Victorian Water Accounts 2008-2009

A statement of Victorian water resources

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Data presented in this report has been compiled from a number of sources and varies in reliability. However, where possible checks on the accuracy of the data have been undertaken and the data compilation process is auditable.

Acknowledgements

Data compilation: GHD

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Foreword

The challenge of the thirteenth straight year of drought was dramatically highlighted in the *Victorian Water Accounts 2008-2009*.

The year started with water supplies and inflows at extremely low levels and it ended with storages in a worse situation: the total volume stored in Victoria's major rural reservoirs fell from 22 per cent of capacity at the start of the year to only 17 per cent.

In addition, the worst bushfires in a century directly affected water supplies in several towns and damaged a third of Melbourne's catchments, fortunately without threatening the city's two major storages.

All irrigation systems in northern Victoria started the year with a zero allocation for the second successive year; 366 towns were on some form of restricted water use; several small towns were experiencing extreme water shortages; and groundwater resources were under pressure.

To manage these challenges, the Victorian Government worked closely with water businesses, progressing water augmentations across the state and facilitating emergency response measures when required.

Lessons learned through managing scarce water resources since 2006/07 were applied.

Various responses were developed, including water restrictions in urban areas, seasonal allocations of surface water and groundwater in regulated systems; restrictions, rosters and bans on users in unregulated systems; operating the emergency water supply network; augmenting water supply systems; water carting; and qualifying rights to water.

This responsiveness and flexibility were among several positives to emerge from this difficult year of continuing low flows.

Apart from capably managing scarce water resources, the water industry saw the benefits start emerging from *Our Water Our Future: The Next Stage of the Government's Water Plan*.

The first pipeline project completed under the Victorian Water Plan – the Goldfields Superpipe supplying water from the Goulburn system to Bendigo and Ballarat – provided a reliable supply of water to the drought-affected cities.

The reconnected Tarago Reservoir increased the water supply available to Melbourne.

These projects were among many initiatives implemented under the Victorian Water Plan, which aims to secure future water supplies through augmentation such as the desalination plant and Tarago reconnection, water saving projects such as irrigation modernisation and the Wimmera Mallee Pipeline, increased recycling, expanding the water grid and conservation. This report includes an update on the plan.

I commend this report as an important account of water availability, entitlement, use and related water resource management measures in 2008/09.

Tim Holding MP

Minister for Water

Alphabetical listing of Victoria's river basins

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Introduction

Overview of the *Victorian Water Accounts 2008-2009*

The *Victorian Water Accounts 2008-2009* documents the key water resource management issues for Victoria. It is the sixth in a series of reports[1] providing an overview of water availability and use across Victoria and reflects the government's continuing commitment to accounting for and reporting on the state's water availability and use.

As a signatory to the National Water Initiative, Victoria has obligations to implement water accounting systems and report on water entitlements, consumption, trade, environmental releases and initiatives. The *Victorian Water Accounts 2008-2009* is an important contribution towards meeting Victoria's obligations.

The *Victorian Water Accounts 2008-2009* examines the entire state's water allocation and use for the 2008/09 year at bulk supply level. It is a consolidation of information from all Victorian water businesses[2], catchment management authorities, the Department of Sustainability and Environment, the Essential Services Commission, the Murray-Darling Basin Authority, Victorian Alpine Resorts Commissions, power generators and other major users.

The *Victorian Water Accounts 2008-2009* consists of:

- Part 1, which provides the statewide overview. It summarises water availability including rainfall, streamflow and storage levels, the amount that was taken for consumptive purposes, and how the government manages water for the environment.
- Part 2, which comprises the water accounts for each of Victoria's 29 river basins. The accounts include quantitative data on water available and used, and concise commentary that provides the contextual background to the data. An introductory chapter describes the approach taken to compile the basin accounts, as well as key assumptions and any identified limitations of the data.

Victorian Water Accounts and the drought

Victoria remains in the grip of its worst drought on record and 2008/09 was the thirteenth straight year of drought.

The drought and its impacts are key themes of the *Victorian Water Accounts 2008-2009*, which plays an important role in providing both the factual and contextual information required for an accurate assessment of the drought's effects on Victoria.

Living with less water in 2008/09

The key statistics which help illustrate the impact of the drought include:

- Rainfall was below average across all of Victoria in 2008/09 – most of the state received between 60% and 80% of the long term average. Higher totals of between 80% and 100% of the long term average were recorded in south-west Victoria and throughout parts of the Mallee.
- Victoria experienced a very dry August to October period in 2008/09. Apart from south-west Victoria and parts of Gippsland, less than 60% of the long term August to October average was recorded across the state. Rainfall in parts of northern and central Victoria was 20% to 40% of the average.
- Continuing below-average rainfall combined with dry catchment conditions meant that streamflows remained well below average in 2008/09.
- The driest river basins in 2008/09, relative to their long term averages, were the Broken, Campaspe, Loddon, Wimmera, Corangamite, Werribee and Glenelg basins.
- The total volume of water stored in Victoria's major rural reservoirs started the year at 2,081,435 ML (22% of capacity) and ended the year at 1,621,394 ML (17% of capacity). Levels peaked in September and declined over summer and autumn as inflows receded and water was released from the reservoirs for irrigation and urban use.
- The continuing dry conditions also impacted groundwater supplies, with 26 groundwater management units showing a long term trend of declining water levels.

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1 Previous reports are the *State Water Report 2003-2004*, *State Water Report 2004-2005*, *State Water Report 2005-2006,Victorian Water Accounts 2006-2007* and *Victorian Water Accounts 2007-2008*.

2 Water businesses means the water corporations established under the *Water Act 1989* and the metropolitan retailers established under the *Corporations Act 2001* that hold water and sewerage licences issued under the *Water Industry Act 1994*.

Actions taken to address drought

The duration and severity of the low flows of the last 12 years has required the Victorian Government, water businesses and water users to take additional measures to respond to the ongoing water shortage and the risk that the recent low flows will continue to be the norm.

In 2008/09 a number of measures were employed across the state to manage the effects of ongoing reduced water availability. These include water restrictions in urban areas, seasonal allocations of surface water and groundwater in regulated systems, restrictions, rosters and bans on users in unregulated systems, operation of the emergency water supply network, augmenting water supply systems, water carting and qualifying rights to water.

Many water businesses activated their dry inflow contingency plans during 2008/09 as water availability did not improve across the state. Many of the lessons learnt through managing scarce water resources since 2006/07 were applied as the dry conditions continued in 2008/09. The government again worked closely with the businesses throughout the year, monitoring the water supply situation and facilitating emergency response measures when required.

Many urban customers experienced water restrictions during 2008/09. At 1 July 2008, some 366 towns were on some form of restriction. By 30 June 2009 the number had decreased to 337, mainly due to an increase in groundwater use.

All irrigation systems in northern Victoria started with 0% (zero) allocation for the second year in a row. All irrigation systems, except the Thomson-Macalister system, received allocations of less than 100%. Irrigators in seven irrigation districts did not receive an allocation in 2008/09.

