of unallocated groundwater is available under current PCVs for use in the Western Region.

In some areas, actual use is below the total licensed volume. In the 12 GMUs that are fully allocated, groundwater is available only by trade. In some areas, water is available only via temporary trade because a groundwater management plan has not been established (see Chapter 4).

Figure A2.3 Groundwater management units in the Western Region

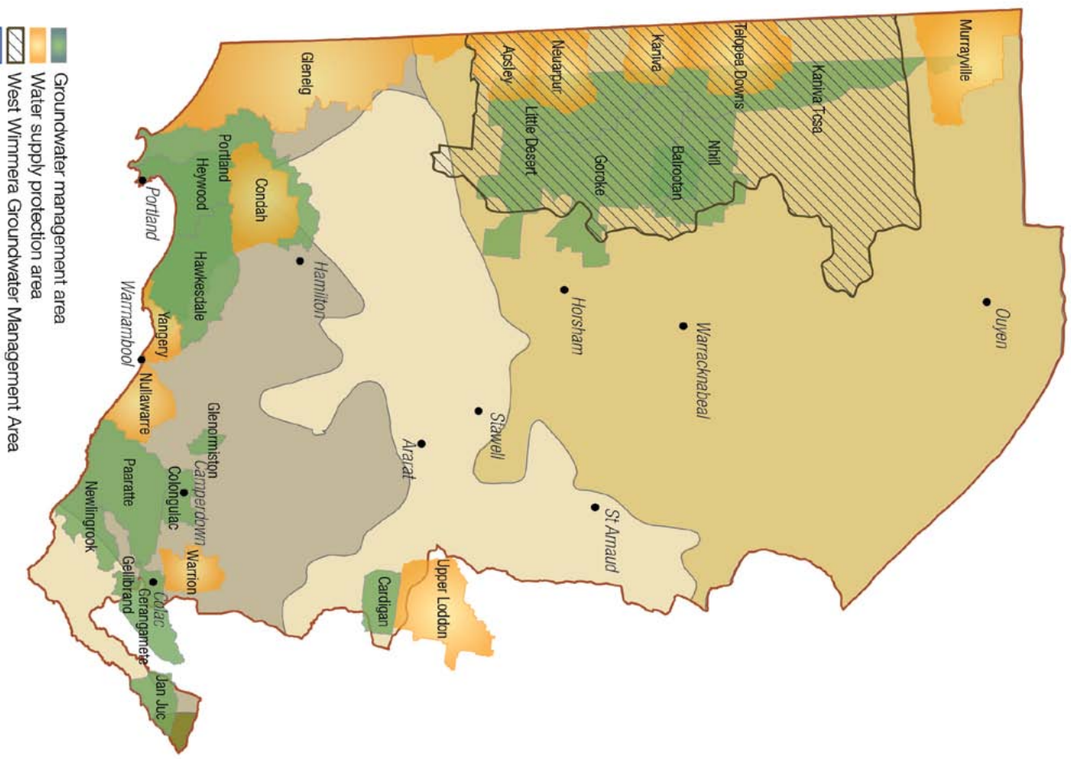


Table A2.2 Groundwater level status and availability in the Western Region

Groundwater management unit	Depth (m)	Aquifer type	Water level status[10] 30 June 2011	PCV[1] (ML)	Licensed entitlement (ML) (30 June 2010)	Available volumes (B-C)	Licensed metered and estimated use (30 June 2010) (ML)	Groundwater availability
			A	B	C			
Otway Groundwater Basin								
Otway sub-region								
Colongulac GMA	<60	Unconfined	Insufficient Information	4,695	4,043	652	684	By allocation or by trade
Gellibrand GMA[2]	All depths	Generally confined	Declining	-	-	-	0	Not available
Jan Juc GMA [3, 4]	All depths	Generally confined	Declining	39,250	39,250	0	3,457	Only by trade as the licensed entitlement has reached the permissible consumptive volume
Newlingrook GMA	All depths	Generally confined	Declining	1,977	1,947	30	95	By allocation or by trade
Paaratte GMA	>120	Generally confined	Stable	4,606	3,193	1,413	291	By allocation or by trade
Western District sub-region								
Gerangamete GMA[3, 5]	>60	Generally confined	Declining	20,000	20,000	0	12,692	Only by trade as the licensed entitlement has reached the permissible consumptive volume
Glenormiston GMA	<60	Unconfined	Insufficient information	2,565	2,463	102	658	By allocation or by trade
Warrion WSPA	All depths	Unconfined	Insufficient information	13,836	13,835	<1	2,781	By trade under the approved Management Plan
Glenelg WSPA	All depths	Semi confined to unconfined	Declining	32,660	32,660	-	7,759	Temporary trade only[8]
South-West sub-region								
Condah WSPA	70-200	Generally confined	Declining	7,437	7,436	<1	2,628	Only by trade as the licensed entitlement has reached the permissible consumptive volume
Heywood GMA	<70	Semi confined to unconfined	Insufficient information	8,500	6,564	1,936	1,578	By allocation or by trade
Hawkesdale GMA[9]	Zone 1: All depths Zone 2: >200	Semi confined to unconfined	Stable	16,161	11,753	0	5,214	Trade only – capped at current entitlement
Nullaware WSPA	0-250	Semi confined to unconfined	Insufficient information	21,280	21,279	<1	9,859	By trade under the approved Management Plan

Table A2.2 continued - Groundwater level status and availability in the Western Region

