Part 3
Directions for Victorian water resource management and reporting

Part 3 examines the key directions and policy influences shaping the government's management of water resources in Victoria.

It points to some key action areas for the government that will impact on subsequent editions of the State Water Report and, in doing so, will inform future State Water Reports.

The *Our Water Our Future* action plan provides the framework for the major initiatives being implemented by the Victorian Government to ensure a sustainable future for Victoria's water resources. The establishment of the environment's formal right to water in legislation under the *Water (Resource Management) Act 2005* is now firmly in place with the creation of the Environmental Water Reserve and its important impact on Victoria's water sharing arrangements.

Prolonged drought coupled with clearly detectable trends towards climate change are issues that are now well known to Victorians. Both will have ongoing ramifications for the way we manage our limited water resources. Fundamental changes in water management practices as reflected in the development of Regional Sustainable Water Strategies, continued expansion of water markets and the launch of the Water Register, as well as examination of alternative water supply sources including groundwater, are key steps for ensuring sustainable water resource planning.

The importance of improved monitoring, reporting and accounting to strengthen the body of information available to water resource planners and decision makers are all important concerns identified and being progressed by the Victorian Government.

35 Challenges for water resource management in Victoria

Drought continued to characterise the 2005/06 period, as has been the case for the last ten years. Over this time, rainfall and streamflows across all of Victoria have been well below average.

Historically, Victoria's water management arrangements have been designed to cope with drought by storing water in reservoirs in wet years and relying on this supply in dry times. The prolonged dry conditions of the past ten years resulted in very low storage levels in reservoirs at the end of 2005/06.

The cumulative reduction in storage levels and ongoing rainfall deficiencies during this period indicate that the typical cycle of drought and rain may have been exacerbated and distorted by climate change. As a result, new water resource and drought management planning activities were initiated to ensure the sustainable management of resources over the 2005/06 period and into the future, along with new investments to secure long-term water supplies for the State.

35.1 The next stage of the *Our Water Our Future* water plan

Building on the 2004 *Our Water Our Future* plan for sustainable water management in Victoria, the government released the second phase of the strategy in June 2007.

Around $4.9 billion will be spent on major infrastructure projects to boost Victoria's water supplies. Over the next five years the government will:

- build Australia's largest desalination plant
- modernise irrigation systems in Victoria's food bowl to capture lost water
- expand Victoria's water grid – the network of rivers, channels and pipes linking our major water systems
- provide more water for regional centres including Geelong, Westernport, South Gippsland and Hamilton
- upgrade Melbourne's Eastern Treatment Plant to provide more high grade recycled water
- support new and existing water conservation programs for Victorian homes and industry.

Along with Victorians' continued efforts to save water, these projects will secure water supplies for Victoria's growing economy and population.

The full details of the next stage of the *Our Water Our Future* water plan are available on www.ourwater.vic.gov.au

35.2 Regional Sustainable Water Strategies

Regional Sustainable Water Strategies are a key action from the Victorian Government's *Our Water Our Future* action plan. As such, they form a key plank in Victoria's new planning framework for determining large scale, long term changes in water use. Once the strategies are implemented, the annual water accounts included in future State Water Reports will track the allocation and report on the annual review of Regional Sustainable Water Strategies. The State Water Report will also highlight discrepancies between supply and demand forecasts identified in Regional Sustainable Water Strategies and actual occurrences. Five Regional Sustainable Water

Strategies will be developed across Victoria: Central Region, Wimmera and Glenelg Region, Northern Victoria, Gippsland Region and South-West Region.

The Central Region Sustainable Water Strategy (CRSWS) was developed, and after community input over six months and a review by an independent panel, was finalised in late 2006. The development of the Northern Region Sustainable Water Strategy will be initiated in 2007. The other three strategies will be progressively completed in the future.

35.2.1 Aim of each Regional Sustainable Water Strategy

The Regional Sustainable Water Strategies consider all aspects of water resource management in each region of Victoria over the next 50 years. They look at all sources of water, including rivers, reservoirs and aquifers, as well as recycled water, stormwater and seawater. They identify a range of water resource management issues and opportunities, and implement actions to maintain and improve the condition of rivers and provide safe, reliable water supplies for all users.

35.2.2 Central Region Sustainable Water Strategy

The CRSWS is a plan to secure water supplies for homes, business, industry, agriculture and the environment for the next 50 years.

It is responsive to changing water needs and includes actions to ensure Victoria has sufficient supplies in the event that the low inflows to reservoirs experienced over the last 10 years continue. It has clear objectives, and is the result of over two years planning and consultation with community, industry, key stakeholders and government agencies.

The plan takes an integrated approach to water resource planning. It considers all water sources including rivers, reservoirs, aquifers, as well as recycled water, stormwater and seawater.

The Central Region stretches in an arc around Melbourne and covers Geelong, Ballarat, the Macedon district and West Gippsland. It includes the Barwon, Moorabool, Werribee, Maribyrnong, Yarra, Bunyip, Thomson and Latrobe basins. Particular objectives of the CRSWS include to:

- ensure reliable and safe water supplies for all uses into the future
- understand the implications of the record low rainfall and inflows to reservoirs experienced over the past 10 years
- protect and where necessary improve the health of rivers, aquifers and estuaries
- protect the indigenous and other heritage values associated with the region's rivers and catchment areas
- maximise overall community benefits and ensure that no generation or group incurs unwarranted extra costs or receives inequitable benefits
- support high value water use by industry and agriculture with the least adverse impact
- make the best use of water resources locally and throughout the region
- further develop an appreciation of the value of water and a conservation culture in the community
- aim to be greenhouse gas emission neutral.

35.2.3 Implementation of the Central Region Sustainable Water Strategy

A key objective of the CRSWS is planning and delivering on-ground improvements in the way Victorians use water, and setting up monitoring and reporting regimes to track progress. Many organisations contribute to water management and provide water-related services in the Central Region, and will have a part to play in implementing the CRSWS. Actions identified in the CRSWS fall into two categories:

- policy regulations, performance obligations and targets determined by the Victorian Government and enforced by its regulatory agencies such as EPA Victoria
- projects, services and targets delivered by water authorities and catchment management authorities.

Key actions currently being undertaken include:

- the Goldfields Superpipe, a new pipe linking the Goulburn system directly with Bendigo and Ballarat. This project is expected to be completed by August 2008 to provide long term water security for these cities
- investigation of major augmentation options for Melbourne
- investigation of major augmentation options for Geelong
- Westernport Water accelerating the augmentation of the bore at Corinella aquifer.

35.2.4 Annual review

The CRSWS outlined that an annual review of water availability and demand compared to forecasts would be undertaken. If the reviews show that inflows have consistently returned to more average conditions over the medium to long term, the volumes of water required may require amendment.

The review will include an evaluation of progress in meeting water conservation targets. River flows and progress in meeting environmental targets will also be monitored.

The outcomes of the annual review of water availability and demand (including the need for any change to targets or the timing of actions) will be publicly available before the end of the calendar year.

35.2.5 Northern Region Sustainable Water Strategy

In 2007, the Department of Sustainability and Environment will commence work on the Northern Region Sustainable Water Strategy (NRSWS) in collaboration with catchment management authorities, local government, water authorities, other stakeholders and the community. The NRSWS will be focused on the River Murray and its tributaries, from Wodonga in the east to Shepparton, Bendigo and Mildura in the west. It includes the Ovens, Broken, Goulburn, Campaspe and Murray basins.

During the development of this strategy, the government will release a discussion paper for public comment. This will represent the first formal opportunity for community members to have input into the development of the NRSWS.

35.3 Managing urban supplies

Urban water authorities are responsible for the development of water supply and demand strategies for their customers and contribute to the development of Regional Sustainable Water Strategies. Both of these strategies aim to ensure security of water supplies for the long term (to 2055) by forecasting supply and demand and identifying appropriate augmentation or demand management initiatives to ensure a sustainable supply at times of low water availability.

Water authorities are required to have drought response plans in place to manage limited supplies. During 2006 the majority of Victoria's urban water authorities adopted the standardised water restriction system contained in the Uniform Drought Response Guidelines. Under this system, each water authority's drought response plan identifies appropriate trigger levels for enacting the four stages of water restrictions.

Uniform Drought Response Guidelines were adopted by Melbourne's water retailers through their Uniform Drought Response Plans in July 2006. The majority of regional water authorities adopted

the guidelines through by-laws in mid to late 2006. Although South Gippsland Water and East Gippsland Water had four stages of water restrictions, they did not formally adopt the Uniform Drought Response Guidelines during the reporting period. Copies of the guidelines can be sourced from relevant Victorian water authorities.

Drought response plans also require the identification of contingency measures to temporarily boost water supplies or ration water use beyond Stage 4 in the event that a drought is more severe than envisaged and Stage 4 restrictions are not adequate.

35.3.1 Permanent water saving measures

In accordance with Action 5.4 of the *Our Water Our Future* action plan, all water authorities were required to introduce permanent water saving measures. The measures were to be developed at the local level and suitable for local conditions, requiring a minimum level of 'water wise' behaviour by consumers.

Melbourne introduced permanent water saving measures on 1 March 2005 with penalties applicable for failing to comply. The five key permanent water saving measures are:

- Use manual watering systems only between 8pm and 10am.
- Use automatic watering systems only between 10pm and 10am.
- Fit hoses with trigger nozzles.
- No hosing paved areas.
- Apply to fill a new pool.

March 2006 figures showed record amounts of water had been saved since the introduction of the permanent water saving rules in 2005. In Melbourne, water consumption was 22% lower than the city's water usage in the 1990s with less water used per person in 2005 than in any other year since the metropolitan water authorities started keeping detailed records in 1995.