Other measures taken to secure supplies included the operation of 270 emergency water supply points under the state's emergency water supply network, carting water to townships and rural customers to augment water supply and infrastructure augmentations to increase short and long term security of water supplies for urban and rural customers.

Securing future water supply

Work progressed on the water infrastructure projects featured in *Our Water Our Future: The Next Stage of the Government's Water Plan*. Launched in June 2007, the plan is the blueprint for augmenting Victoria's water supply.

Augmentation will be achieved through investment in better distribution infrastructure to make water go further, by creating new supply through desalination, and by linking supply systems to move water to where it is of highest value, and/or most needed.

In 2008/09 the Goldfields Superpipe completed its first full year of operation, providing a more reliable supply of water to central Victorian urban and rural sectors by transferring water from the Goulburn system to Bendigo and Ballarat. The Tarago Reservoir was reconnected to the Melbourne water supply system in June 2009.

Conclusion

Sustainable management of our water resources requires adequate monitoring, accounting and reporting. The *Victorian Water Accounts 2008-2009* provides public accountability for water availability, entitlements and use across Victoria. Importantly, our efforts in monitoring, reporting and accounting continue to be improved.

The report is also available on the Department of Sustainability and Environment's website at www.ourwater.vic.gov.au/monitoring/accounts

Part 1
Overview of Victorian water resources 2008/09

Part 1 of the *Victorian Water Accounts 2008-2009* provides a statewide overview of Victoria's water resources during the year. It reports on the:

- quantity of water available in terms of rainfall, streamflow, reservoirs and aquifers
- quantity of water allocated for consumption from reservoirs, streams and aquifers under entitlements issued by government, as well as quantity used and quantity recycled
- actions taken by the government and water businesses to respond to drought, including water restrictions, qualifications of rights and bans
- water available to the environment.

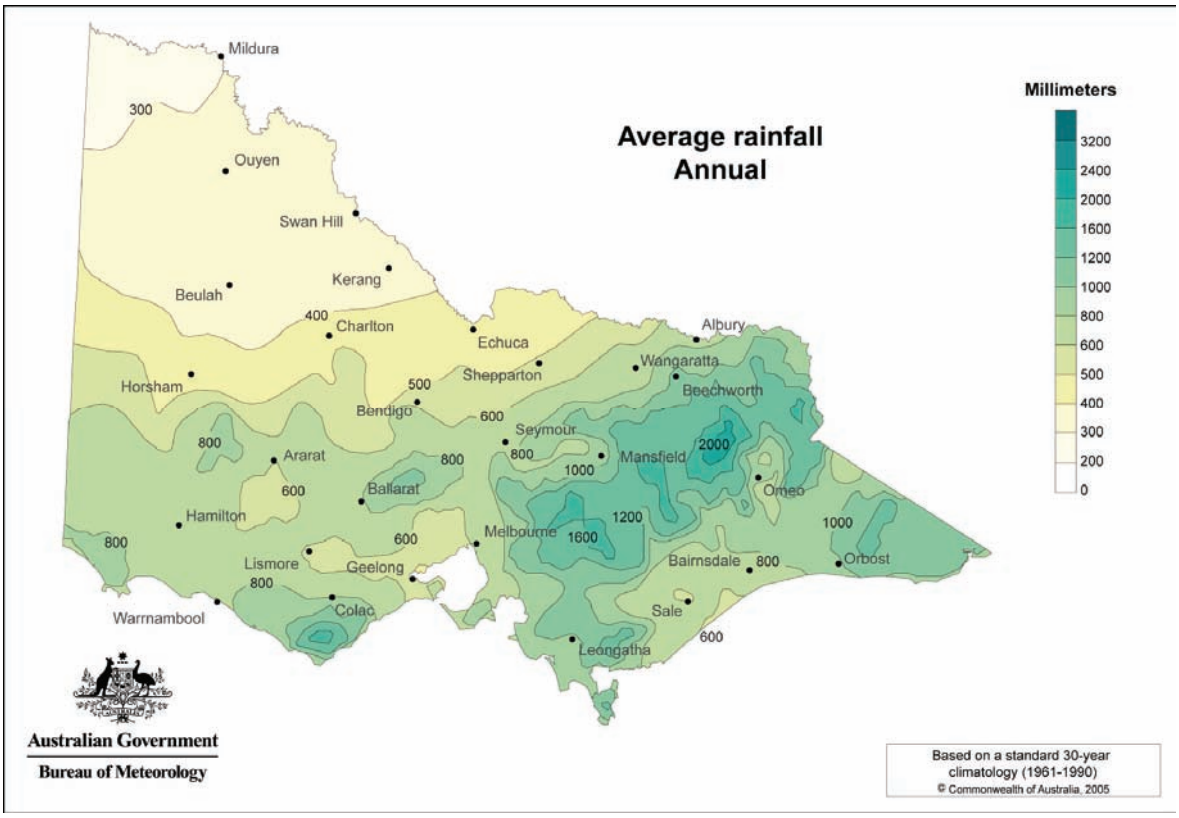
1 Water availability

This chapter presents a description and analysis of surface water and groundwater in Victoria during 2008/09. It examines how much surface water was available in Victoria during the year compared with previous years and reports rainfall, streamflow and reservoir levels. A high level synopsis of Victoria's groundwater resources during 2008/09 is also presented, including groundwater levels, entitlement volumes and extractions.

1.1 Rainfall

Victoria's rainfall in an average year is shown in Figure 1-1. The average rainfall varies from less than 300 millimetres a year in the north-west of the state, up to approximately 2,000 millimetres a year in the alpine area of north-east Victoria.

Figure 1-1 Victorian average annual rainfall



Victoria's rainfall during 2008/09 is shown in Figure 1-2, while Figure 1-3 compares rainfall during 2008/09 to the long term average.

Rainfall was below average across all of Victoria in 2008/09. Most of the state received between 60% and 80% of the long term average, while higher totals of between 80% and 100% of the long term average were recorded in south-west Victoria and throughout parts of the Mallee.

Figure 1-2 Victorian rainfall in 2008/09 (millimetres)