Groundwater management unit	Depth (m)	Aquifer type	Water level status[10] 30 June 2011	PCV[1] (ML)	Licensed entitlement (ML) (30 June 2010)	Available volumes (B-C)	Licensed metered and estimated use (30 June 2010) (ML)	Groundwater availability
Portland GMA	>200	Generally confined	Stable	7,795	7,794	<1	2,726	Only by trade as the licensed entitlement has reached the permissible consumptive volume
Yangery WSPA	<100	Semi confined to unconfined	Insufficient information	14,103	14,101	2	4,026	By trade under the approved Management Plan
Otway Groundwater Basin TOTAL				**194,865**	**186,318**	**4,135**	**54,448**	
Murray Groundwater Basin								
North West sub-region								
Apsley WSPA[6, 7]	All depths	Generally confined	Stable	5,591	5,591	-	1,356	Temporary trade only[8]
Balrootan GMA[6, 7]	60-125	Generally confined	Insufficient Information	1,522	1,522	-	786	Temporary trade only[8]
Goroke GMA[5]	TCSA	Generally confined	Stable	2,200	0	2,200	0	By allocation or by trade
Kaniva TCSA GMA[7]	TCSA	Generally confined	Stable	1,100	0	1,100	0	By allocation or by trade
Kaniva WSPA[6, 7]	25-140	Generally confined	Stable	7,659	7,659	-	1,991	Temporary trade only[8]
Little Desert GMA[7]	TCSA	Generally confined	Stable	1,100	0	1,100	0	By allocation or by trade
Murrayville WSPA	70-200	Generally confined	Stable	10,883	9,634	1,249	5,415	By trade under the approved Management Plan
Neuarpur WSPA[6, 7]	50-175	Generally confined	Stable	24,750	24,691	59	12,700	By trade under the approved Management Plan
Nhill GMA[7]	TCSA	Generally confined	Stable	1,200	0	1,200	0	By allocation or by trade
Telopea Downs WSPA[6, 7]	All depths	Generally confined	Stable	10,682	10,682	0	2,312	Temporary trade only[8]
Murray Groundwater Basin TOTAL				**66,687**	**59,779**	**6,908**	**24,560**	
Western Region TOTAL				**261,552**	**246,097**	**11,043**	**79,008**	

Notes:
1. Permissible consumptive volume
2. A temporary PCV was issued for Gellibrand. This PCV (625 ML) expired in August 2009. The PCV beyond August 2009 is yet to be determined.
3. Only part of the GMU is located within the Western Region. Some of the water extracted from this area may be used outside the Western Region.
4. The PCV for Jan Juc is: Zone 1 – 250 ML/yr, Zone 2 Upper Eastern Formation 4,000 ML/yr, Zone 2 Lower Eastern Formation 35,000 ML in any 5 year period, Zone 2 all other formations 0ML. This PCV was gazetted on 25 June 2009, with the Bulk Entitlement for Barwon Water gazetted on 30 June 2009. The bulk entitlement restricts annual extraction to a maximum of 10,000 ML.
5. The PCV for Gerangamete in the period of 100 years is 400,000 ML, in any one year 20,000 ML, in any consecutive 10 years 80,000 ML.
6. A PCV has not been established for these management units. The volume listed is the sum of licensed entitlements as at 14 July 2011.
7. It is proposed that the following GMUs will be included in the West Wimmera Groundwater Management Area: Apsley WSPA, Balrootan GMA, Goroke GMA, Kaniva TCSA, Kaniva WSPA, Little Desert GMA, Neuarpur WSPA, Nhill GMA and Telopea Downs WSPA (see Table 10.2 for water availability and use figures based on the new West Wimmera boundary zones).
8. Permanent trade within water supply protection areas is not permitted until a groundwater management plan is in place, however, temporary trade is permitted.
9. No more licences are likely to be issued in the Hawkesdale GMA due to a June 2010 VCAT decision.
10. Based on long term (>10 year) trend

Bullocks head, Donald

Photo: Mark Wood

The major influences on Australia's climate are shown in Figure A3.1. These influences have varying levels of impact in different regions at different times of the year. Details of the various influences, including the spatial extent and timing of their impacts, can be found on the Bureau of Meteorology website[1]. The descriptions of the sub-tropical ridge and the Southern Annular Mode below are taken largely from this source.

Of these influences, those most important for Victoria's climate are highlighted in red boxes in Figure A3.1. Larger-scale influences that research has shown to have an impact, but which are not shown in this figure, include global warming of the atmosphere and oceans due to the enhanced greenhouse effect[2,3,4,5,6,7,8,9], ozone depletion at the South Pole[10,11,12] and the impact of Northern Hemisphere aerosol pollution (via impacts transmitted southwards through the Indian Ocean)[13]. Ocean currents are also important influences – both the surface currents within and linking the major ocean basins and the deeper ocean currents that form the 'global conveyor belt' linking the Pacific, Indian, Atlantic and Southern oceans.

Changes in rainfall patterns over south-east Australia during the recent drought (1997-2009) have been linked primarily to increases in mean sea level pressure over southern Australia that, in turn, are linked to the increasing intensity of the **sub-tropical ridge[14].** This is a belt of high pressure about 30° south (and north). It is part of the global circulation of the atmosphere (see Figure A3.2). High pressure systems, which are associated with stable and dry conditions, move east along the ridge.

The position of this ridge has a seasonal cycle, being furthest north in early spring and furthest south in late summer. During the warmer half of the year (November to April), the sub-tropical ridge is generally located south of Australia. In autumn, the sub-tropical ridge moves north and remains over the continent for most of the colder half of the year (May to October).

The position of the mid-latitude westerly wind belt (and its embedded rain-bearing low pressure and frontal systems) to the south of the ridge also reflect this seasonal cycle. Changes in the intensity of the sub-tropical ridge have been shown to account for about 80 per cent of the observed decline in rainfall during the recent drought, and there also have been changes in its seasonal cycle, with the ridge moving northwards later in autumn14,[16],[17]. As a consequence of these changes, Victoria has been less exposed to the influence of the mid-latitude westerlies and the associated embedded frontal systems and low pressure systems that typically used to bring regular rainfall over the period from around March to October. Research has shown that the changes in the intensity of the sub-tropical ridge are at least partly linked to global warming.