The majority of Victoria's regional urban water authorities adopted permanent water saving measures in 2005 and early 2006. North East Water and Lower Murray Water did not adopt permanent water saving measures during the reporting period.

35.3.2 Non-residential consumption

In October 2006, the Victorian Government amended legislation requiring water authorities to report on their major non-residential water users. Passed as part of the Governance Bill, changes were made to the *Water Industry Act* and *Water Act*. The legislation requires that the water authority report annually:

- the number of consumers who fall above a threshold
- whether or not customers participate in water conservation programs
- the names of those customers consuming above a threshold.

Currently government policy has set the threshold at 50ML per annum. (This does not include water for farm use or irrigation). The top 200 users in Melbourne fall above the threshold.

The CRSWS required water authorities to broaden Melbourne's Pathways to Sustainability program to all customers with consumption greater than 10 ML per annum. It was subsequently mandated that all customers across the state with consumption greater than 10 ML (approximately 2,300 additional customers) will be required to develop a water management action plan. It is forecast that in Melbourne new water savings initiated by customers with consumption greater than 10 ML (i.e. 1,500 customers including the top 200) will contribute approximately 5 GL to the forecast saving by Melbourne's non-residential sector of an additional 13 GL by 2015. This program has since been accelerated.

35.4 Bushfires, water quality and water yield

The ongoing dry conditions of the 2005/06 period was a contributing factor in a number of severe bushfires, compounding the impact of the 2002/03 fires on the Victorian landscape and on short and long term water yield.

The 2002/03 bushfires burnt more than a million hectares of forest and grazing land. Run-off from areas burnt in these fires, and from the 2005/06 bushfires, carried high ash and sediment loads into a number of streams.

Research has found that observed water quality impacts from bushfires can vary between different streams, ranging from no measurable impact through to a 1,500 fold increase in total suspended solids concentrations (Sheridan et. al., 2004, *Preliminary analysis of pre-and post-bushfire water quality data from hydrologic stations in Eastern Victoria (Interim Report),* Department of Sustainability and Environment). Early indications of immediate effects after a bushfire (i.e. up to 12 months after the event) are that high flows can result in poor water quality for long periods as these events can remobilise sediment and absorbed nutrients in the stream channel. During periods of low flow between rainfall events, water quality has improved gradually as ground vegetation recovered. Delivery of sediment and nutrients to lower catchment water impoundments is likely to be substantially lower due to in-channel storage.

In 2005/06, the Department of Sustainability and Environment continued to work with water authorities in fire-affected areas. They developed a number of drought contingency plans to respond to the potential water quality problems caused by run-off from burnt areas in north east Victoria and Gippsland. The drought contingency plans range from water treatment to using groundwater for supply augmentation and water carting.

Under the *Our Water Our Future* action plan, the Victorian Government introduced legislation requiring reviews to be conducted every 15 years of water resource availability. These reviews need to take into account the effects of climate change and bushfires and make recommendations on strategies to ensure water supplies are protected using best practices at the given time. The first review is scheduled for commencement in 2017.

In addition, an important part of the planning and contingency measures implemented in relation to the 2005/06 fires was the identification and use of alternative water supply points such as emergency groundwater standpipes to supplement the surface water used to fight fires.

35.5 Groundwater management in Victoria

In the past, groundwater has not received the same degree of attention as other sources of water as it is generally unseen and often poorly understood. Some 366,000 ML of groundwater was extracted from Victoria's aquifers in 2005/06 and used for a variety of purposes including town water supply, rural domestic consumption, stock watering, irrigation and industry.

Although many groundwater levels in Victorian aquifers show a trend downwards because of increased use and the prolonged dry conditions, of the 70 managed groundwater areas in Victoria only six are seen to be under significant stress. They are Neuarpur, Glenelg, Yarram, Sale, Upper Loddon and Condah. All have been declared as water supply protection areas, thereby ensuring that no more licences can be issued. Management plans have been developed or are under development to ensure that allocations are managed to sustainable levels.

35.5.1 Sustainable management of groundwater

The Victorian Government, through *Our Water Our Future*, has made the commitment of bringing all the state's water resources under a sustainable water allocation regime. For groundwater, this means ensuring that all extraction falls within limits defined by the 'sustainable yield' of the aquifer. The sustainable yield is the renewable part of the groundwater resource, identified after

making allowance for acceptable impacts on users, the surface environment and the resource itself.

Permissable consumptive volumes (PCVs) for groundwater were declared for 25 aquifers in the Central Region on the basis of estimates of sustainable yield.

Recent groundwater management plans have also included seasonal allocation rules which require the allocations to be restricted if groundwater levels fall below specified trigger levels. The trigger levels are set taking into account surface-groundwater interactions, the protection of water quality, as well as operational issues such as bore interference.

Continued monitoring of water levels and groundwater use over the long term is an essential part of the management approach. The information gathered may lead to a review of a particular system's PCV.

Monitoring the condition, levels and use of groundwater resources is fundamental to ensuring they are managed properly as this provides decision makers with key information. Intensive groundwater management requires accurate data from groundwater monitoring bores and the metering of groundwater use. This information is modelled and analysed to gain an understanding of the resource and needs to be supplemented by continuous observation of trends.

Key emerging issues with respect to the management of groundwater in Victoria include:

- **Drought**. With the current urban supply situation, the need to find groundwater to augment urban supplies has increased. Any new allocations will need to balance short term needs with the need to minimise long term impacts of such allocations.
- **Domestic and stock versus licensed extractions**. With increasing pressures on groundwater extraction, any improvement to the groundwater allocation process needs to take into account the importance of groundwater to both domestic and stock and licensed users.
- **Cost recovery and pricing**. The increased level of management now required for sustainable groundwater management is now being reflected by increasing prices for groundwater across the state. Further price increases are likely to be necessary in subsequent pricing rounds as the need for increased management efforts continues.
- **Improved metering and compliance**. Active monitoring and improved management of compliance with groundwater licence conditions needs to occur across the water industry as groundwater resources are used more heavily. For example, any unauthorised use of the Deutgam aquifer could have a long term impact on its health.
- **Improving trading systems**. The groundwater allocation and trading system in Victoria is under-developed, and new trading and accounting rules need to be created for groundwater to promote water efficient practices.
- **Groundwater-surface water interaction**. There is a continued need to invest in better understanding the role of groundwater in Victoria's water cycle. In particular, an improved understanding of aquifer shape and behaviour is needed, especially in areas of groundwater-surface water interaction and where there are groundwater dependant ecosystems.

Over the next twelve months, the Department of Sustainability and Environment will continue to improve the groundwater allocation framework in Victoria to streamline existing processes and ensure allocation and resource management are efficient and responsive to immediate pressures. A more responsive approach will ensure those groundwater areas requiring more active management and intervention receive due attention. Similarly, the issues of over-allocation and over-use, more vigorous metering and proactive enforcement will also be addressed.

36 Securing the environmental health of water resources

36.1 Importance of environmental flows

As a water resource management document, the State Water Report covers the water resource elements of environmental water. However, it should be noted that rivers have naturally variable flow regimes, reflecting the rainfall and run-off within their catchments. The total annual streamflow volumes, as reported in Part 1 and Part 2 of this report, are not in themselves indicators of river health. Seasonal flow regimes are critical.

Detail of the importance of flow regimes in sustaining streams, rivers and groundwater, and their dependent ecosystems has been outlined in a number of documents, including Chapter 35 of the *State Water Report 2004-05* and Chapter 2 of the *Central Region Sustainable Water Strategy, Action to 2055*.

36.2 Environmental Water Reserve

The Environmental Water Reserve (EWR) is the legal term used for the share of water set aside for the environment as environmental flows.

The government established the EWR to provide a higher degree of legal protection and recognition for the environment's share of water resources. It is also recognised that the EWR in some river systems needs to be enhanced to provide for the long term health of the river and its floodplain.

Catchment management authorities have responsibility for the operational management of the EWR. Melbourne Water manages the EWR in the Port Phillip and Westernport region.

The EWR is required by the *Water Act 1989* to be managed in accordance with the EWR objective specified in the Act, and as such it:

- aims to achieve ecological objectives for the protection and/or restoration of priority river, wetland and aquifer assets
- is undertaken as one key component of an integrated program of river, wetland and aquifer restoration aimed at achieving ecological objectives
- aims to achieve the most effective use of environmental water, achieving the greatest level of environmental benefits possible and minimising as far as possible any adverse impacts on water users
- engages communities, particularly where these are likely to be affected by the water management regime.

Environmental operating strategies are prepared by the EWR managers for the operational management of environmental entitlements held in storage. The catchment management authorities are required to report to the Minister for the Environment on the allocation and use of the environment's water currently held under bulk entitlements.

Reporting on the allocation and use of the various components of the environment's water will be further developed as management systems for the EWR are established.

In 2005 the Department of Sustainability and Environment commissioned the eWater Cooperative Research Centre to initiate an ecological monitoring program to assess the ecological outcomes of the use of environmental water in a number of regulated rivers across the state where there has been a government commitment to increase environmental flows. Known as the Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP), this project is investigating the effects of improved environmental flow regimes that have occurred as a result of major water recovery projects. Its work is focusing on the following priority rivers:

- Broken River
- Goulburn River
- Campaspe River
- Loddon River
- Thomson River
- Macalister River
- Wimmera River
- Glenelg River.

The data will allow EWR managers to test hypotheses about the relationships between flow and a number of ecological parameters to ensure effective adaptive management of the EWR. It is also important to demonstrate to the broader community the environmental water is being well managed and is achieving the environmental benefits as set by the community.