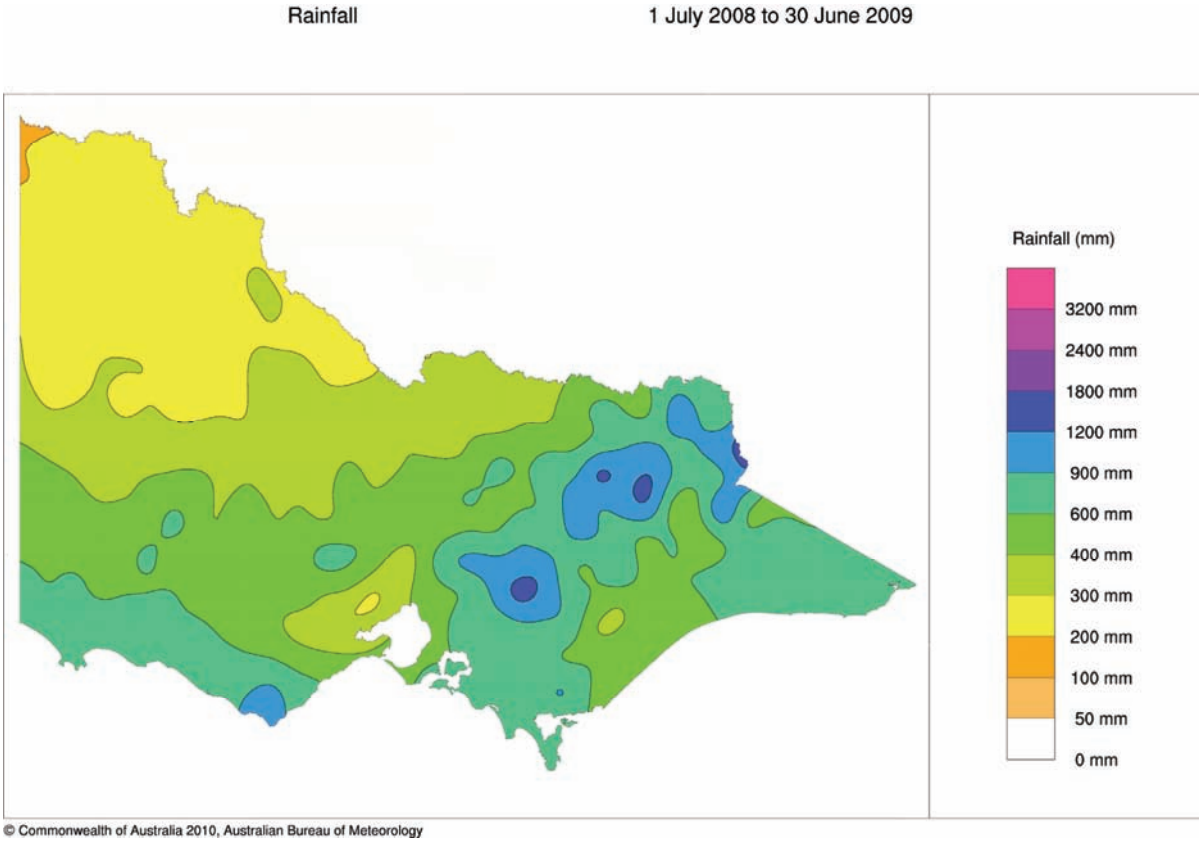
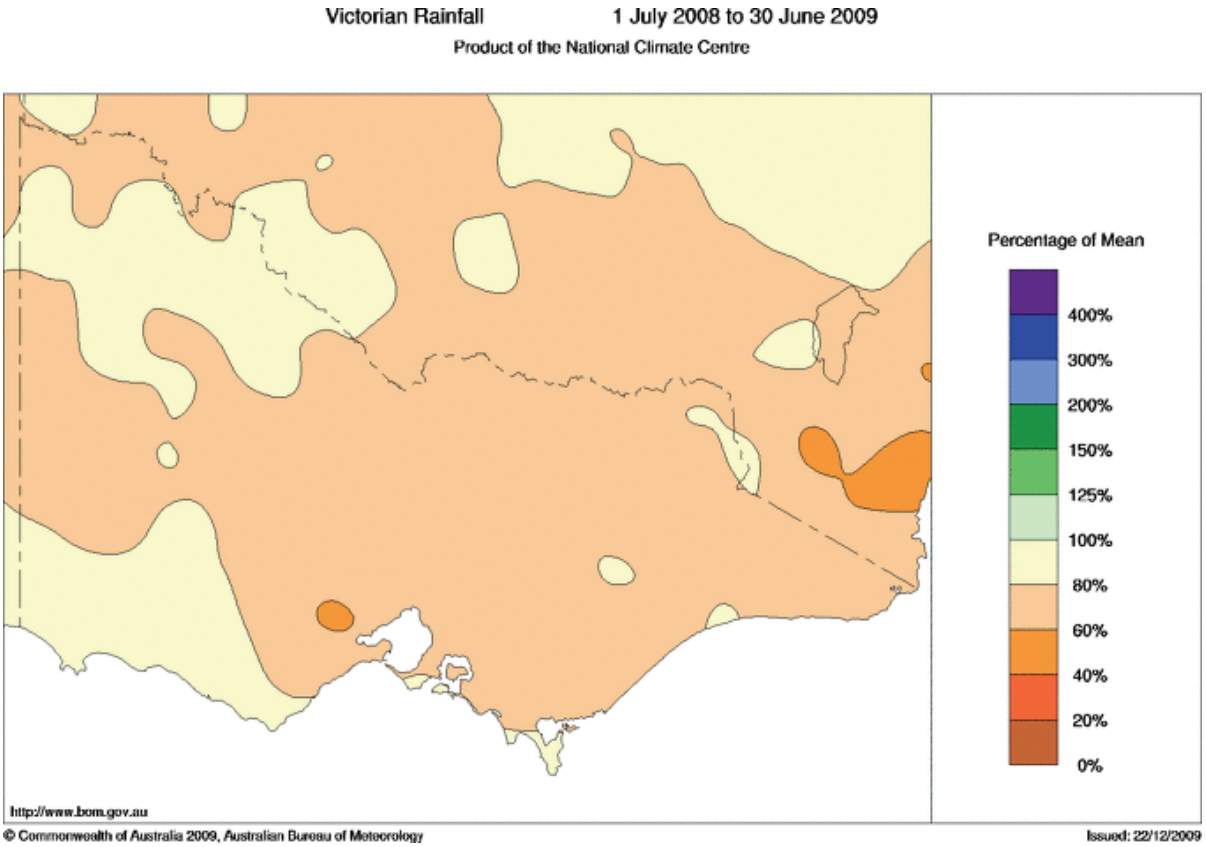
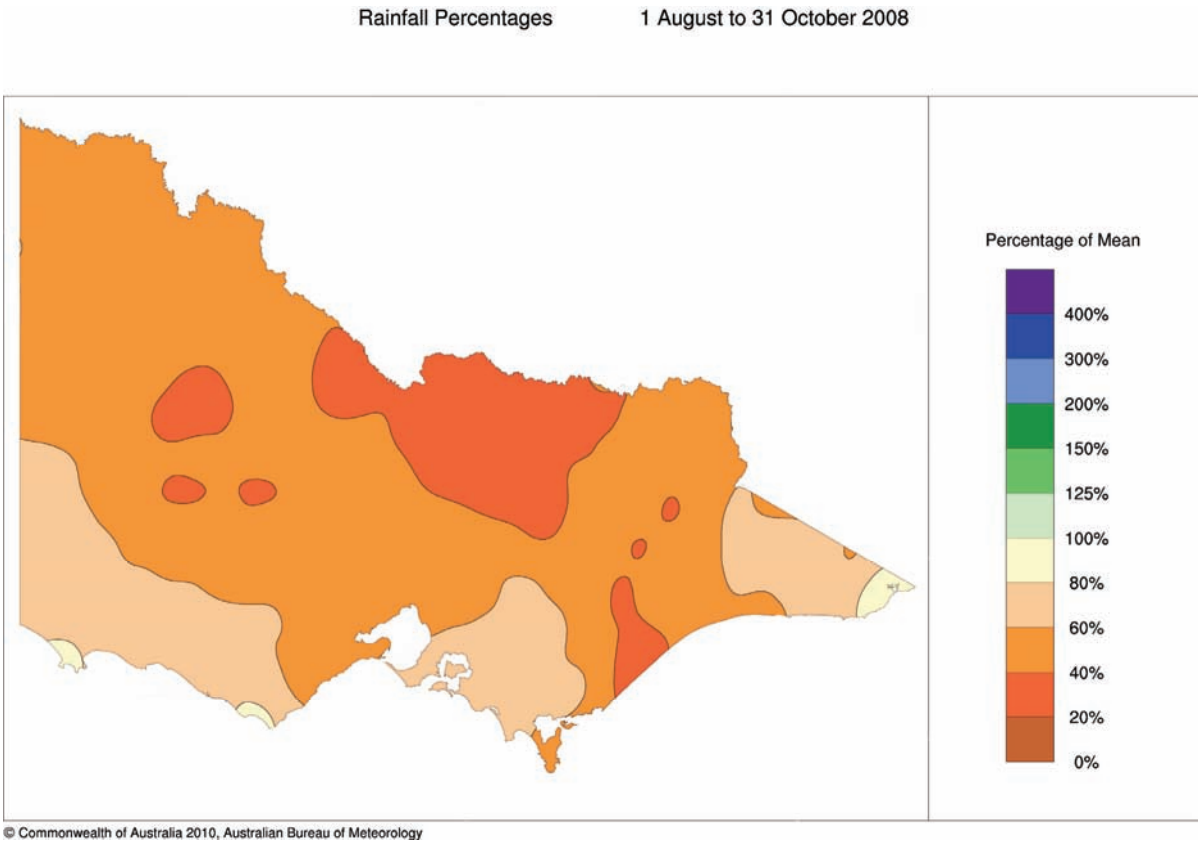