The changes in mean sea level pressure may also partly reflect an increasing trend in the **Southern Annular Mode** (SAM). The SAM is a relatively short-term mode of climate variability (10+ days) characterised by a 'flip-flopping' of pressures and associated changes in storms and winds between mid (about 45°S) and higher (about 65°S) latitudes. During a 'positive' SAM event, the belt of strong westerly winds contracts towards the South Pole. Conversely, during a 'negative' SAM event the belt of westerly winds moves towards the equator. The effect of fluctuations in SAM on Victoria's climate depends on the season. During winter, a positive SAM results in weaker than normal westerly winds, higher pressures, and more stable conditions over southern Australia, with associated reductions in rainfall. A negative SAM in winter results in lower pressures and more storm systems over southern Australia with associated increases in rainfall. During spring and summer, a positive SAM results in a stronger than normal easterly component to the winds, increasing the likelihood of warm moist air moving into eastern Victoria and enhancing rainfall in the eastern half of the State. While there has been a generally increasing trend in 'positive' SAM over recent decades, the magnitude of the trend varies between seasons (as does the strength and direction of the association between SAM and Victorian rainfall). Overall, SAM appears to be an important factor in contributing to the observed decreases in rainfall in winter, and its influence is an ongoing area of research[18].

Figure A3.1 Australian climate influences [1]

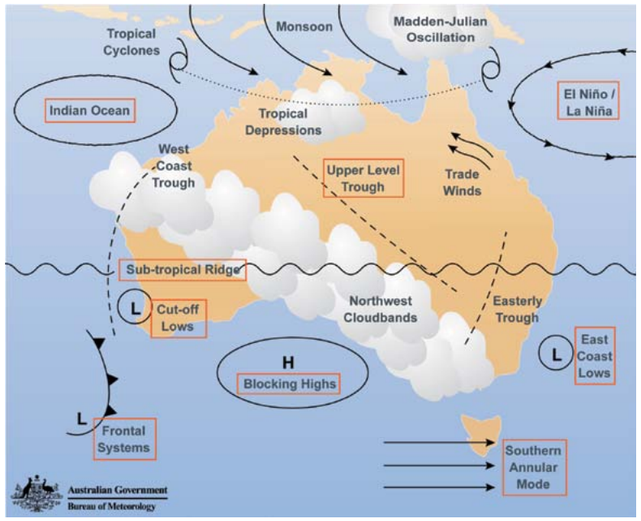
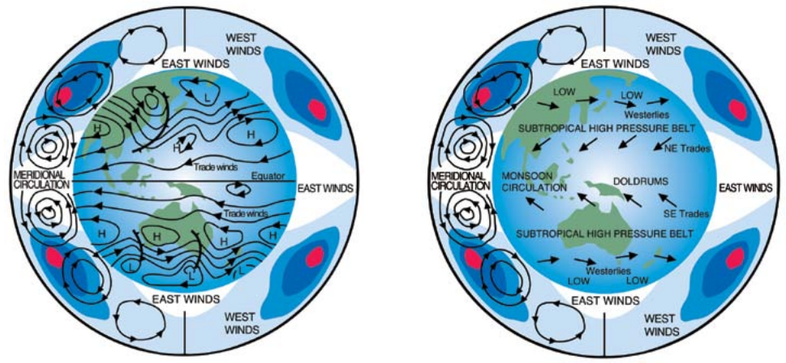


Figure A3.2 Essential features of the general circulation of the atmosphere[15]



As described in Section 2.2, the very wet conditions experienced in Victoria (and across much of Australia) from late 2010 to early 2011 were largely due to the influence of one of the strongest La Niña episodes on record[19]. The impact of this strong La Niña was exacerbated by the SAM (which reached positive record values in late spring and early summer of 2010). In addition, one of the largest negative Indian Ocean Dipole events of the past 50 years was recorded in 2010, which contributed to the enhanced spring rainfall.

Despite this high spring/summer rainfall, it is of note that average to below average rainfall was recorded across much of the State from May to July 2010 and (with the exception of Gippsland) from April to August 2011. This generally reflects the pattern established during the recent drought of below average rainfall during the autumn/winter months. This is consistent with research indicating that continuing reductions in winter storminess and further intensification of the sub-tropical ridge are expected into the future due to the enhanced greenhouse effect.

Victoria's future climate can be expected to reflect both the influence of these longer-term trends and the large year to year variability that results in particular from the climate influences operating (singly and in combination) in the Pacific (El Niño/ La Niña), Indian (the Indian Ocean Dipole) and Southern (SAM) Oceans[20,21].

Further information about climate change and climate variability in south-eastern Australia can be accessed from the South Eastern Australian Climate Initiative (SEACI) website (http://www.seaci.org/index.html).

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Appendix 4: Summary of urban water supply demand strategies

Introduction

This appendix outlines the water supply-demand strategies (WSDSs) of each of the urban water corporations in the Western Region. WSDSs are prepared by water corporations to ensure there are sufficient water supplies to meet demand projections over a 50-year period. Five water corporations supply water to the Western Region's cities and towns: Wannon Water, Grampians Wimmera Mallee Water (GWMWater), Barwon Water, Central Highlands Water and Coliban Water.

The WSDSs consider the reliability of water supplies based on two climate scenarios: medium potential future climate (Scenario B); and a return to the low inflows of 1997 to 2009 (Scenario D) (see Section 2.2.2). They also identify demand reduction and supply enhancement options to meet future needs and consider the range of social, environmental and economic costs and benefits of each option.

In the event of drought or water shortages, drought response plans for each system aim to address reduced supplies and continue to meet service level objectives through the use of trigger points and operational actions.

Water corporations review their WSDSs every five years, and at the time of release of this Strategy were updating their 2007 WSDSs with the new documents to be released in March 2012. The information in this Appendix is based on the 2007 WSDSs with some updated information provided by the water corporations where appropriate. Each water corporation will make further information about the updated WSDS available on their website.

Note:
References to Scenario B are to the medium potential future climate scenario.
References to Scenario D are to a return to dry conditions (1997-2009) scenario.