Amendments to the Water Act in 2005 created the EWR where it is formally defined as water set aside for the environment through:

- Environmental entitlements: The legislation provides for volumes of water in regulated river systems to be granted to the environment. Environmental entitlements are held by the Minister for the Environment. The existing bulk entitlements held by the Minister are equivalent to environmental entitlements and it is expected they will be amended so as to afford them the same legal status as environmental entitlements. Because they exist in regulated water supply systems, which provide opportunities for discretionary releases of water, environmental entitlements can be managed with considerable flexibility to meet environmental objectives.
- Consumptive entitlement holders meeting the obligations attached to their water entitlements: This is flow that a consumptive entitlement holder must allow to pass before they can take any water; it is also flow that is in excess of entitlements. This component of the EWR does not include water set aside for future consumptive purposes in a river basin, but which is not yet allocated (e.g. unallocated water within permissible consumptive volumes for groundwater; or unallocated water identified in regulated systems under the statewide sustainable diversions rules).
- Operation of a management plan: e.g. a streamflow management plan.
- Operation of other legislation, e.g. the *Murray Darling Basin Act 1993* and the *Groundwater (Border Agreement) Act 1985*.

Environmental entitlements already exist in the Wimmera/Glenelg river system (41 GL), Thomson River (10 GL), Loddon River (2 GL), River Murray (27.6 GL), and the Snowy River (21.5 GL). The status and annual allocation for the environmental entitlements that existed in 2005/06 are reported in the basin water accounts and summarised in Chapter 4.

New or expanded environmental entitlements are proposed and committed for the following systems: the River Murray, Goulburn, Broken, Loddon, Wimmera, Glenelg, Macalister, Thomson, Latrobe, Werribee, Maribyrnong, Barwon, Moorabool and Tarago rivers.

Stormwater, recycled water and irrigation drainage flows may also contribute to the environmental wellbeing of a river or stream, but are not currently included in the EWR.

36.3 Completion of the Environmental Water Reserve

A number of actions are required by government to fully establish the EWR:

- completion of all consumptive bulk entitlements across the state. The largest of these are the bulk entitlements for Melbourne Water to take from the Tarago River. A small number of small town water supplies also require bulk entitlements to formalise their water supply entitlements, as well as the Newlyn Reservoir/Hepburns lagoon system in the upper part of the Loddon basin
- in unregulated streams, the statutory recognition of the statewide sustainable diversion limits as PCVs
- for groundwater management units, the proclamation of permissible consumptive volumes.

36.4 Enhancing the Environmental Water Reserve

The government's *Our Water Our Future* action plan outlined key projects for enhancing the EWR including:

- Unbundling water entitlements: This irrigation reform initiative will improve the security of irrigation water entitlements and enhance the water market. The agreed implementation package for irrigation areas in northern Victoria includes the transfer of 20% of the new irrigation sales entitlements to the environment. The project will deliver a total of 145,000 ML a year towards Victoria's share of the water required for the Living Murray project. This water will be transferred into environmental entitlements for use in improving environmental flows in the River Murray as well as the Goulburn, Broken, Campaspe and Loddon rivers. The *Water (Resource Management) Act 2005* was passed in the spring session of Parliament 2005 to enable the unbundling of water entitlements. On 1 July 2007, some 120,000 ML of lower reliability entitlement will be transferred to the environment. The supply of this water will depend on the annual allocation for lower reliability entitlements.
- Snowy River: The Victorian Government, together with the Commonwealth and New South Wales Governments, have committed to increase the river's flow below Jindabyne Dam from approximately 1% to 21% of its natural flow. This requires 212,000 ML of water to be recovered by water savings projects in New South Wales and Victoria. An allocation of 10,200 ML for the Snowy River was available in 2004/2005, which was created through water savings projects in Normanville, Woorinen and Goulburn-Murray irrigation districts that were completed during 2003/2004. This volume was carried over for use in 2005/06 (see Chapter 4). Other water savings projects initiated in Victoria include the decommissioning of Lake Mokoan, and the channel reconfiguration project in the Goulburn-Murray Irrigation District.
- River Murray: The Living Murray initiative, from the Murray Darling Basin Ministerial Council, aims to improve the ecological health of the River Murray, initially focussing on six priority

sites. Under the First Step Decision by the Council, 500,000 ML will be returned to the River Murray for the environment. (This includes 145,000 ML for the environment from the unbundling water entitlements project). Physical structures such as regulators and channels to deliver and manage the environmental water at the priority sites will be developed under a $150 million works program. Four of the six sites are wholly or partly within Victoria: Barmah/Millewa, Gunbower-Pericoota/Koondrook, Hattah Lakes and Chowilla-Lindsay/Wallpolla.

- Thomson/Macalister: An additional 5,000 ML of water for environmental flows in the Macalister River will become available by December 2007. This is the second instalment of the *Our Water Our Future* action plan's proposed total transfer of 25,000 ML of additional water for environmental flows in the Thomson and Macalister rivers. The first instalment of 10,000 ML was provided to the Thomson in 2005 as an environmental bulk entitlement. The water for the Macalister will be provided through improving the efficiency of water delivery infrastructure in part of the Macalister Irrigation District. This project is expected to initially save an estimated 5,000 ML for the environment, with more savings expected to follow as efficiency improvements are extended to other parts of the district.
- Wimmera-Glenelg: The Wimmera-Mallee pipeline project will significantly change the balance between consumptive and environmental use in the basin with the environment's average share of total annual flows increasing from the current 20% to an estimated 60%. Further additions to the Wimmera/Glenelg environmental bulk entitlement are expected as this project proceeds.

Through the Central Region Sustainable Water Strategy (CRSWS) the government committed to increase the EWR of rivers in the Central Region by a total of 66,000 ML by 2015. This water will be provided through a range of measures including the allocation of unallocated water, voluntary licence buy-back schemes, water savings through conservation and efficiency projects and the transfer of entitlements. The increased EWR for each of the rivers in the Central Region is:

- Yarra River: an additional 20,000 ML per year
- Moorabool River: an additional 3,000 ML per year
- Barwon River: an additional 4,700 ML per year
- Werribee River: an additional 6,000 ML per year
- Maribyrnong River: an additional 3,000 ML per year
- Tarago/Bunyip rivers: an additional 3,000 ML per year
- Latrobe River: an additional 10,000 ML per year
- Thomson/Macalister rivers: an additional 15,000 ML per year. (This is a reconfirmation of the original government commitment made through *Our Water Our Future*)
- Gellibrand: an interim EWR to be confirmed as part of a Victorian Government decision on the possible development of the Newlingrook groundwater resource, including possible surface water interactions.

Further information regarding these projects can be found in the Victorian Government's *Our Water Our Future* action plan, the Victorian Government's CRSWS, or by visiting the Department of Sustainability and Environment's website at www.dse.vic.gov.au.

36.5 Managing the Environmental Water Reserve during drought

The current drought conditions are severely affecting rivers and wetlands. When drought occurs naturally, native fauna retreats to key refuges and populations decrease, wetlands dry out and plants start to die off. When the drought breaks, the refuges provide the basic stock for river recovery. However, the severity and duration of the current drought on the environment has been greatly increased by the combined effect of water extraction and river regulation.

In addition, the ability to recover from drought has been compromised further by other factors eg barriers along the river and/or deteriorating water quality as a result of catchment management practices. This means active management is required to ensure that key refuges are protected through the drought to provide some recovery capacity.

To cope with prolonged periods of low flows and to ensure that long term management objectives for rivers outlined in Regional River Health Strategies are met, catchment management authorities are developing drought response plans for priority rivers. These plans will develop contingencies to prevent catastrophic events and critical loss of species, and enable future recovery. They include:

- emergency management of the EWR
- complementary river restoration activities
- identifying opportunities in the management of water for consumptive purposes during drought to also provide environmental benefits.

37 Water accounting and reporting

Key actions in the Victorian Government's *Our Water Our Future* action plan that contribute to improving the accuracy, accountability and accessibility of water resource information are:

- **State Water Report**. An annual overview of water allocation and use, including the basin accounts. It relies on the development of water accounting rules.
- **Water Register**. Development of a public register of water rights and licences, including information on bulk entitlements in Victoria.
- **Metering program**. All new licences for commercial and irrigation use are required to be metered and funding incentives are provided to install meters on existing significant un-metered water extractions.

In addition, and also consistent with the Australian Government's National Water Initiative, Victoria is continuing to develop its water resource accounting framework. This includes:

- retail accounting to account for the consumptive use of water, for which the accounting concepts will be applied for irrigation use through the Victorian Water Register. Further work is required on an expanded retail accounting framework which includes urban water consumption (including the accounting for large non-residential use) and links to water resource accounting at the wholesale level
- wholesale resource (bulk) water accounting which primarily accounts for the overall volume of the resource at a basin scale. The conceptual basis for this is being developed through the annual basin accounts in the State Water Report
- whole-of-water-cycle accounting which accounts for water through the various stages of the water cycle, in particular through the terrestrial stage.

A fundamental requirement of water accounting is that it must align with the water allocation frameworks. The Victorian water allocation framework defines water for consumptive and environmental purposes. Consumptive use entitlements are currently issued through bulk entitlements, water rights and water licences, as outlined in Part 1, Chapter 2 Water for consumptive use. The Environmental Water Reserve provides a legal foundation for water to be set aside to maintain environmental values of rivers and streams. This water is defined through a range of mechanisms outlined in Part 1, Chapter 4 Water for the environment. The mechanisms include rules and conditions on consumptive use entitlements.

The development of water accounting concepts has progressed to varying degrees for different elements of the water allocation framework. This is evidenced in the issues outlined in the following sections, in particular those relating to basin accounts, accounting for groundwater and the Environmental Water Reserve.

37.1 Water accounting in the State Water Report 2005/06

Water accounting has historically been based on water authorities' customer accounting and water supply operating systems that focus on measuring consumption and billing customers.