Figure 1-3 Victorian rainfall in 2008/09 relative to average rainfall



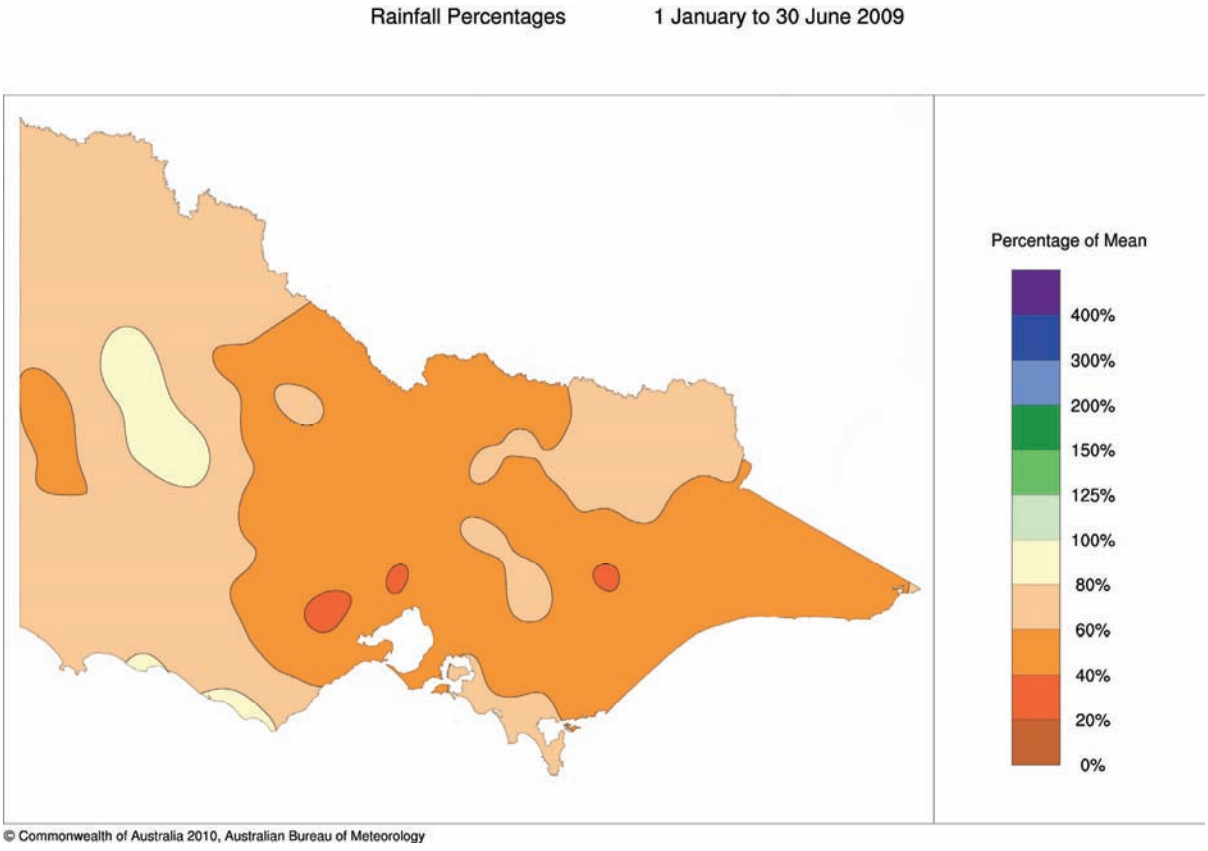
The August to October period historically produces the highest rainfall and streamflows of the year. However, as Figure 1-4 demonstrates, Victoria experienced a very dry August to October period in 2008/09. With the exception of south-west Victoria and parts of Gippsland, less than 60% of the long term August to October average rainfall was recorded across the state. Parts of north central Victoria received as little as 20% to 40% of the long term average.

Figure 1-4 Victorian rainfall from 1 August to 31 October 2008 relative to average rainfall