Wannon Water

Wannon Water manages 14 systems servicing 36 towns with a permanent population of 79,000 people. The major systems include the Otway and Hamilton systems and Tullich and Port Campbell groundwater bore systems. Portland, Heywood and Port Fairy are supplied from groundwater bores located within each township.

Hamilton system

The Hamilton-Grampians pipeline was constructed to secure Hamilton's future water needs beyond 2055. The pipeline was opened in July 2010 and will supply up to 2,000 ML per year from Rocklands Reservoir to supplement existing supplies from the Southern Grampians system.

Otway system

The Otway supply system, which supplies Warrnambool and 11 other towns, has capacity to meet new residential demand in the fast growing Warrnambool area over the next decade with the help of water conservation measures. From 2040, demand will begin to exceed supply, with a shortfall of about 1,600 ML projected by 2055. A suite of options including new water sources will be considered to bridge the projected gap between supply and demand.

Glenthompson

Glenthompson has inadequate long-term supplies under the range of climate scenarios. Based on the 2007 WSDS, the reliability of Glenthompson's water supply will be ensured by water conservation measures, reducing evaporation from the town's water storages and securing a supply from the Willaura system through a bulk entitlement.

Dilwyn

Water supply systems that tap the Dilwyn aquifer need no augmentation to meet projected demand through to 2055. These systems supply townships including Portland, Port Fairy, Heywood, Dartmoor, Port Campbell, Timboon and Peterborough.

Supply systems for Caramut, Casterton, Macarthur, Merino, Penshurst, Sandford and Balmoral are also sufficient to meet long-term demands.

Table A4.1 shows the modelled yields and demands for Wannon Water's supply systems, along with some of the actions being considered based on the 2007 WSDS.

Table A4.1 Wannon Water

Note: These figures will be updated in the 2012 WSDS.

Year	Unrestricted demand[1] (ML/yr)	System supply (ML/yr)			Possible actions to ensure supply needs are met in the future
		Historical climate	Scenario B	Scenario D	
Otways urban supply system – includes Warrnambool, Camperdown, Terang, Koroit, Cobden, Simpson, Mortlake, Allansford, Lismore and Derrinallum					
2015	10000	11920	11520	11360	Demand management, rain water harvesting in new subdivisions, additional bores
2030	12600	11920	11320	11360	
2055	13874	11920	10820	11360	
Hamilton urban supply system – includes Hamilton, Dunkeld, Cavendish and Tarrington					
2015	1950	1350	1300	985	Demand management, purchase additional 2 GL supply from Rocklands Reservoir
2030	1850	1350	1150	985	
2055	1722	1350	907	985	
Dilwyn urban supply system – includes Timboon, Port Campbell, Peterborough, Portland, Port Fairy, Heywood and Dartmoor					
2015	3650	8760	8760	8760	Demand management
2030	3710	8760	8760	8760	
2055	3861	8760	8760	8760	
Glenthompson urban supply system					
2015	55	54	53	39	Demand management
2030	51	54	50	39	
2055	46	54	47	39	
Tullich urban supply system – includes Casterton, Coleraine, Merino and Sandford					
2015	530	1000	1000	1000	Demand management
2030	474	1000	1000	1000	
2055	380	1000	1000	1000	
Other Wannon Water urban supply system – Penshurst, Caramut, Macarthur, Darlington and Balmoral					
2015	237	450	450	450	Demand management
2030	198	450	450	450	
2055	127	450	450	450	

1) Assumes baseline demand which does not include water saving measures identified in the 2007 Wannon Water Water-Supply Demand Strategy
Scenario B = medium potential future climate; Scenario D = 1997-2009 low inflows

GWMWater

GWMWater supplies 74 towns in the Western Region through several systems including the Northern Mallee Pipeline, the Wimmera-Mallee Pipeline and a groundwater system.

Population growth is not expected to place substantial pressure on water resources. However, improving the reliability of supplies remains a priority for GWMWater. The population of rural areas and smaller inland towns in the North-west is projected to decline as people continue to migrate to larger urban centres. For example, the Wimmera population (based on the Australian Bureau of Statistics boundary) is predicted to decrease by 13 per cent by 2055 (49,586 in 2009 to 43,019 in 2055), while the population of Horsham is predicted to increase by 15 per cent (19,415 in 2009 to 22,807 in 2055).

It is estimated that another 1,980 ML will be needed for urban use in the GWMWater supply area by 2055 based on climate projections and urban expansion in regional centres.

Northern Mallee and Wimmera-Mallee pipelines

The Wimmera-Mallee and Northern Mallee pipelines currently supply water to 34 towns in the north-west of the region. The construction of these pipelines has greatly increased the security of supply for these towns (see Chapter 6).

The current average annual urban demand from this system is 4,260 ML. The population in rural towns in this area is declining at about one per cent each year. By 2055, weather sensitive demand increases are likely to be less than the reduction in demand from the lower population. Overall, urban demand is expected to fall by approximately 1,330 ML by 2055 under a medium potential future climate scenario and without conservation targets. A further 170 ML per annum is anticipated to be saved by achieving water conservation targets.

Horsham supply

Horsham is supplied from the Wimmera-Mallee Pipeline with supplementary supply available from the Mount Zero groundwater borefield.

The current average annual urban demand from this system is 3,010 ML. Horsham is experiencing population growth of approximately one percent per annum. This growth, and weather sensitive demand if the medium potential future climate scenario occurs, are expected to increase demand by 2,310 ML by 2055 without conservation targets. Achieving water conservation targets would save 240 litres per person per day on average, and ensure that demand will not exceed supply up to 2055.

Groundwater supply to towns in the western Wimmera-Mallee

GWMWater supplies 12 towns from the Murray Group Limestone Aquifer. Supply capacity to these towns is comfortably in excess of current demand. The current average annual urban demand from this system is 1,190 ML. Population within these towns is decreasing at about 0.2 per cent per annum except for Nhill, which has had a small population increase. Per capita consumption increases may be experienced in Nhill and Edenhope with water quality improvements. Weather sensitive demand increases are unlikely to be greater than population related decreases in demand.