It has also included seasonal assessments of water resources to determine allocations for irrigators in the large regulated water supply systems. Generally speaking, water accounts have been kept for individual entities and aggregated to larger groupings to allow analysis on a wider scale.

The 2005/06 basin accounts included in Part 2 of this report are an example of annual water resource accounting at the river basin and aquifer scale. These are at an early stage of development and it is expected that the scope of water accounts in future State Water Reports will be broadened to include a more complete record of transactions associated with holding and transferring bulk water and environmental flows.

The basin water accounts in the State Water Report present data on diversions and extractions rather than use, and for this reason surface water diversions are reported in the basin where the water is extracted, not where it is ultimately used. The majority of diversions are used for consumptive purposes, although in some cases there are some non-consumptive uses such as environmental flows.

A number of initiatives are underway at a national level to improve water accounting (see Section 37.7). At a Victorian level the Water Register for northern Victorian regulated systems will become operational in July 2007 (see Section 37.4).

Once implemented, the Water Register will ease the collection of data, simplify the compilation and improve the accuracy of the state water accounts.

Furthermore, the framework underpinning the water accounting in State Water Report will be more stringently defined during 2007. A chart of accounts will be developed, and accounting rules implemented in order to improve the accuracy and consistency of the basin water accounts. Work will also be undertaken to better link the water resource accounting information shown in the basin water accounts with urban water use information such as that presented in Figure 2-1 in Chapter 2 of this report.

37.2 Accounting for groundwater

While including groundwater as part of a wholesale water account appears at first glance to be an obvious way to produce combined surface water/groundwater accounts, groundwater poses a number of challenges for water accounting:

- If an aquifer underlies more than one surface water basin, an accounting system that tries to deal with groundwater within the boundaries of river basins will present great difficulties.
- Groundwater and surface water can be connected, flowing into each other. If double counting of some water is to be avoided, the connections must be identified and understood.
- Groundwater management areas and water supply protection areas in Victoria are currently managed using extraction rates and groundwater levels, not volumes in aquifers because estimates of volumes in aquifers are very unreliable

At this stage it is useful to regard water in an aquifer as a retail delivery system account at the same level as a surface water distribution system, and quantify such items as inflows from recharge, water feeding into rivers and other groundwater systems, and water extracted by retail customers. However, of these items, only the extractions can be readily calculated and these are reported in the basin accounts.

Estimating the other items is a technical exercise involving modelling and high levels of uncertainty. Therefore at this stage there is limited benefit in pursuing full groundwater accounts of this type except as a knowledge gathering exercise to better understand surface water/groundwater interconnections. The Victorian approach of managing groundwater by extraction rates and water level means that the risks of double counting and of the extraction impacting on surface water and groundwater-dependant ecosystems can effectively be managed.

37.3 Accounting for environmental water

The *Water (Resources Management) Act 2005* has conferred on the environment a legal share of the water in rivers and aquifers by establishing the Environmental Water Reserve (EWR). This water is defined through a range of mechanisms outlined in Part 1, Chapter 4 Water for the environment including: environmental entitlements, passing flow obligations on consumptive bulk entitlements, streamflow management plans, and in some instances above cap water. While these mechanisms cover the surface water component of the EWR, the groundwater components require further work to define.

These mechanisms through which the EWR is defined cover two components of water: storage elements and in-stream elements.

As with water accounting more broadly, water accounting for environmental water is a developing discipline. The approach developed for Victoria's environmental water accounting will need to ensure that the use of storage elements and in-stream elements are accounted for separately and explicitly.

37.3.1 Storage elements of the EWR

Extractive entitlements to discrete volumes of water can be used at the discretion of the environmental manager for, say, watering a wetland. They are usually held in regulated water systems.

Environmental entitlements will appear in the Victorian Water Register and, as Victoria's water accounting framework is further developed, it is anticipated that they will appear in the various retail water accounts.

37.3.2 In-stream elements of the EWR

The in-stream elements of the EWR include flows maintained by a water authority as an obligation or rule of a bulk entitlement or licence, and above-cap water. They include passing flows below storages on regulated systems and diversion restrictions in unregulated rivers.

The timing of flows in this component is determined by rules in bulk entitlements, rules in streamflow management plans, conditions on licences and flows in river systems (for example, increased flows in response to rain when a storage spills). The accounting for this component needs to demonstrate compliance with volumetric, temporal and spatial aspects of the rules.

The further development of EWR accounting concepts will assist in identifying which rules (in particular the temporal and spatial components) can be accounted and reported though water accounting systems and which will need to be reported through different processes in order to assess compliance.

It is worth noting, however, that temporal factors will need to be reported through non-accounting mechanisms. This is due to the need to recognise characteristics of flow, as well as volumes in water reporting.

37.4 Victorian Water Register

At present rural water authorities manage and maintain individual registers of water entitlements. The water authorities process and approve transfers of water entitlements and allocations and record the changes in their registers.

These registers are kept using different systems and to different standards but generally include information such as the name of the landowner, the description of the land, the volume and type of entitlement (e.g. water right or Section 51 licence) and other information such as drainage diversions.

On 1 July 2007 the water registers currently being operated by Goulburn-Murray Water, Lower Murray Water, and the First Mildura Water Trust will be replaced by a single web-based State Water Register. On 1 July 2008 the registers operated by Southern Rural Water and Melbourne Water will be replaced by the state register.

The Water Register will have five key operational aspects:

- a public register of water shares (unbundled entitlements) and interests over these entitlements (i.e. mortgages can now be recorded against water shares and these are recorded in the water register)
- a public register of water use licences and works licences
- a workflow process system for assessing and approving applications, and their subsequent recording in the register
- a system to make annual allocations to holders of water shares to account for allocation and usage
- reporting functionality including public on-line access to report on water trade prices, and water share, water use licence, and works licence records.

The Water Register accounting module will enable water shares, allocation, water use and transfers of water shares and allocation to be recorded, analysed and reported. This will include information regarding owner, delivery system, trading zone, reliability, tenure, source and water authority.

The Water Register will be underpinned by a rigorous accounting framework that is based on commonly accepted financial accounting principles of double entry accounting, chart-of-accounts, natural accounts, basic internal control practices of separation of responsibilities, and audit trails. The accounting framework adopted is the basis of retail water accounting.

The Victorian Water Register will:

- improve information on water authorities' compliance with their bulk entitlement volumes and enable the bulk entitlements to be updated and reconciled for trade
- enable reporting to individuals on their annual allocation and use
- enable annual reconciliation and reporting of water accounts at the retail system level.

Once implemented, the Water Register will ease the collection of data, simplify the compilation and improve the accuracy of the state water accounts.

37.5 State metering program

Accurate water accounts rely on accurate and complete data on the volumes of water extracted from rivers and aquifers. The *Our Water Our Future* action plan recognised that the metering of water extractions needed to be improved for resource monitoring and compliance purposes. The Victorian Government committed to meter all new surface water and groundwater licences for commercial and irrigation use, and to provide funds towards the installation of meters on existing unmetered water extractions of significant size.

The Victorian Government subsequently introduced the following metering thresholds, which apply unless a lesser volume is specified in a water management plan:

- 10 ML and greater to take and use surface water from unregulated systems
- 20 ML and greater to take and use groundwater.

Installation of meters will not be compulsory for licences below these thresholds.

The Victorian Government metering program contributes $400 to the cost of metering each site. The program commenced in 2005 and in the order of 1,300 meters were installed to June 2007.

As this project progresses, the accuracy of the figures reported in future State Water Reports on volumes of water extracted from groundwater aquifers and from unregulated streams will be significantly improved. It will add a greater level of confidence in the water resource information presented in future reports and will also assist water managers and water users to better understand water usage patterns and help them comply with their entitlement and licensed volumes.

37.6 Water consumption reporting

Victoria uses a range of tools to achieve sustainable urban water management. These include public education, incentives, regulation, planning provisions, technical change, pricing and investments. The availability of information on urban water consumption for the 2005/06 period varies across the state which limits the ability to evaluate the utility and effectiveness of such tools.

Over the next few years, Victoria will continue to seek improvements to the way water consumption information is collected, reported and analysed. It is expected that these developments will lead to improved water consumption reporting in the State Water Report and add to the body of knowledge available to water resource managers for future modeling, planning and investment.

A working group of the Council for the Australian Federation (CAF) is currently assessing the need for a national system for reporting urban water consumption, with particular focus on large users. The recommendations arising from this review will be considered by CAF once they are complete.

37.7 National water accounting policy

Water accounting is a formative discipline and its importance has been acknowledged through the National Water Initiative. The State, Territory and Commonwealth Governments have convened a water accounting development committee and established a three year workplan to develop national water accounting standards. The committee will oversee the development of a range of products to lead towards a national accounting model, including outputs such as:

- the information requirements of users of water accounting information
- a conceptual framework for water accounting
- a range of water accounting standards and guidelines for water market accounting, water resource accounting and environmental water accounting
- a national common chart of water accounts
- a series of pilot projects to aid development of the model
- recommending reporting requirements, obligations and assurance mechanisms for water accounting.

At this stage, development of the framework is still in its initial conceptual stage and is focusing on identifying relevant issues and information gaps.

The first practical element of the National Water Initiative in relation to water accounting will be delivered through the Australian Water Resources 2005 initiative expected to be released in mid 2007. The Australian Water Resources 2005 project covers water availability, use and quality to varying extents across Australia. The project envisages a water accounting framework that covers the whole of the terrestrial phase of the water cycle in a way that can be aggregated to a national level. The considerable challenge in applying these broad concepts will no doubt progress thinking on water accounting at both the national and state level.