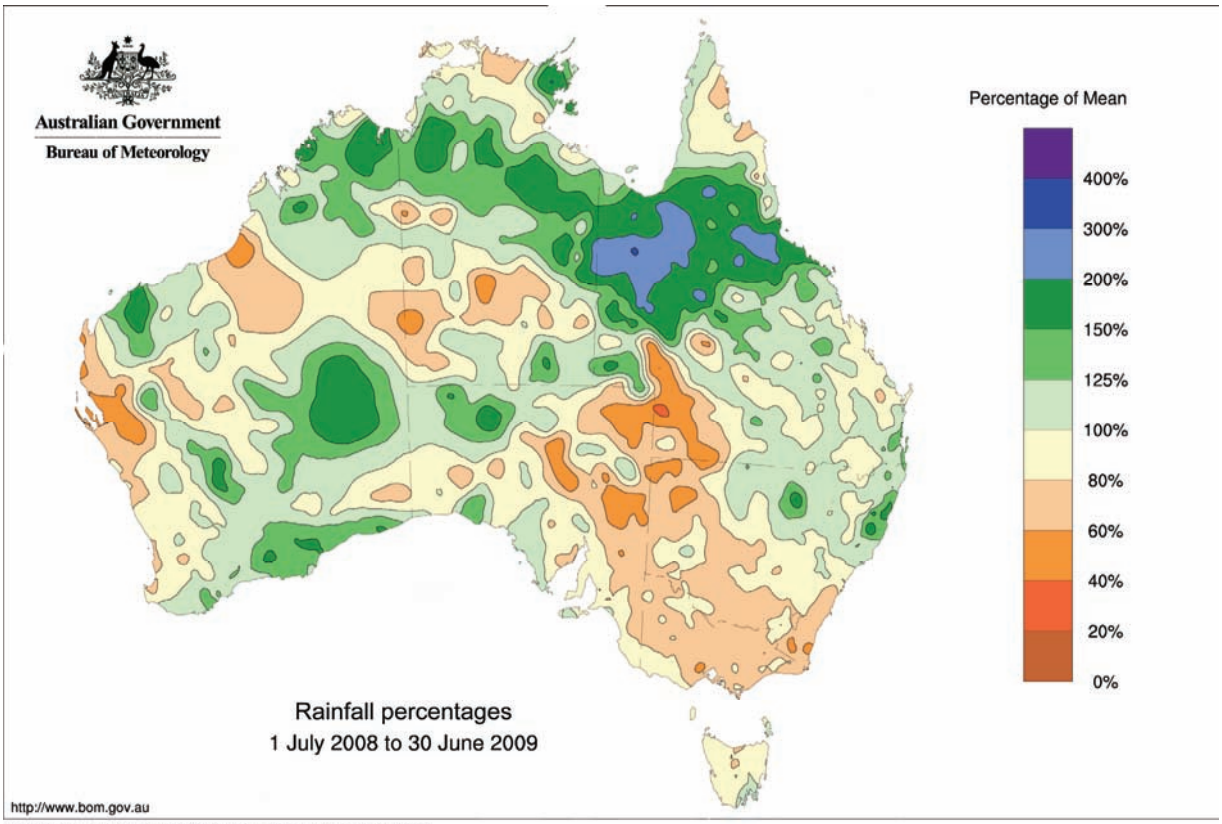
As illustrated in Figure 1-5, rainfall across most of Victoria in the January to June period in 2008/09 was also very low compared to the long term average. Most of Victoria recorded totals less than 80% of the long term January to June average, while most of central and eastern Victoria received less than 60% of the long term average. Although streamflows do not traditionally respond well to rainfall during this period, particularly in the summer months, the lack of rain combined with high temperatures contributed to further drying out of the catchments.

Figure 1-5 Victorian rainfall from 1 January to 30 June 2009



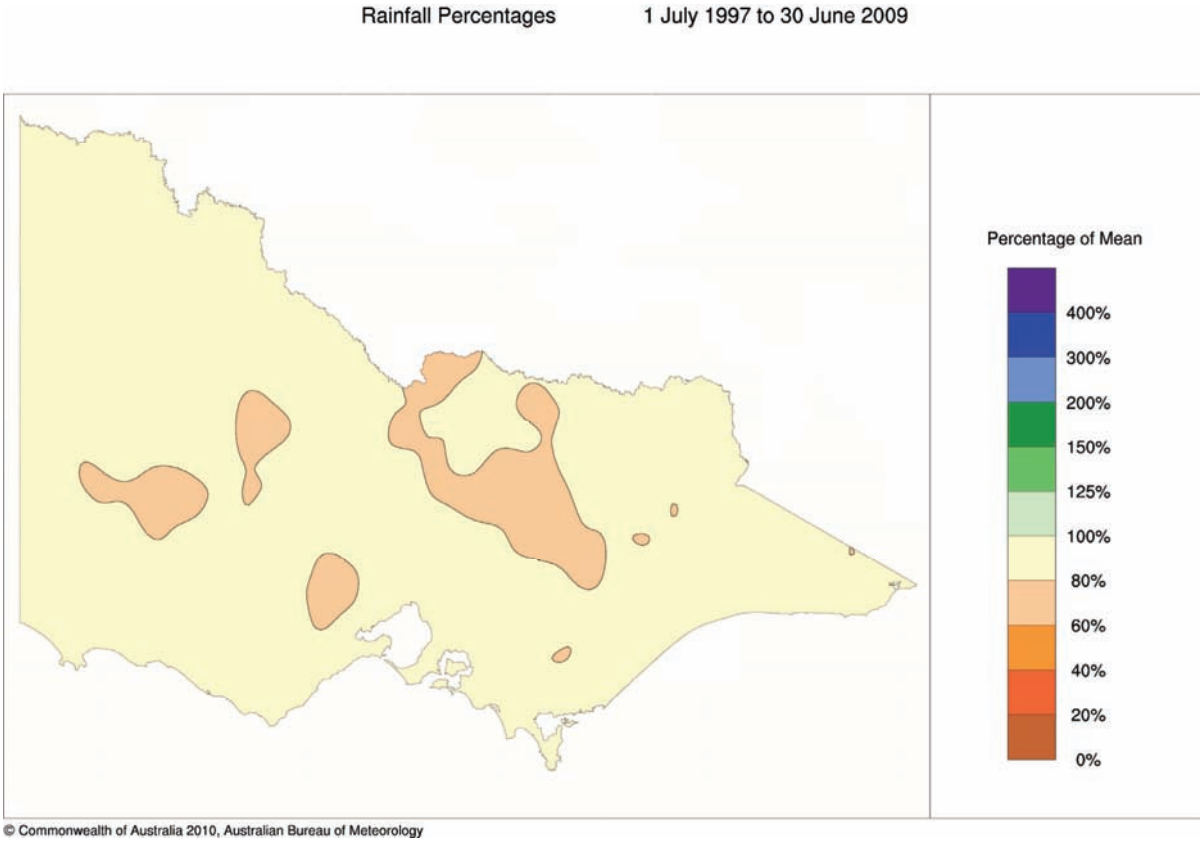
The pattern of below average rainfall across Victoria for 2008/09 is consistent with the rainfall patterns experienced in the southern parts of south-eastern Australia over the year. To provide a national context, rainfall deficiencies in southern and western New South Wales, southwest Queensland and coastal Western Australia were similar to Victoria. In contrast, eastern Queensland, northern South Australia, central and southern Western Australia and northern Australia received above long term average rainfall (Figure 1-6).

Figure 1-6 Australian rainfall, percentage of average, 1 July 2008 to 30 June 2009



The dry conditions experienced in Victoria in 2008/09 extended the period of lower than average rainfall and inflows to twelve years. Figure 1-7 depicts the average annual rainfall in Victoria since July 1997 as a percentage of the long term average. It shows that yearly rainfall totals in the past twelve years across most of the state have been 80% to 100% of the long term average. Parts of northern, central and western Victoria have experienced even drier conditions having recorded rainfall totals of 60% to 80% of the average.

Figure 1-7 Average annual rainfall percentage 12 years ending June 2009



Data from the Bureau of Meteorology indicates that evaporation was generally above historical long term averages for the majority of the state in 2008/09.

1.2 Streamflow

Local factors influence how much rainfall ends up as streamflow and these factors vary between river basins. Local influences include subsurface geology, permeability and moisture levels of the soil, vegetation cover, and the pattern of individual rainfall events.

The streamflow data presented in Table 1-1 is taken from the water balance for each basin in Part 2 of this report. The table includes a comparison between streamflows in 2008/09, 2007/08 and over the long term.