Table A4.2 shows the modelled yields and demands for GWMWater's supply systems, along with some of the actions being considered based on the 2007 WSDS.

Table A4.2 Grampians Wimmera Mallee Water

Note: These figures do not include improved supply reliability from construction of the Wimmera-Mallee Pipeline. This will be included in the 2012 WSDS.

Year	Unrestricted demand[1] (ML/yr)	System supply (ML/yr)			Possible actions to ensure supply needs are met in the future
		Historical climate	Scenario B	Scenario D	
Northern Mallee Pipeline Area urban supply system – includes 15 towns GWMWater Northern Region					
2015	890	1500	1386	Data being reviewed for 2012 WSDS	Water conservation measures
2030	876	1500	1215		
2055	847	1500	930		
Horsham urban supply system					
2015	3327	4810	4446	Data being reviewed for 2012 WSDS	Wimmera-Mallee pipeline construction, water conservation measures
2030	3965	4810	3900		
2055	5279	4810	2982		
Headworks urban supply system – includes Ararat, Great Western, Halls Gap, Pomonal and Stawell					
2015	3160	4094	3784	Data being reviewed for 2012 WSDS	Wimmera-Mallee pipeline construction, water conservation measures
2030	3377	4094	3319		
2055	3748	4094	2544		
Channel urban supply system – 34 towns supplied					
2015	3175	4717	4359	Data being reviewed for 2012 WSDS	Water conservation measures
2030	2759	4717	3822		
2055	2169	4717	2923		
Groundwater urban supply system					
2015	1186	2524	2332	Data being reviewed for 2012 WSDS	Water conservation measures
2030	1185	2524	2044		
2055	1175	2524	1565		
Southern urban supply system – Includes Willaura, Moyston, Lake Bolac and Wickliffe					
2015	206	300	277	Data being reviewed for 2012 WSDS	Water conservation measures
2030	168	300	243		
2055	118	300	186		

1) Assumes baseline demand which does not include water saving measures identified in the 2007 GWMWater Water Supply-Demand Strategy
Scenario B = medium potential future climate; Scenario D = 1997-2009 low inflows
Scenario D is being reviewed for the 2012 WSDS as new modelling was required to account for the water sharing arrangements for the new Wimmera-Mallee pipeline.

Barwon Water

Barwon Water provides water and wastewater services to approximately 20,867[a] permanent residents in the Western Region. This includes the towns of Aireys Inlet, Fairhaven, Lorne, Apollo Bay, Skenes Creek, Marengo, Colac, Cressy, Gellibrand, Anglesea, Jan Juc and Torquay.

When Barwon Water released its 2007 WSDS the worst effects of drought were yet to come. Whilst the strategy did not predict that the drought would be as severe or long, it prepared augmentation options that served the supply area well. The diverse range of water source projects now being implemented were all identified in the 2007 strategy.

Greater Geelong Area

The Greater Geelong supply area is largely outside the Western Region boundary. However the towns of Anglesea, Jan Juc and Torquay are connected to the Geelong system and receive water from the Barwon catchment. In 2008, the Anglesea Borefield project was initiated as a new water source for the Greater Geelong supply area. The borefield is now nearing completion and will access up to 7,000 ML per year from the Jan Juc Groundwater Management Area.

Colac

Supply to Colac is secure with the actions identified in the 2007 WSDS. In 2007, the Colac system was augmented by constructing a new 450 ML raw water storage. It is filled from the Gellibrand River in winter for use in Colac during summer. The 2007 demand forecast was based on a low rate of growth in the town, and could change if new major water users locate near Colac.

The supply for this system relies on two small dams on the upper Gellibrand River capturing and transferring water to storages in Colac. The system has been largely reliable throughout the recent drought. Catchment inflows and the duration of winter flows were not reduced as much as elsewhere in the region. Water restrictions have only been required in recent years due to maintenance on the Colac transfer pipeline.

However, this system is still susceptible to future climate variability. Under prolonged dry conditions, the yield from the Colac supply system would be much lower than it has been historically. The lack of good quality streamflow data in the upper Gellibrand limits the reliability of these estimates. Additional supply and/or demand management measures are being considered in the WSDS review.

Apollo Bay and Skenes Creek

The 2007 WSDS identified the need to augment supply to meet existing and future levels of demand from the township of Apollo Bay. A new 250 ML off-stream storage has been constructed close to town. The location of the storage was selected carefully, and minimises pumping requirements. Water from the storage will be treated before it is supplied to customers.

Lorne

Water use in Lorne is highly variable, making future supply needs difficult to determine. Monitoring since the 2007 WSDS shows that water use in Lorne has not increased greatly. The Allen Reservoir has capacity to meet demand in the near future, and it is unlikely any major work will be needed. Nonetheless, the balance between supply and demand will be closely monitored.

Aireys Inlet

Although demand growth in Aireys Inlet is limited, seasonal fluctuations in use due to tourists make it difficult to determine future supply needs. Painkalac Reservoir has capacity to reliably meet demand unless demand increases unexpectedly. The need for supply augmentation projects will be considered based on close monitoring. Demand management may be used to buffer the effects of fluctuating demands on storage levels.

Table A4.3 shows the modelled yields and demands for Barwon Water's supply systems and some of the actions being considered based on the 2007 WSDS.

[a] From Barwon Water WSDS 2007, page 41

Table A4.3 Barwon Water

Note: These figures will be updated in the 2012 WSDS.