Victoria's public reporting on water accounting is arguably the most developed in Australia. As work progresses in developing national water accounting standards, these developments will find their way into the state water accounts, however given the many complexities in water resource management, there will continue to be many challenges in producing meaningful national accounts.

37.8 Water Account Australia

The Australian Bureau of Statistics (ABS) prepares information on the supply and use of water in the Australian economy in a report entitled Water Account Australia (ABS catalogue no. 4610). Water Account Australia is currently produced every four years - the most recent version is for 2004/05. It is compiled using methods proposed in a 2003 United Nations document *System of Integrated Environmental and Economic Accounting* (SEEA). This system focuses on water that is in 'the economy' – water in systems that extract water for production and consumptive purposes – as distinct from water 'in the environment'. As a result, for

example, the ABS information provides information on water consumption across different industry types. It does not account for water for the environment and does not readily align with the Victorian Water Allocation Framework.

Information sources for *Water Account Australia 2004-05* include general survey information collected by the ABS, as well as a specific 2004/05 water supply survey. It also includes information provided by state agencies including the Department of Sustainability and Environment.

Because the state water accounts have a stronger focus on whole-of-system water reporting (including environmental water use) information presented in Water Account Australia and the state water accounts are not necessarily comparable. However, *Water Account Australia 2004-05* does incorporate data collected through the State Water Report process and hence in some cases the same base data has been used. It is expected that as water accounting develops greater alignment between the state water accounts and Water Account Australia will occur.

37.9 National metering standards

Under clause 88 of the National Water Initiative, states, territories and the Commonwealth have agreed to develop a national meter specification and national meter standards specifying the installation of meters. Clause 88 relates to meters for rural/agricultural water use including domestic and stock and industrial and does not apply to urban reticulated supply (which is already covered by existing standards).

Over time, this initiative is likely to involve the replacement of a significant number of meters that do not meet the standard. In turn this will improve the accuracy of information in the State Water Report.

Victoria is working with the Commonwealth and the states to progress this work.

38 Future State Water Reports

The scope and direction of the annual State Water Report is grounded in the policy direction detailed in the Victorian Government's *Our Water Our Future* action plan. As various elements of the action plan are implemented, the content of the State Water Report will evolve.

The reports will continue to provide publicly accessible accounts of the state's water resources that support the government's commitment to open, transparent and sustainable management. They also contribute to the government's commitments under the National Water Initiative in the area of water accounting and reporting.

Access to the accounts will continue to improve as web-based mechanisms that facilitate the public's ability to access and utilise data are enhanced. The commencement of the Victorian Water Register on 1 July 2007 will be a significant boost in this area.

As the EWR is progressively implemented, the reporting of the water resource elements in the State Water Report will be expanded. In the future, the definition of the EWR in each basin will incorporate groundwater.

Improvements to methodology will continue with each report. The classification of recycling data and improved reporting on entitlement compliance are two areas where processes and reporting will be enhanced. Developments in the emerging discipline of water accounting at both the state and national level will also add to the rigour of the basin accounts.

Urban water consumption continues to be an area of both policy action and public interest. Future reports will build on bulk water accounting concepts for urban use and will provide expanded information.

Appendix A

Groundwater entitlement and use

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
GWMWater											
WSPA (approved plan)											
Murrayville WSPA	10,883	9,634	33	33	100%	2,870	0		280	560	3,430
Neuarpur WSPA	24,696	24,696	50	104	100%	15,600	0		297	594	16,194
WSPA (draft plan)											
Apsley WSPA	4,285	4,285	20	11	80%	1,770	350	Metering program %	134	268	2,388
Kaniva WSPA	3,673	3,673	14	20	100%	2,360	0		112	224	2,584
Telopea Downs WSPA	7,482	7,482	10	12	100%	4,120	0		97	194	4,314
GMA											
Balrootan (Nhill) GMA	980	1,522	13	13	50%	690	690		51	102	1,482
Goroke GMA	2,200	0	0	0	0%	0	0		0	0	0
Kaniva GMA	1,100	0	0	0	100%	0	0		0	0	0
Little Desert GMA	1,100	0	0	0	0%	0	0		0	0	0
Nhill GMA	1,200	0	0	0	0%	0	0		0	0	0
Unincorporated areas											
GWMWater		5,909	32	n/a		0	2,068	35% of entitlement	314	628	2,696
Southern Rural Water											
WSPA (approved plan)											
Nullawarre WSPA	22,238	22,238	206	158	100%	10,500	0		1,197	2,394	12,894
Yangery WSPA	14,488	14,488	165	161	100%	3,270	0		1,432	2,864	6,134
Koo-Wee-Rup WSPA	13,854	13,854	391	326	100%	3,460	0		600	1,200	4,660
WSPA (draft plan)											
Bungaree WSPA	5,401	5,401	95	117	100%	2,700	0		252	504	3,204
Condah WSPA	7,568	7,568	39	45	100%	2,710	0		58	116	2,826
Denison WSPA	13,733	13,733	125	101	100%	6,680	0		297	594	7,274

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Deutgam WSPA	5,234	5,234	159	205	100%	2,660	0		257	514	3,174
Glenelg WSPA	32,777	32,777	79	77	100%	7,570	0		0	0	7,570
Sale WSPA	21,519	21,519	104	77	100%	10,450	0		919	1,838	12,288
Wandin Yallock WSPA	3,037	3,037	184	206	100%	590	0		163	326	916
Warrion WSPA	14,214	14,214	131	131	100%	3,650	0		461	922	4,572
Wy Yung WSPA	7,521	7,521	61	55	100%	1,110	0		116	232	1,342
Yarram WSPA	25,457	25,457	84	70	100%	11,070	0		970	1,940	13,010
GMA											
Cardigan GMA	3,967	3,759	18	2	50%	10	253	CHW entitlement	481	962	1,225
Colongulac GMA	14,271	3,577	41	16	100%	0	1,073	30% of entitlement	208	416	1,489
Corinella GMA	2,550	164	13	2	100%	0	49	30% of entitlement	157	314	363
Cut Paw Paw GMA	3,650	533	6	3	100%	0	160	30% of entitlement	2	4	164
Frankston GMA	3,200	1,034	25	15	100%	0	310	30% of entitlement	199	398	708
Gellibrand GMA	0	0	0	0	0%	0	0		0	0	0
Gerangamete GMA[5]	8,000	8,000	1	0	0%	2,000	0		5	10	2,010
Giffard GMA	3,000	5,705	14	18	100%	3,260	0		171	342	3,602
Glenormistom GMA	5,042	2,512	35	9	100%	0	753	30% of entitlement	125	250	1,003
Heywood GMA	21,763	6,474	94	31	100%	0	1,942	30% of entitlement	1,735	3,470	5,412
Jan Juc GMA	6,804	4,000	1	0	0%	0	1,200	30% of entitlement	0	0	1,200
Lancefield GMA	1,485	1,373	15	16	100%	400	0	0	76	152	552
Leongatha GMA	6,500	1,471	31	6	100%	0	441	30% of entitlement	114	228	669
Merrimu GMA	452	452	15	9	100%	120	0	0	13	26	146
Moe GMA	8,193	3,299	81	13	100%	0	990	30% of entitlement	197	394	1,384
Moorabbin GMA	4,305	2,202	30	25	100%	0	661	30% of entitlement	238	476	1,137
Nepean GMA	5,000	6,049	65	44	100%	0	1,815	30% of entitlement	1,162	349	2,163
Newlingrook GMA	74,970	1,968	5	2	0%	0	590	30% of entitlement	0	0	590
Orbost GMA	1,200	1,200	3	4	100%	350	0		0	0	350
Paaratte GMA	4,606	3,192	5	0	0%	0	958	30% of entitlement	4	8	966

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Portland GMA	20,683	2,340	8	1	0%	0	702	30% of entitlement	63	126	828
Rosedale GMA	9,000	13,102	49	37	100%	10,860	0		1	2	10,862
Stratford GMA	31,553	31,553	7	4	100%	17,690	0		410	820	18,510
Tarwin GMA	1,300	41	3	0	0%	0	12	30% of entitlement	806	242	254
Wa De Lock Zone GMA	11,500	26,865	242	107	100%	0	8,059	30% of entitlement	482	964	9,023
Unincorporated areas											
Southern Rural Water		64,712	1,191	0		0	19,414	30% of entitlement	0	0	19,414
Gouburn-Murray Water											
WSPA (approved plan)											
Campaspe Deep Lead WSPA	46,069	46,251	109	105	96%	23,110	344	Operational knowledge of system	188	376	23,830
Shepparton WSPA	244,226	224,226	1,373	789	60%	62,750	0		1,373	2,746	65,496
Spring Hill WSPA	4,957	4,947	56	51	91%	1,850	0		64	128	1,978
Katunga WSPA	59,770	42,487	183	121	66%	21,610	0		593	1,186	22,796
WSPA (draft plan)											
Mid Loddon WSPA	37,200	37,200	120	83	69%	15,830	0		124	248	16,078
Upper Loddon WSPA	12,991	12,991	177	60	33%	2,380	0		198	396	2,776
GMA											
Alexandra GMA	900	1,821	20	0	0%	0	686	Operational knowledge of system	52	104	790
Barnawartha GMA	2,100	595	10	0	0%	0	194	Operational knowledge of system	28	56	250
Ellesmere GMA	1,900	2,616	15	7	47%	1,040	400	Previous readings	27	54	1,494
Goorambat GMA	4,888	1,651	13	0	0%	790	0		17	34	824
Kialla GMA	4,770	2,332	13	0	0%	0	1,062	Operational knowledge of system	23	46	1,108
Kinglake GMA	3,830	2,012	87	0	0%	0	966	From summary sheets	342	684	1,650
Mullindolingong Zone 1 GMA	6,980	1,285	58	0	0%	0	514	40% of entitlement	77	154	668

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Murmungee GMA	16,710	12,012	191	0	0%	0	4,717	40% of entitlement	1,285	2,570	7,287
Nagambie GMA	5,650	6,476	39	24	61%	1,340	0	0	78	156	1,496
Unincorporated areas											
Goulburn Murray Water		41,179	871	2,393		0	14,413	35% of entitlement	3,193	6,386	20,799
Total	**950,574**	**879,898**	**7,328**	**5,919**		**259,220**	**65,786**		**22,318**	**41,290**	**366,297**

Notes:

(1) Areas with zones have been totalled.