Continuing below average rainfall, combined with dry catchment conditions, ensured streamflows across Victoria remained well below average in 2008/09. Overall, the total streamflow volume for Victoria was 32% of the long term average. Inflows in most river basins were also lower than those experienced in 2007/08.

The driest river basins in 2008/09, relative to their long term averages, were the Broken, Campaspe, Loddon, Wimmera, Corangamite, Werribee and Glenelg basins. Inflow in the Loddon basin was 8% of the long term average and around half those experienced in 2007/08. Streamflows in 23 basins were lower than 2007/08, with streamflows in only the Murray, Wimmera, Tambo and Yarra basins higher than in 2007/08.

The Snowy, Tambo, South Gippsland, Bunyip and Otway Coast were the only basins that recorded streamflows of more than 50% of the long term average.

Table 1-1 Streamflow compared with long term average

Basin	Average annual streamflow (ML)[1]	2008/09 streamflow[2]		2007/08 streamflow[2]	
		(ML)	(% of average)	(ML)	(% of average)
Murray[6]	7,618,000	1,977,900	26%	1,632,800	21%
Kiewa[6]	689,000	302,300	44%	322,600[7]	47%
Ovens[6]	1,758,000	498,600	28%	589,700	34%
Broken[6]	308,000	51,200	17%	66,000	21%
Goulburn[6]	3,363,000	933,400	28%	1,260,800	37%
Campaspe[6]	352,000	46,100	13%	93,400	27%
Loddon[6]	373,000	31,300	8%	57,900	16%
Avoca	136,200	24,200	18%	26,900	20%
Mallee[3]	0	0	n/a	0	n/a
Wimmera	316,400	48,700	15%	27,200[7]	9%
East Gippsland[6]	714,000	150,700	21%	466,700	65%
Snowy [4][6]	1,022,000	538,000	53%	893,900	87%
Tambo[6]	297,800	170,700	57%	146,700	49%
Mitchell[6]	884,500	365,800	41%	609,300[7]	69%
Thomson[6]	1,101,760	408,300	37%	1,245,900[7]	113%
Latrobe[6]	847,400	416,200	49%	575,200	68%
South Gippsland[6]	911,500	454,000	50%	538,300	59%
Bunyip	541,000	296,800	55%	398,300	74%
Yarra	1,054,000	395,000	37%	386,900	37%
Maribyrnong	113,000	20,000	18%	27,200[7]	24%
Werribee	102,000	14,500	14%	21,800[7]	21%
Moorabool	97,000	28,700	30%	39,200	40%
Barwon	360,000	82,700	23%	181,400[7]	50%
Corangamite	316,000	53,200	17%	61,400	19%
Otway Coast	884,000	479,100	54%	622,600	70%
Hopkins	635,000	166,000	26%	210,400	33%
Portland Coast	361,000	141,900	39%	315,400	87%
Glenelg	964,000	149,600	16%	309,000[7]	32%
Millicent Coast [5]	0	0	n/a	0	n/a
Total	**26,119,560**	**8,244,900**	**32%**	**11,126,900[7]**	**43%**

Notes:

(1) Data is average annual basin outflow under current level of development. Average annual streamflow in the basins within the Murray-Darling catchment is based on estimates provided in the National Land and Water Resources Audit (2001), except for the Murray basin, where estimates are based on model outputs. The average for all other catchments is based on the average annual flow calculations of the Sustainable Diversion Limits project (Department of Natural Resources and Environment, 2002), the Central Region Sustainable Water Strategy (Department of Sustainability and Environment, 2006).

(2) 'Streamflow' in the above table is defined in the same manner as catchment inflow as shown in each basin water balance, i.e. excluding interbasin transfers, irrigation return flows and recycled water.

(3) Streamflow not calculated due to absence of surface water resources other than direct rainfall.

(4) Volumes shown for Snowy basin exclude catchment inflows from NSW (i.e. above Burnt Hut Crossing).

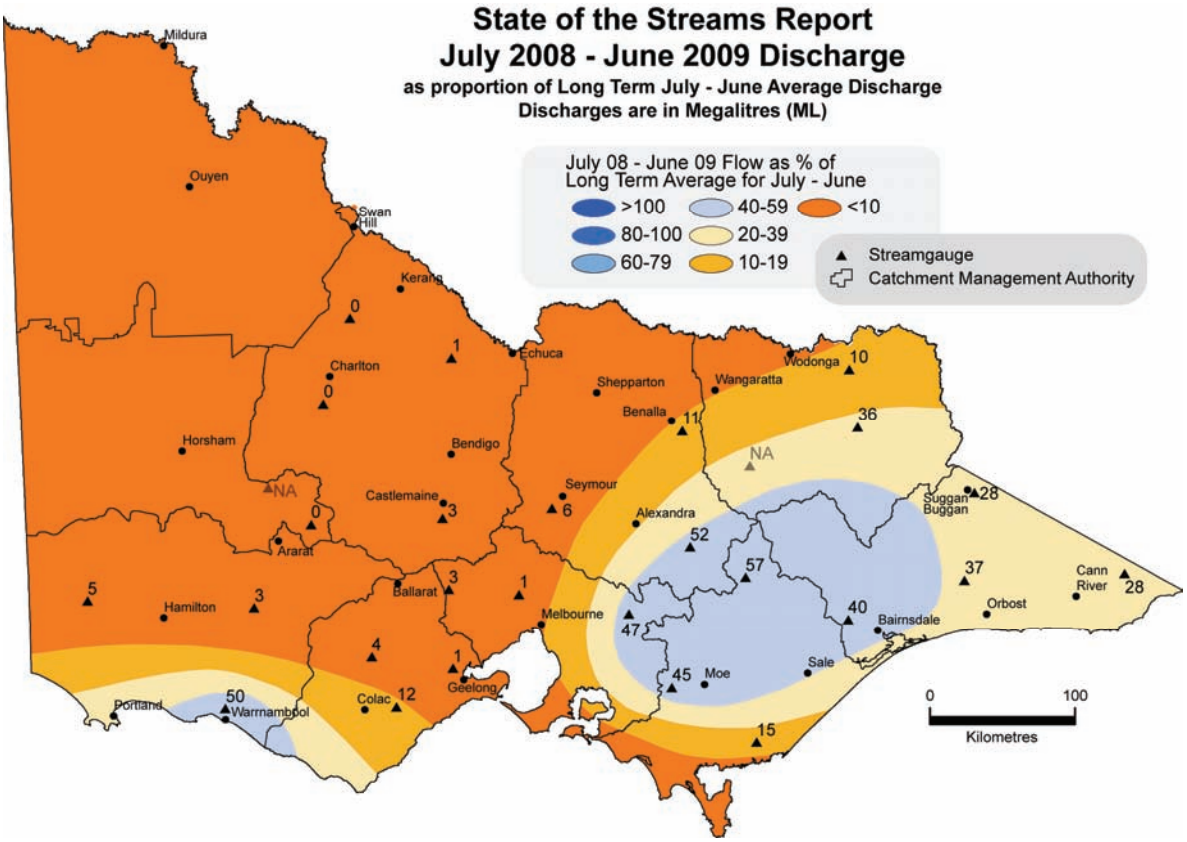
(5) A reliable estimate of streamflows could not be made as there are no streamflow gauges within the basin. Estimated streamflow is assumed to equal the estimated volume of water diverted.