Year	Unrestricted demand[1] (ML/yr)	System supply (ML/yr)			Possible actions to ensure supply needs are met in the future
		Historical climate	Scenario B	Scenario D	
Colac urban supply system					
2015	3800	4200	4100	3500	Water conservation measures
2030	4000	4200	3800	3500	
2055	4067	4200	3500	3500	
Lorne urban supply system					
2015	500	500	490	450	Water conservation measures
2030	570	500	480	450	
2055	702	500	470	450	
Apollo Bay / Skenes Ck urban supply system					
2015	460	600	580	550	Water conservation measures
2030	510	600	560	550	
2055	626	600	530	550	
Aireys Inlet / Fairhaven Ck urban supply system					
2015	200	310	310	190	Water conservation measures
2030	220	310	300	190	
2055	283	310	290	190	

1) Assumes baseline demand which does not include water saving measures identified in the 2007 Barwon Water Water Supply-Demand Strategy
Scenario B = medium potential future climate; Scenario D = 1997-2009 low inflows

Central Highlands Water

In the Western Region, Central Highlands Water supplies the towns of Amphitheatre, Avoca, Beaufort, Landsborough and Redbank. Most towns serviced by Central Highlands Water are outside the Western Region.

Over the next 50 years, the water demand for the small supply systems in the region, except Beaufort, is expected to increase due to population growth. Demand reduction targets have been set for all supply systems.

Central Highlands Water is proceeding with various actions to ensure future demands can be met through:

- a drought relief bore for Amphitheatre;
- a major water security and water quality improvement project (desalination plant and improved groundwater infrastructure) for Avoca;
- a new bore at Raglan for Beaufort; and
- a desalination plant and improved groundwater infrastructure for Landsborough and Navarre.

Demand management strategies will help to reduce the need for new water supplies. These initiatives conserve water by achieving greater efficiency, technological improvements and behavioural change.

Table A4.4 shows the modelled yields and demands for Central Highlands Water's supply systems, along with some of the actions being considered, based on the 2007 WSDS.

Table A4.4 Central Highlands Water

Note: These figures will be updated in the 2012 WSDS.

Year	Unrestricted demand[1] (ML/yr)	System supply (ML/yr)			Possible actions to ensure supply needs are met in the future
		Historical climate	Scenario B	Scenario D	
Amphitheatre urban supply system					
2015	17	25	24	18	Drought relief bore and other augmentations, unaccounted for water strategy
2030	17	25	22	18	
2055	19	25	18	18	
Avoca urban supply system					
2015	182	220	213	100	Demand management, leakage prevention, a desalination plant and improved groundwater infrastructure
2030	187	220	195	100	
2055	206	220	157	100	
Beaufort urban supply system					
2015	204	250	242	232	Demand management, unaccounted for water strategy and a new bore at Raglan.
2030	198	250	221	232	
2055	188	250	179	232	
Landsborough and Navarre urban supply system					
2015	42	150	145	105	Household demand management, unaccounted for water strategy, a desalination plant and improved groundwater infrastructure
2030	45	150	132	105	
2055	52	150	105	105	
Redbank urban supply system					
2015	10	5	5	3	Household demand management, unaccounted for water strategy
2030	10	5	4	3	
2055	11	5	3	3	

1) Assumes baseline demand which does not include water saving measures identified in the 2007 Central Highlands Water Water Supply-Demand Strategy

Scenario B = medium potential future climate; Scenario D = 1997-2009 low inflows

Coliban Water

Coliban Water provides water and wastewater services to central and northern Victoria. A small portion of the western part of this area is in the Western Region and includes the towns of Wedderburn, Borung, Korong Vale and Wychitella. This area and its population of 923 are supplied from the Wimmera-Mallee supply system under a bulk entitlement for 450 ML held by GWMWater. The populations of these towns are predicted to decline by an average rate of 0.2 per cent a year over the next 50 years resulting in a 10 per cent decline in unrestricted demand over that time.

The Wimmera-Mallee Pipeline has improved the reliability of supply and greatly reduced delivery and storages losses. The former service basins in Korong Vale, Borung and Wychitella required to store a year's supply have been replaced by more efficient storages capable of holding one to two weeks' supply and fed by more frequent pipeline supply.

Coliban Water has an entitlement of 300 ML from the Wimmera-Mallee Pipeline and has the ability to use carryover and their Spillable Water Account to manage water supplies. Coliban will also utilise the water market to purchase additional temporary water allocations, if needed, such as during times of low allocations.

Demand may exceed supply after 2045 under the medium potential future climate scenario. If needed to address this, works will be done to reduce losses at the service basins and demand management programs will be introduced.

Table A4.5 shows the modelled yields and demands for Coliban Water's supply system, along with some of the actions being considered, based on the 2007 WSDS.

Table A4.5 Coliban Water

Note: These figures will be updated in the 2012 WSDS.

Year	Unrestricted demand[1] (ML/y)	System supply (ML/y)			Possible actions to ensure supply needs are met in the future
		Historical climate	Scenario B	Scenario D	
Wimmera urban supply system – includes Wedderburn, Korong Vale, Borung and Wychitella					
2015	340	450	420		Reduction in system losses at service basins and demand management strategies
2030	330	450	380		
2055	315	450	290		

1) Assumes baseline demand which does not include water saving measures identified in the 2007 Coliban Water Water Supply-Demand Strategy

Scenario B = medium potential future climate; Scenario D = 1997-2009 low inflows

Appendix 5: Regional strategies for healthy rivers and wetlands

The Government is developing a Victorian strategy for healthy rivers, estuaries and wetlands to set state-wide policy and guide regional strategies for healthy rivers and wetlands (regional SHRWs). Each catchment management authority (CMA) will prepare a SHRW for their area by 2012-13. Regional SHRWs are now statutory documents under the *Water Act 1989*. They are being prepared because the six-year lifespan of the first generation of regional river health strategies has finished.