(2) In non-metered areas, the water authorities' estimates have been adopted. Use in unincorporated areas has been estimated based on 35% of entitlement, as per the *2004/05 State Water Report*.

(3) The numbers of domestic and stock bores represent bores registered in the state database records as being drilled since 1965.

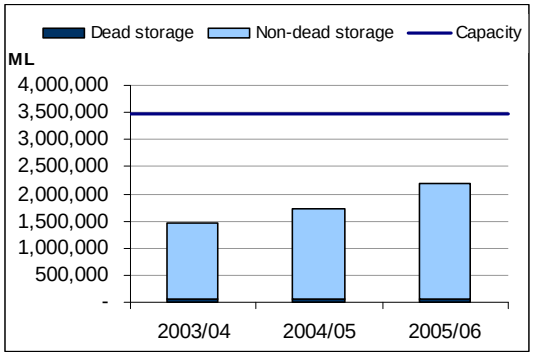
(4) Domestic and stock use is estimated as 2 ML/bore except in the Tarwin and Nepean GMAs (0.3 ML/bore) which is a more accurate estimate for these two GMAs.

(5) Barwon Water's groundwater licence allows extraction of a maximum of 20,000 ML every one year, 80,000 ML over a consecutive 10 year period and 400,000 ML over a 100 year period from the Gerangamete GMA.