(6) Long term average streamflows were updated during 2008/09 based on information from the Northern Sustainable Water Strategy and Gippsland Sustainable Water Strategy (2010). The Victorian long term average streamflow reduced from 27,602,900 ML to 26,119,600 ML. The updated values have been used to determine the ratio of catchment inflows to long term average streamflows in the relevant basin chapters.

(7) 2007/08 streamflow estimates for these basins updated during 2008/09 following corrections in the VWA Model loss calculations.

Figure 1-8 shows Victorian streamflows in 2008/09 as a percentage of the long term average flow. The figure illustrates how widespread the dry conditions were across Victoria. Streamflows at selected sites across most of northern, western and central Victoria were less than 10% of the long term average. The areas affected by the extremely low inflows represent about three-quarters of the state. Streamflows were higher as a proportion of the long term average across eastern and southwest Victoria, but volumes in these districts were still less than 60% of the long term averages.

Figure 1-8 Streamflow in 2008/09 expressed as a percentage of long term average flow(1)

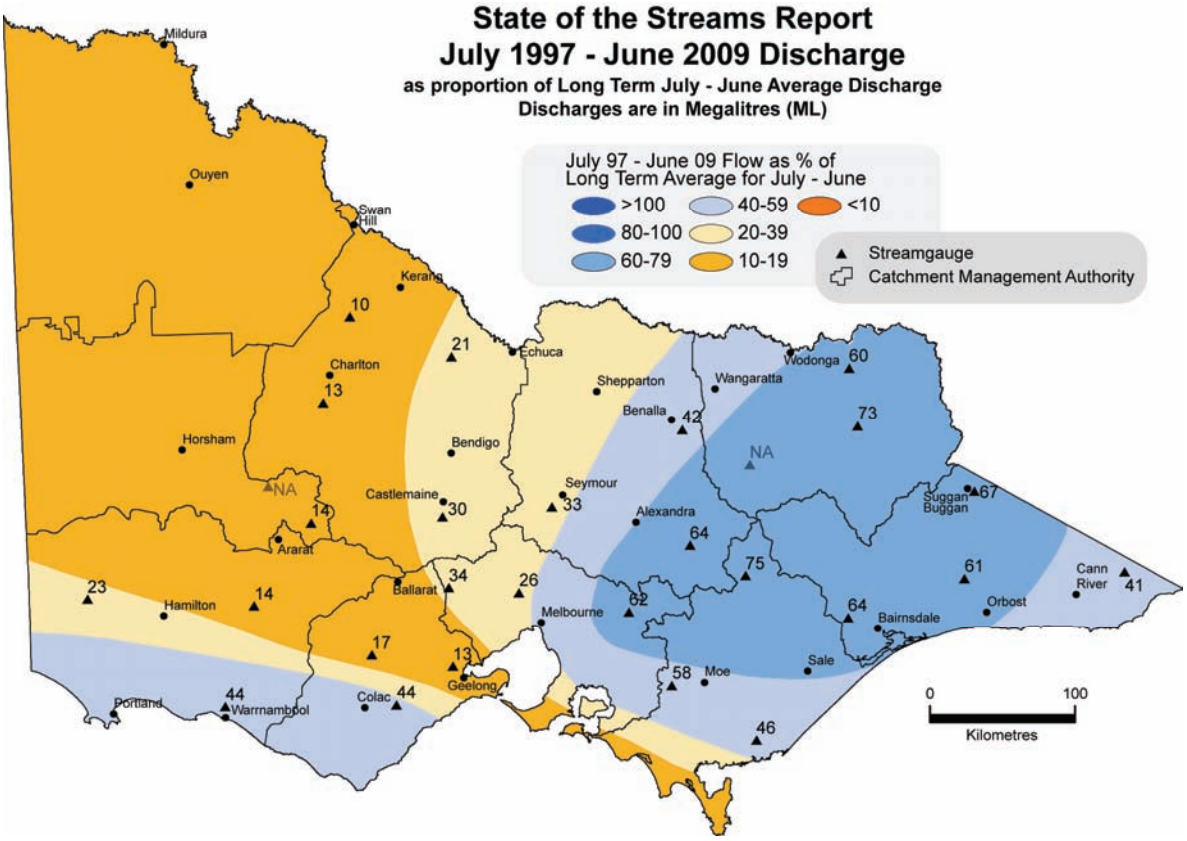


Note:

(1) Figure 1-8 shows an isoline representation of 2008/09 streamflow as a percentage of long term average streamflow (inclusive of 2008/09), based on data from 28 selected streamflow gauges distributed across Victoria. The percentages are not directly comparable to the total river basin flows listed in Table 1-1 because some gauges are located downstream of major storages, and the period of streamflow record differs for each site.

Figure 1-9 depicts the average streamflows in Victoria since 1997/98 as a percentage of the long term average. It shows streamflows across central and western Victoria have reduced considerably since 1997. It also shows that flows across eastern Victoria have fallen by around 20% to 60%. The noticeable difference between the pattern of flows depicted in Figure 1-8 and Figure 1-9 is the scale of dry conditions experienced in northeast and central Victoria in 2008/09 when compared to the last 12 years. For example, where streamflows in central Victoria since 1997 have been between 20% and 60% of the long term average, flows in 2008/09 were less than 10% of the average.

Figure 1-9 Streamflow July 1998 to June 2009 expressed as a percentage of long term average flow[1]



Note:

(1) An isoline representation of 1997/98 to 2008/09 streamflow as a percentage of long term average streamflow (inclusive of 2008/09), based on data from 28 selected streamflow gauges distributed across Victoria. The percentages are not directly comparable to the total river basin flows listed in Table 1-1 because some gauges are located downstream of major storages, and the period of streamflow record differs for each site.

The streamflow data presented in Table 1-2 allows a comparison between total streamflow volumes for Victoria in 2008/09 and the volumes recorded each year since 2003/04. Streamflows in 2008/09 were 26% lower than that of 2007/08 and only 16% higher than the extreme low inflow of 2006/07, making 2008/09 the second driest year in the last six years.

Table 1-2 Streamflow compared with long term average of 26,119,600 ML[1]

Year	Streamflow (ML)	% of average
2003/04	16,848,300	65%
2004/05	17,015,900	65%
2005/06	15,296,700	59%
2006/07	7,091,100	27%
2007/08	11,070,600	42%
2008/09	8,244,900	32%

Note:

(1) Long term average streamflows were updated during 2008/09 based on information from the Northern Sustainable Water Strategy and Gippsland Sustainable Water Strategy. The Victorian long term average streamflow reduced from 27,602,900 ML to 26,119,600 ML.