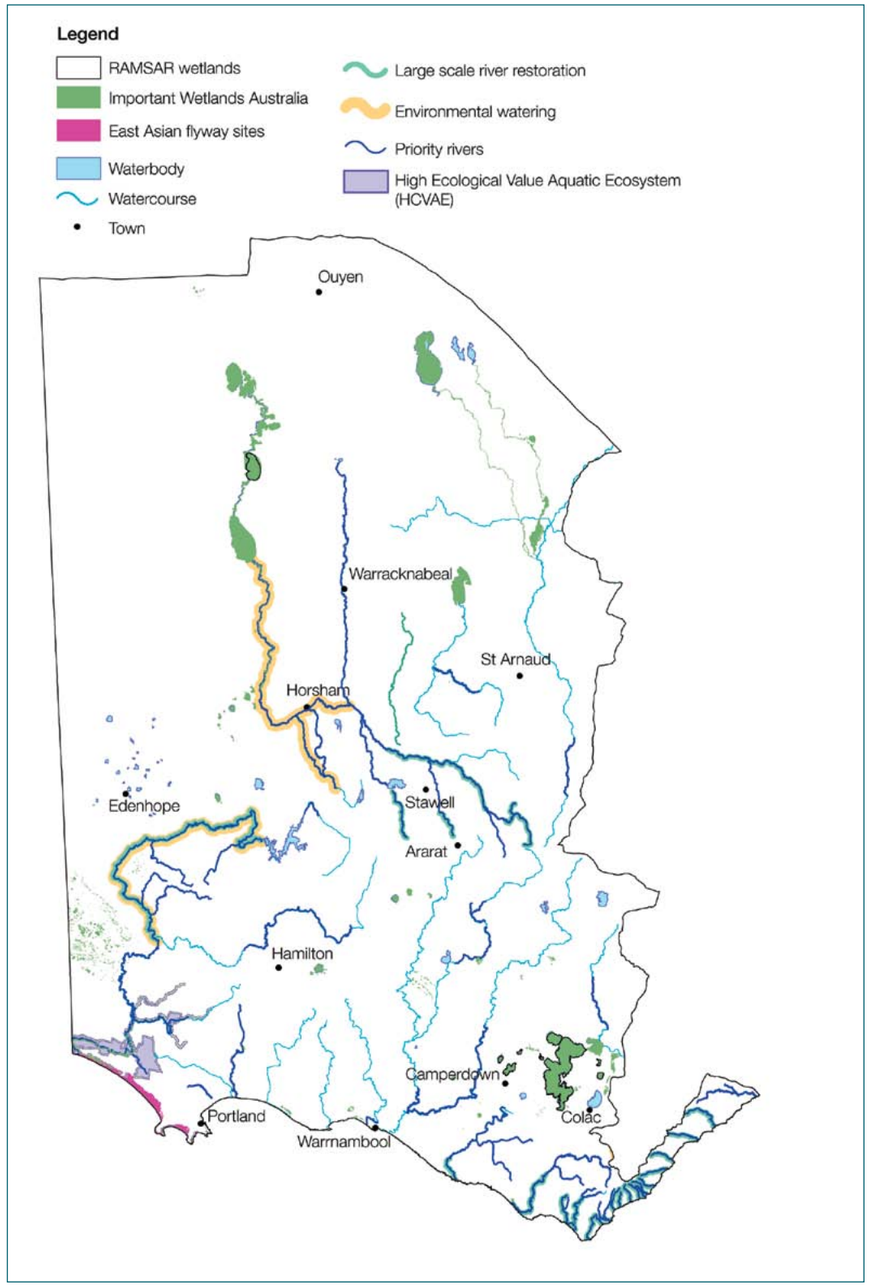
The overarching aim of the regional SHRWs is to provide each CMA with a single, regional planning document for rivers, estuaries and wetlands and a high level, six-year regional work program to achieve integrated waterway outcomes. The regional SHRWs will:

- identify river reaches, estuaries and wetlands of highest community value;
- identify threats and risks to the community values of waterways;
- identify where waterway processes pose a serious risk to public infrastructure;
- articulate the priorities for all relevant waterway health activities across an entire CMA region;
- set six-year targets and long-term desired outcomes;
- engage communities in the development and implementation of the strategy; and
- build an evidence-based and robust case for government investment in waterway health.

The first generation of regional river health strategies previously prepared by each of the CMAs in the Western Region are summarised below and in Figure A5.1. For more information, visit the CMA websites (see “Further Information”).

Figure A5.1 River, estuary and wetland health priorities in the Western Region

Note: Priority reaches in the regional SHRWs, to be completed in 2013, may be different from those in the previous regional river health strategies.



Corangamite CMA

Some of the key environmental assets managed by the Corangamite CMA are in the Western Region.

In the Otway Coast Basin, these include the heritage-listed Aire River (and associated wetlands) valued for its essentially natural upper reaches and native fish populations, and the numerous waterways and estuaries that form part of the spectacular coastline of the Great Ocean Road and the adjoining Great Otway National Park. A number of these waterways are in good or excellent condition and are recognised for their very high ecological values, including populations of rare and threatened native fish populations, such as Australian grayling and Australian mudfish.

Major threats to these waterways include the presence of barriers to fish migration, pest plants and animals, degraded riparian vegetation and altered flow regimes. Major investment in the estuaries in these areas is focused on improving or maintaining estuary condition through in-stream and riparian restoration and broader catchment management activities to improve upstream water quality (particularly by reducing nutrient and sediment loads). These activities are delivered by the Corangamite CMA and partners, including landholders, landcare networks, water corporations, local government and coastal committees of management. Other projects include actions to reduce pressures on threatened native fish species, such as installation of fishways, improved decision making to manage risks around estuary mouth openings, and active community-based water quality monitoring of estuaries through the successful Corangamite EstuaryWatch program.

The Western District Lakes Ramsar site, in the Corangamite Basin, is the most significant wetland asset in the CMA area. The site comprises nine separate lakes that are internationally recognised for their high environmental values, particularly the presence of significant bird species. Major threats to the Western District Lakes, and other wetlands in the area, include inappropriate agricultural practices in the surrounding catchments, altered hydrology and invasive species. Significant Australian and Victorian government investment is being directed at protecting or improving the values of these wetlands, as part of a broader project aimed at securing the important ecological communities of the Victorian Volcanic Plains. For example, the Borrell-a-kandelop project, a partnership between Greening Australia, the Corangamite CMA and Parks Victoria, has for the past nine years involved the community and landholders to help protect the values of the area by fencing, creating buffer strips, controlling pest plants and animals and revegetation. This work has helped protect threatened species, particularly migratory shorebirds, the Corangamite water skink and brolga. More broadly within the Victorian Volcanic Plains, the CMA's market-based WetlandTender program aims to achieve conservation outcomes for natural wetland assets on private land.