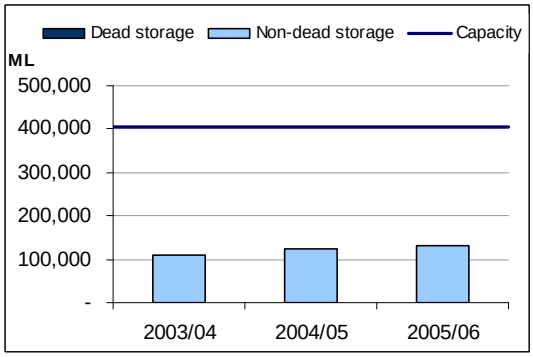
Appendix B

Storage volume by basin

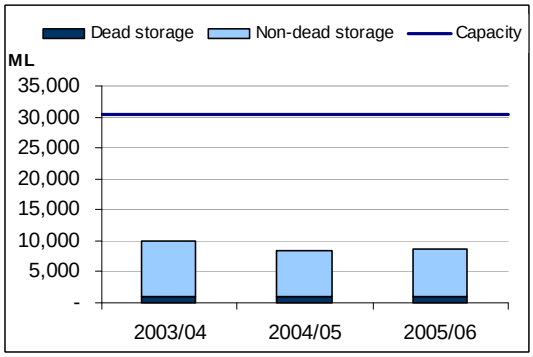
Murray basin



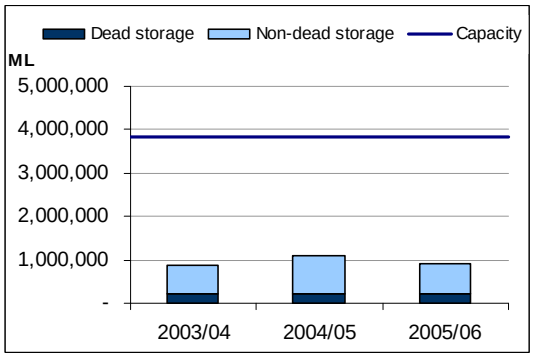
Broken basin



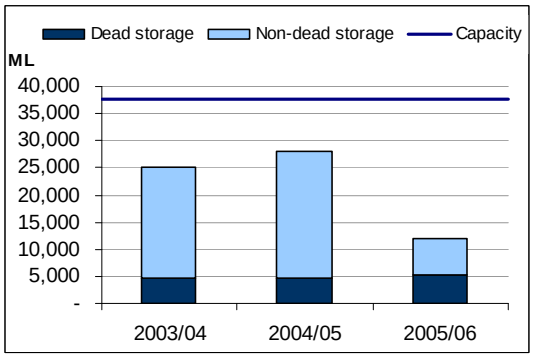
Kiewa basin



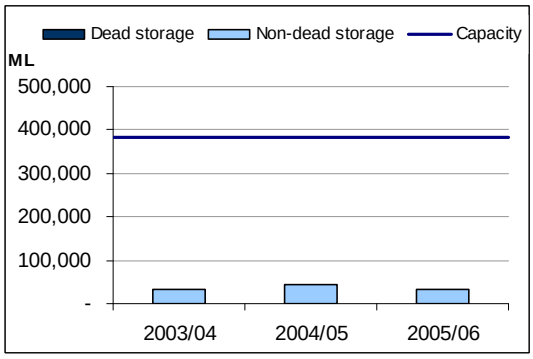
Goulburn basin



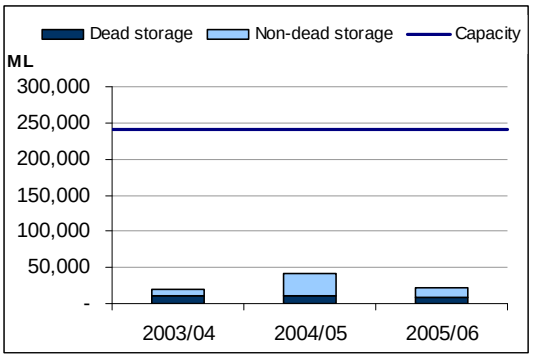
Ovens basin



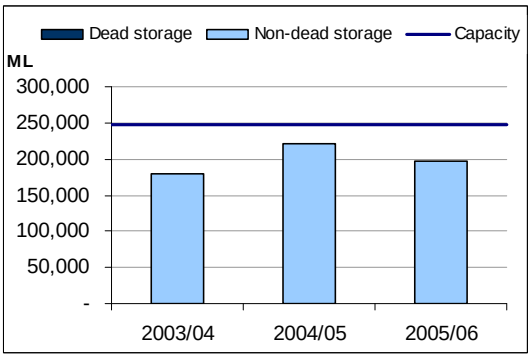
Campaspe basin



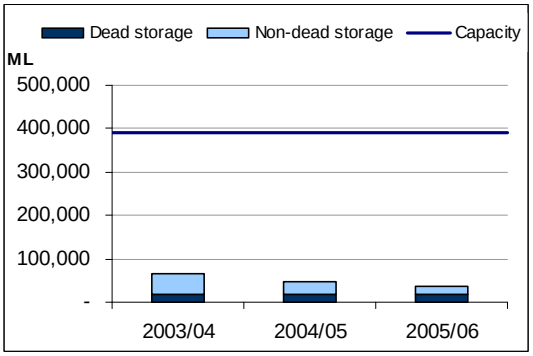
Loddon basin



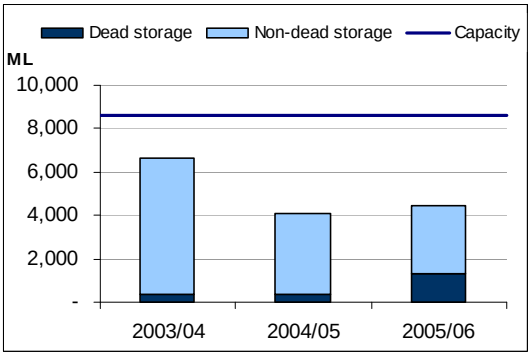
Latrobe basin



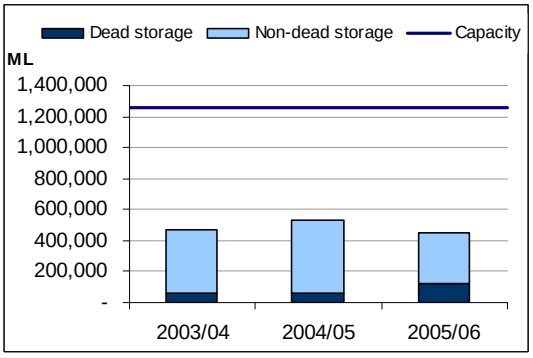
Wimmera basin



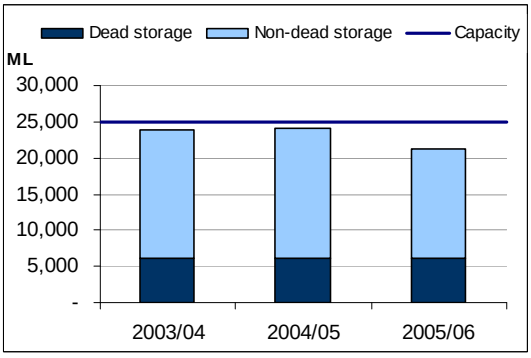
South Gippsland basin



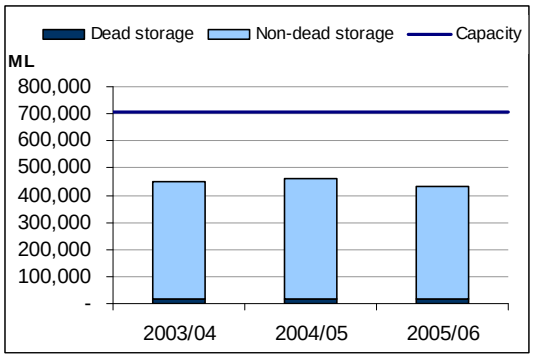
Thomson basin



Bunyip basin



Yarra basin



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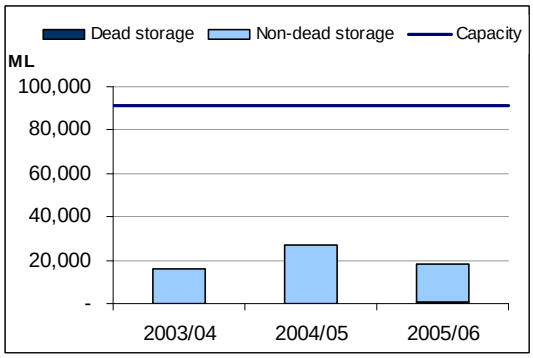
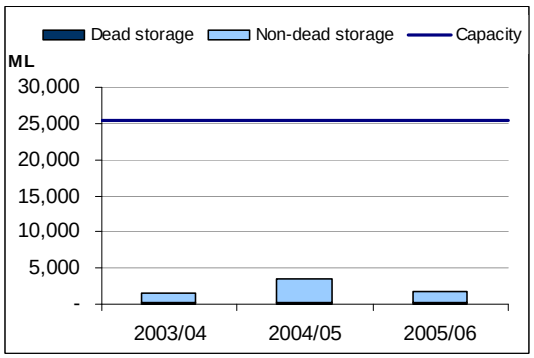
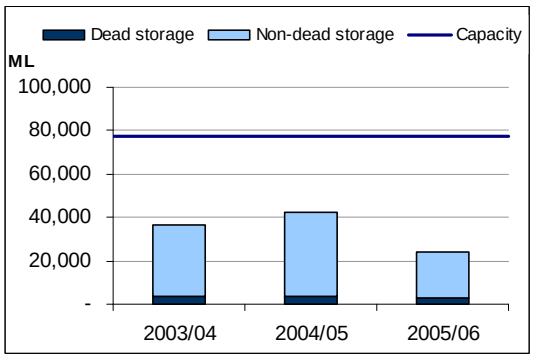


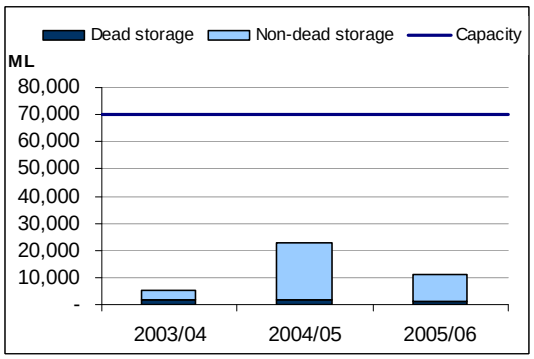
Maribyrnong basin



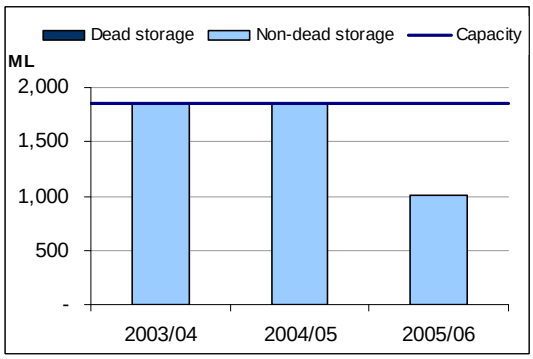
Barwon basin



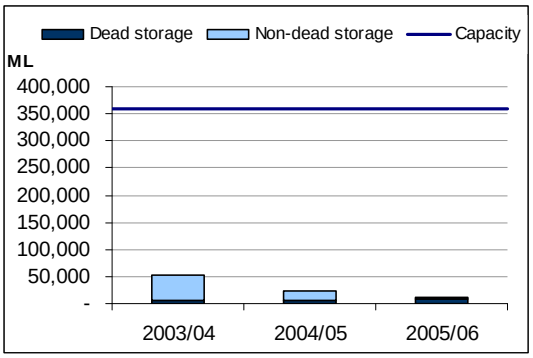
Werribee basin



Otway Coast basin



Glenelg basin



This appendix contains a visual representation of the volume held in storage as at 30 June 2006 in each of the basins. These charts represent all major on-stream and off-stream storages in the basin and therefore do not always correspond with volumes reported in the water balances in each basin account.

Appendix C

On-stream storages used in basin water balances

Basin	Reservoir	Data provider
East Gippsland	None	n/a
Snowy	None	n/a
Tambo	None	n/a
Mitchell	None	n/a
Thomson	Lake Glenmaggie	Southern Rural Water
	Thomson Reservoir (total of SRW+MW shares)	Melbourne Water
Latrobe	Blue Rock (total)	Southern Rural Water
	Lake Narracan	Southern Rural Water
	Moondarra Reservoir	Gippsland Water
South Gippsland	Lance Creek Reservoir	South Gippsland Water
	Hyland Reservoir	South Gippsland Water
	Western Reservoir	South Gippsland Water
	Candowie Reservoir	Westernport Water
Bunyip	Tarago Reservoir	Melbourne Water
Yarra	Upper Yarra Reservoir	Melbourne Water
	O'Shannassy Reservoir	Melbourne Water
	Maroondah Reservoir	Melbourne Water
	Yan Yean Reservoir	Melbourne Water
Maribyrnong	Rosslynne Reservoir (total)	Southern Rural Water
Werribee	Melton Reservoir	Southern Rural Water
	Merrimu Reservoir (total)	Southern Rural Water
	Pykes Creek Reservoir	Southern Rural Water
	Djerriwarrh Reservoir	Western Water
Moorabool	Korweinguboora Reservoir	Barwon Water
	Bostock Reservoir	Barwon Water
	Lal Lal Reservoir (total CHW + BW)	Central Highlands Water
	Wilsons Reservoir	Central Highlands Water
	Moorabool Reservoir	Central Highlands Water
Barwon	West Barwon Dam	Barwon Water
	White Swan Reservoir	Central Highlands Water
	Gong Gong Reservoir	Central Highlands Water
Corangamite	None	n/a
Otway Coast	West Gellibrand Reservoir	Barwon Water
Hopkins	None	n/a
Portland Coast	None	n/a
Glenelg	Rocklands Reservoir	Grampians Wimmera Mallee Water
	Moora Moora Reservoir	Grampians Wimmera Mallee Water
	Konongwootong Reservoir	Wannon Water - Hamilton
	Hayes Reservoir	Wannon Water - Hamilton
Millicent Coast	None	n/a
Murray	Lake Victoria (Victoria's share only)	Murray-Darling Basin Commission
	Menindee Lakes (Victoria's share only)	Murray-Darling Basin Commission
	Lake Hume (Victoria's share)	Goulburn-Murray Water

Basin	Reservoir	Data provider
	Lake Dartmouth (Victoria's share)	Goulburn-Murray Water
	Lake Cullulerraine	Lower Murray Water
Kiewa	Rocky Valley	Southern Hydro
	Lake Guy	Southern Hydro
Ovens	Lake William Hovell	Goulburn-Murray Water
	Lake Buffalo	Goulburn-Murray Water
Broken	Lake Mokoan	Goulburn-Murray Water
	Lake Nillacootie	Goulburn-Murray Water
	Loombah-McCall Say	North East Water
Goulburn	Lake Eildon	Goulburn-Murray Water
	Goulburn Weir	Goulburn-Murray Water
	Sunday Creek Reservoir	Goulburn Valley Water
Campaspe	Upper Coliban Reservoir	Coliban Water
	Lauriston Reservoir	Coliban Water
	Malmsbury Reservoir	Coliban Water
	Lake Eppalock	Goulburn-Murray Water
Loddon	Newlyn Reservoir	Goulburn-Murray Water
	Tullaroop Reservoir	Goulburn-Murray Water
	Cairn Curran Reservoir	Goulburn-Murray Water
	Laanecoorie Reservoir	Goulburn-Murray Water
	Hepburn Lagoon	Goulburn-Murray Water
Avoca	None	n/a
Mallee	None	n/a
Wimmera	Taylors Lake	Grampians Wimmera Mallee Water
	Lake Lonsdale	Grampians Wimmera Mallee Water
	Wartook Reservoir	Grampians Wimmera Mallee Water
	Lake Bellfield	Grampians Wimmera Mallee Water
	Fyans Lake	Grampians Wimmera Mallee Water

Note:
n/a: not applicable.

Abbreviations

AWRC	Australian Water Resources Council
BE	Bulk Entitlement
BOM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CMA	Catchment management authority
D&S	Domestic and stock
DSE	Department of Sustainability and Environment
EC	Electrical conductivity
ESC	Essential Services Commission
EWR	Environmental Water Reserve
FMIT	First Mildura Irrigation Trust
GL	Gigalitre
GMA	Groundwater management area
GMU	Groundwater management unit
ISC	Index of Stream Condition
MDBC	Murray Darling Basin Committee
ML	Megalitre
NTU	Nephelometric turbidity unit
PAV	Permissible annual volume
PCV	Permissible consumptive volume
REALM	Resource Allocation Model
SDL	Sustainable diversion limit
SFMP	Streamflow management plan
SWR	State Water Report
TCSA	Tertiary confined sand aquifer
UA	Unincorporated area
WSPA	Water supply protection area

Glossary of terms

Above cap water: Any water in a basin in excess of water authorities' and other entitlement holders' water entitlements, and any other defined elements of the EWR.