Glenelg Hopkins CMA

The Glenelg River and its major tributaries are recognised for their high ecological values and are important community assets. The Glenelg River is the most important waterway in the Glenelg Hopkins Regional River Health Strategy. Twelve of the twenty priority reaches of the Strategy are in the Glenelg Basin, including a heritage-listed reach and a High Ecological Value Aquatic Ecosystem. This Basin contains a number of threatened flora and fauna species and is considered one of only fifteen listed 'Biodiversity Hotspots' in Australia. The lower Glenelg River (including the Estuary and Discovery Bay area) is threatened by pest plants and animals, bed and bank instability, sedimentation and damage by stock access to the river. Investment in this area is focussed on protecting high priority riparian vegetation to ensure that significant fauna and critical habitat are maintained. The CMA has invested significantly in the Glenelg River below Rocklands Reservoir in recent years, focussing on delivering environmental flows, protecting and improving riparian areas, restoring in-stream habitat, controlling carp, and reducing erosion and sedimentation. To date, the current Large Scale River Restoration and River Tender projects have achieved excellent results, protecting more than 425 km of waterway, removing five fish barriers, establishing erosion control structures and removing 324,000 tonnes of sand from the heritage-listed reach of the Lower Glenelg River.

Wetlands are significant and prominent natural resources in the Glenelg Hopkins area. The area contains about 44 per cent of the total number of Victoria's wetlands and 16 wetlands listed in *A Directory of Important Wetlands in Australia*. One wetland is part of the Western District Lakes Ramsar site. Key threats to wetlands include invasive species, inappropriate agricultural practices, drainage and land use change. The lack of primary information on the condition and values of, and threats to, most wetlands in the area also limit the CMA's ability to identify and prioritise management actions. Further research and investigations are underway to identify other priority wetlands for management. Significant state and federal investment has been made to improve wetland management, with programs such as Wetland Tender and Plains Tender promoting actions with landholders such as pest plant and animal control, habitat restoration and education to improve the communities' understanding of the value of wetlands.

Wimmera CMA and Mallee CMA

The Wimmera River is the major waterway in this area and the largest river in Victoria that does not flow to the sea. The river and its major tributaries are significant environmental assets. Major threats to these assets include altered flow regimes, soil erosion, poor water quality and invasive species. Investment to improve the health of the river, tributaries and terminal lakes (lakes Hindmarsh and Albacutya) is currently underway and includes on-ground riparian and instream management, comprehensive waterway health monitoring, working closely with riparian land managers and managing the river's environmental water reserve. The terminal lakes are threatened by invasive weed species and rabbits during long dry periods, inappropriate agricultural practices in the catchment and the potential risks from climate change. In addition to the significant investment in returning water to the river (and terminal lakes), the Mallee and Wimmera CMAs have formed strong partnerships to promote the importance of wetlands such as the Ramsar-listed Lake Albacutya and invested in community education and awareness campaigns.

Yarriambiack Creek, Dunmunkle Creek, Lake Lascelles and Lake Coorong are also key environmental assets in this area. The Wimmera CMA and Mallee CMA work closely with the Yarriambiack Creek Advisory Committee to implement priority management actions including fencing to keep stock out of the creek and revegetation. The Wimmera CMA is also part of a broader habitat restoration project along the Yarriambiack called 'Yarrilinks'.

Lalbert and Tyrell creeks (which flow from the North Central CMA area) and their floodplains are significant assets running into the Mallee CMA area. Local, state and federal governments are investing in fencing, revegetation and rubbish removal, amongst other actions.
The supply area of the Wimmera-Mallee Pipeline includes key wetland assets distributed throughout the north-eastern Wimmera, south-eastern Mallee and south-western North Central CMA areas. These wetlands will receive water from the pipeline water savings to maintain important community values (see Section 6.4.1). Wetlands in the Wimmera-Avon and Millicent Coast river basins are also key environmental assets. The south-west Wimmera is a hotspot for high value wetland ecosystems, containing more than 2,300 individual wetlands that support considerable biodiversity, including threatened species, and have significant social and economic value. Threats to these assets include poor water quality, degraded riparian vegetation, stock access, altered hydrologic regimes, inappropriate agricultural practices, invasive species, soil erosion and the potential risks from climate change. Significant investment in these wetlands is underway using a range of mechanisms to protect, maintain or improve high value wetlands on private land.

North Central CMA

In the Avoca catchment, key river assets include the upper Avoca River, and the ephemeral Lalbert and Tyrell creeks (which extend into the Mallee CMA area) and their floodplains. There are also significant wetlands in northern areas, including Lake Bael Bael and the Avoca Marshes that are part of the Ramsar-listed Kerang Lakes. Key threats to these assets include invasive species, dryland salinity, inappropriate agricultural practices and the potential risks from climate change. Significant investment is being directed to these assets and implemented through strong partnerships between public and private land managers to protect the wetlands and control rabbits, foxes and weeds.

In the Avon-Richardson catchment, the terminal Lake Buloke is a nationally significant environmental asset. Despite often being dry, the area supports many native bird species. Lake Buloke is threatened by increasing salinity throughout its catchment, invasive species and inappropriate agricultural practices. Establishing riparian buffer strips along the Avon and Richardson rivers is a priority because they enhance river health and minimise the threat of poor water quality to the rivers and Lake Buloke downstream. Other priority assets include the York Plains, a series of wetlands on private property adjacent to the Avon River. Significant investment in these wetlands has occurred over the past few years to fence riparian, wetland and remnant terrestrial vegetation to protect it from grazing. Substantial areas of perennial pasture have been planted to reduce the threat of salinity.

Index of policies and actions