Allocation: The assignment of a water entitlement to a person or authority by government. See also 'seasonal irrigation water allocation'.

Aquifer: A layer of underground sediments which holds groundwater and allows water to flow through it.

Baseflows: The component of streamflow supplied by groundwater discharge.

Basin (river basin): The area of land which a river and its tributaries drain. In the State Water Report river basins are consistent with those defined by the Australian Water Resource Council (AWRC). The exception is the Murray basin which, for the purposes of this report, includes the Upper Murray basin as defined by AWRC and areas in Victoria supplied from the River Murray downstream of Lake Hume. See also 'river basin'.

Bulk entitlement: The right to water held by water and other authorities defined in the *Water Act 1989*. The bulk entitlement defines the amount of water from a river or storage to which an authority is entitled, and may include the rate at which it may be taken and the reliability of the entitlement.

Bulk entitlement conversion order: The statutory instrument used to issue the bulk entitlement under the provisions in the *Water Act 1989*.

Consumptive entitlement: A water entitlement that permits the holder to use the water taken under the entitlement for the purposes of consumption.

Call (calling of water): See 'order'.

Cap: A limit placed on the amount of water that can be taken from a system within a specific timeframe.

Catchment: An area of land where run-off from rainfall goes into one river system.

Catchment management authorities (CMAs): Statutory bodies established under the *Catchment and Land Protection Act 1994*. CMAs have responsibilities under both the Catchment and Land Protection Act and the *Water Act 1989* which include river health, regional and catchment planning and coordination, and waterway, floodplain, salinity and water quality management.

Compliance point: The location where passing flow requirements are established. Compliance points may include gauging stations, weirs, reservoirs or a section of a river.

Dead storage: Water in a storage that is below the elevation of the lowest constructed outlet.

Drainage division: An aggregation of river basins in an area, as in 'Murray-Darling Drainage Division', 'South-East Coast Drainage Division', etc. Australia has been divided up into 12 drainage divisions.

EC: Electrical conductivity, which is a measure of water salinity.

Entitlement: See 'water entitlement'.

Environment: Surroundings in which an organisation operates including air, water, land, natural resources, flora, fauna, humans and their interdependence.

Environmental (bulk) entitlement: A water entitlement held by the Minister for the Environment that permits the use of water in a river or storage for a purpose that benefits the environment.

Environmental flow: The streamflow required to maintain appropriate environmental conditions in a waterway.

Environmental Water Reserve (EWR): The share of water resources set aside to maintain the environmental values of a water system and other water services that are dependent on the environmental condition of the system.

Evapotranspiration: The process of water being transpired by vegetation.

Floodplain: Land adjacent to rivers which is subject to overflow during flood events. Floodplains are often valuable for their ecological assets.

Flow Stress Ranking Project: Undertaken by the Department of Sustainability and Environment, the project provided a measure of how much current flow conditions of a stream differs from the flow conditions if no water was extracted from the stream.

Flush: See 'fresh'.

Fresh: A flow pulse in a river which is higher than the median flow at that time of year. It may occur naturally or be the result of a decision to release water from a reservoir. A fresh can occur at any time of year.

Gigalitre: One thousand megalitres.

Groundwater: All subsurface water, generally occurring in an aquifer.

Groundwater allocation limit: The amount of water which can be allocated in an aquifer under licences and is defined by the permissible consumptive volume.

Groundwater management unit (GMU): Either a groundwater management area (GMA) or a water supply protection area (WSPA).

Groundwater management area (GMA): A discrete area where groundwater resources of a suitable quality for irrigation, commercial or domestic and stock use are available or expected to be available.

Irrigation district: An area declared under the *Water Act 1989* supplied with water by channels and pipelines used mainly for irrigation purposes.

Irrigation return flows: Water that is returned to a water course subsequent to being used in an irrigation area (e.g. outflows from irrigation drainage systems).

Long term average annual rainfall (expressed as a percentage): The amount of rainfall across the geographical spread of an area, which is averaged over a grid of approximately 25 x 25 kilometres.

Living Murray Initiative: A program to improve the health of the River Murray, established by the Murray-Darling Basin Ministerial Council in 2002 and funded by the New South Wales, Victorian, South Australian, Australian Capital Territory and Australian Governments.

Megalitre: One million litres.

Murray-Darling Basin Cap: The climatically adjusted limit on surface water diversions in the Murray-Darling Basin, agreed by a Ministerial Council under the Murray-Darling Basin Agreement.

NTU: Nephelometric turbidity units, which is a measure of the turbidity of water.

Nutrient: Generally refers to nitrogen and phosphorous in water.

Order (ordering of water): The advance notification given by individual entitlement holders to the storage operator to enable the storage operator to regulate water flows so that all entitlement holders' needs can be met at the agreed time.

Passing flow requirements: The flows that a water authority must pass at its weirs or reservoirs before it can take water for other uses. Passing flow requirements are specified as obligations in bulk entitlements, and entitlement holders must report of the level of compliance with these requirements.

Permissible annual volume (PAV): The total amount of water that can be taken in a groundwater management area under a Ministerial declaration. The *Water (Resource Management) Act 2005* has replaced this term with a new term: permissible consumptive volume.

Permissible consumptive volume (PCV): See 'permissible annual volume'.

Potable water: Water that is suitable for drinking.

Precautionary principle: Erring on the side of caution in favour of a given entity. For example, where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Ramsar Convention: An international treaty that aims to conserve wetlands which have been listed for their international significance and ensure they are managed wisely, signed in Ramsar, Iran, in 1971.

REALM model: A computer-based water supply system model used by the Department of Sustainability and Environment to aid the allocation of Victoria's water resources. Its name is an abbreviation of REsource ALlocation Model.

Recycled water: Water derived from sewerage systems or industry processes which is treated to a standard that is appropriate for its intended use.

Regulated river: A river containing structures such as dams or major diversion weirs which control the flow of water in the river for licensed diverters or users in an irrigation district.

Reticulation: The network of pipelines used to deliver water to end users.

Riparian: Situated alongside a river or stream.

River: Large stream of water flowing to sea or lake or marsh or another river.

River basin: The land which a river and its tributaries drain. See also 'basin'.

Run-off: The volume of water that enters streams and lakes from rainfall.

Sales water: Lower-reliability water offered to irrigators on a seasonal basis, in proportion to their base rights, after provision has been made to meet the base rights in the following year.

Salinity: The total amount of water-soluble salts present in the soil or in a stream.

Seasonal irrigation water allocation: An irrigator's share of the water available for an irrigation season, determined by the water authority and expressed as a percentage of the irrigator's water right or licensed volume. Sometimes shortened to 'allocation'.

Sedimentation: Process where solid particles in water sink to the bottom, forming sediment.

Sewage: The waterborne wastes of a community.

Sewerage system: A physical arrangement of pipes and plant for the collection, removal, treatment and disposal of sewage, trade and liquid waste.

Small catchment dam: A farm dam that is filled from its own catchment and is not located on a waterway. This includes small catchment dams used for domestic and stock purposes which are not required to be licensed. It also includes dams used for commercial and irrigation use which are now required to be registered (under the *Water Act 1989*), but for which registration has not yet been completed.

Spill: An uncontrolled flow of water past a reservoir or a weir.

Stormwater: Untreated rainfall run-off from urban areas.

Stream: A body of water flowing in bed, river or brook.

Streamflow management plan: A management plan prepared for a water supply protection area to manage the surface water resources of the area.

Sustainable diversion limit: The maximum volume which can be diverted from a catchment while protecting the environmental values of the catchment's waterways. **Statewide sustainable diversion limits:** Precautionary estimates of the sustainable diversion limit for 1,600 small Victorian catchments using a statewide methodology.

Terminal lakes: Lakes which form the end point of all surface water flow within a basin.

Unincorporated area: An area of Victoria which contains substantial and often unquantified groundwater of varying yield and quality that has not been designated as either a groundwater management area or a water supply protection area.

Unregulated river: A river that does not contain any dams or major diversion weirs which control the flow of water in the river.

Use (water use): The water use data presented in this edition of the state water accounts is reported as the volume of water diverted from a stream or groundwater bore. It is not reflective of 'use' on a farm or in a town.

Wastewater: For the purposes of this document, wastewater refers to the volume of sewage that enters a treatment plant.

Water authorities: Authorities established under the *Water Act 1989* that have responsibilities to supply water for urban, irrigation, domestic, stock and commercial use in irrigation districts and water districts. Some authorities also have delegated responsibilities for controlling the diversion of water from waterways, passing flows and the extraction of groundwater.

Water balance: A statement of the water flows in a given area and time period, in which the sum of the outflows from the area equals the sum of the inflows less the water accumulated in the area.

Water entitlement: The volume of water authorised to be taken and used by an irrigator or water authority. Water entitlements include bulk entitlements, environmental entitlements, water rights, sales water, surface water and groundwater licences.

Water leaving the basin: The volume of water that is calculated to flow out of the basin. This amount is typically derived from both gauged streamflow information and calculated information.

Water right: A water entitlement held by an irrigator in an irrigation district.

Water shares: A water entitlement held by a water authority or person. The government has passed legislation enabling all water rights and licences to be converted into water shares. The first conversions will be in place in July 2007. For more information, refer to the *Our Water Our Future* action plan.

Water supply protection area: An area declared under Section 27 of the *Water Act 1989* to protect the area's groundwater or surface water resources through the development of a management plan which aims for equitable management and long term sustainability.

Waterway: The *Water Act 1989* defines a waterway as a river, creek, stream, watercourse and a natural channel where water regularly flows, whether or not the flow is continuous.

Wetlands: Inland, standing, shallow bodies of water that may be permanent or temporary, fresh or saline.

Yield: The quantity of water that a storage or aquifer produces.