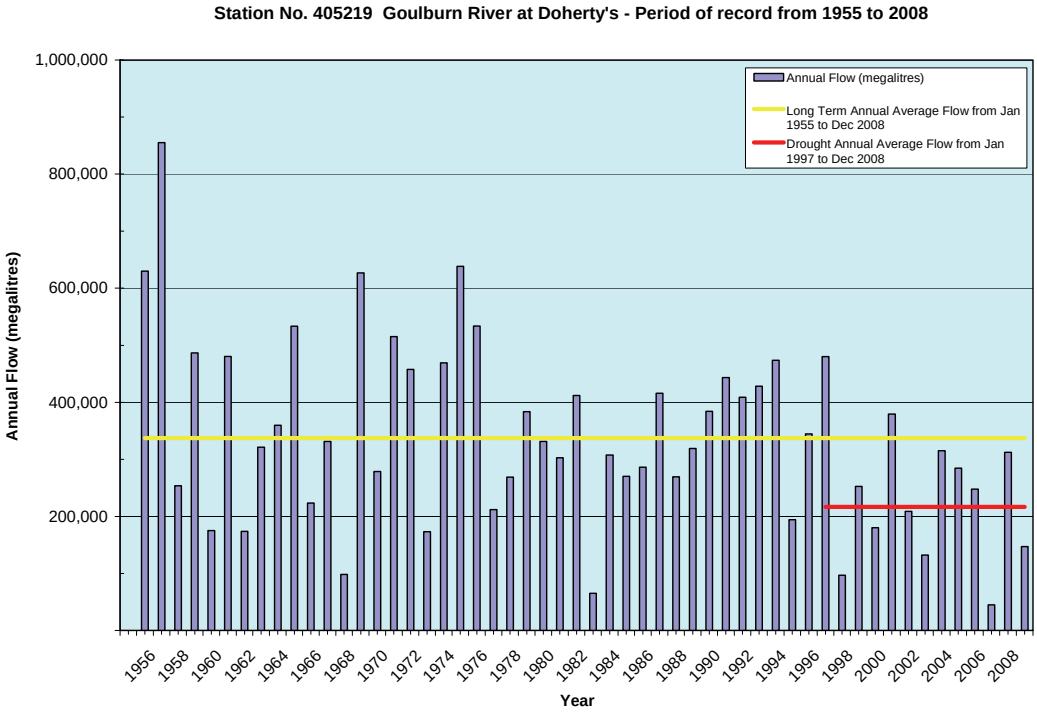
1.2.1 Long term streamflow trends

As mentioned above, average annual streamflows in the past 12 years have generally been 40% to 80% of the previous long term average in eastern and southwest Victoria. Streamflows have fallen more significantly in central and western Victoria over this period, with annual flows in the Wimmera basin having reduced to less than 15% of the long term average.

The following graphs depict flows across a selection of Victorian waterways for the calendar year to the end of 2008. (Note that 2008/09 streamflows in Table 1-1 are for the period from 1 July 2008 to 30 June 2009). They demonstrate that streamflows across all of Victoria in 2008 were below the average of the past 12 years. Conditions in central and western Victoria were much drier relative to their long term averages than in the east of the state.

Figure 1-10 depicts annual flows in the Goulburn River at Doherty's, which is upstream of Lake Eildon. Annual flows here over the past 12 years have been 64% of the long term average. Flows in 2008 were 44% of the long term average. Successive years of low streamflows in the Goulburn basin meant that water users and environmental flows were again heavily restricted in 2008/09.

Figure 1-10 Annual streamflow at Goulburn River

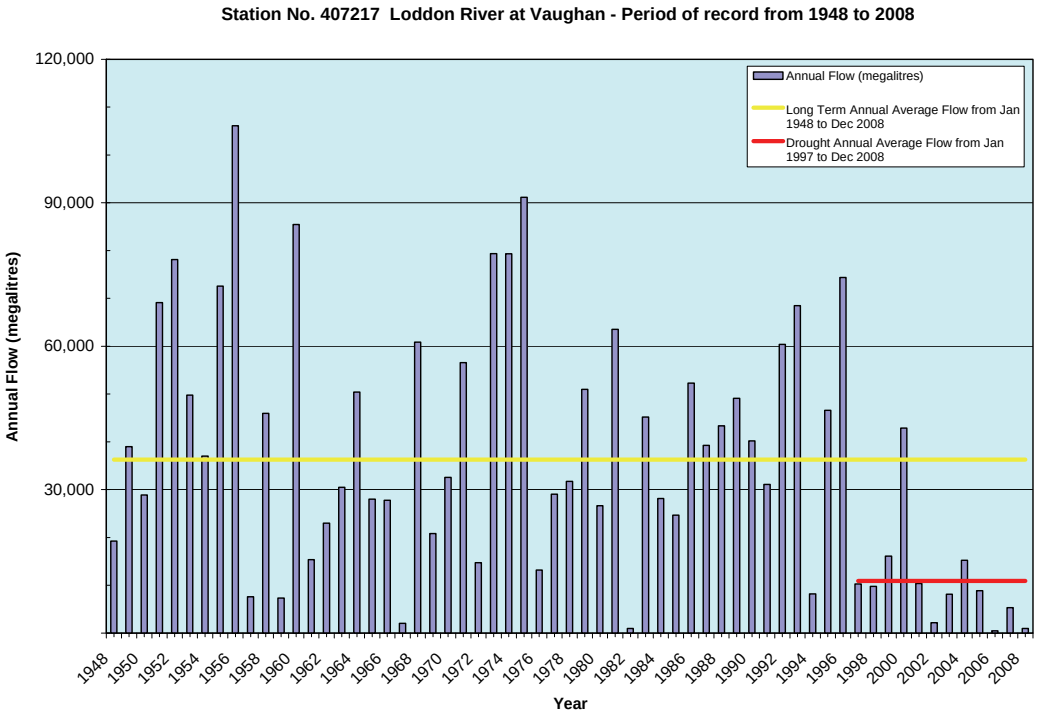


337,400 ML

216,800 ML

Figure 1-11 depicts annual flows in the Loddon River at Vaughan, which is upstream of Cairn Curran Reservoir. Over the past 12 years, annual flows here have been 30% of the long term average. Flows in 2008 were extremely low at 950 ML. This is less than 10% of the annual average flow of the past 12 years. In response to such low inflows, irrigation allocations and urban supplies were again severely restricted and water resource management focussed on ensuring essential supplies for towns and for domestic and stock use.

Figure 1-11 Annual streamflow at Loddon River



36,300 ML

10,900 ML

Figure 1-12 depicts annual flows in the Wimmera River at Glynwylln. The Wimmera River at this location has also experienced a severe decrease in flows over the past 12 years, with average annual flows over this period at 15% of the long term average. Flows in 2008 were again extremely low at 2% of the long term average and the extreme water shortage in the Wimmera basin continued. The partly completed Wimmera Mallee Pipeline was very important in

reducing demands on GWMWater's Grampians storages, which were at such low levels that Grampians Wimmera Mallee Water could only provide limited channel supplies throughout the region. Customers not connected to the pipeline, or who did not receive a channel supply, continued to rely on the rural water carting program for essential needs. Users in the Wimmera irrigation area did not receive an allocation for the fifth year in a row.

Figure 1-12 Annual streamflow at Wimmera River

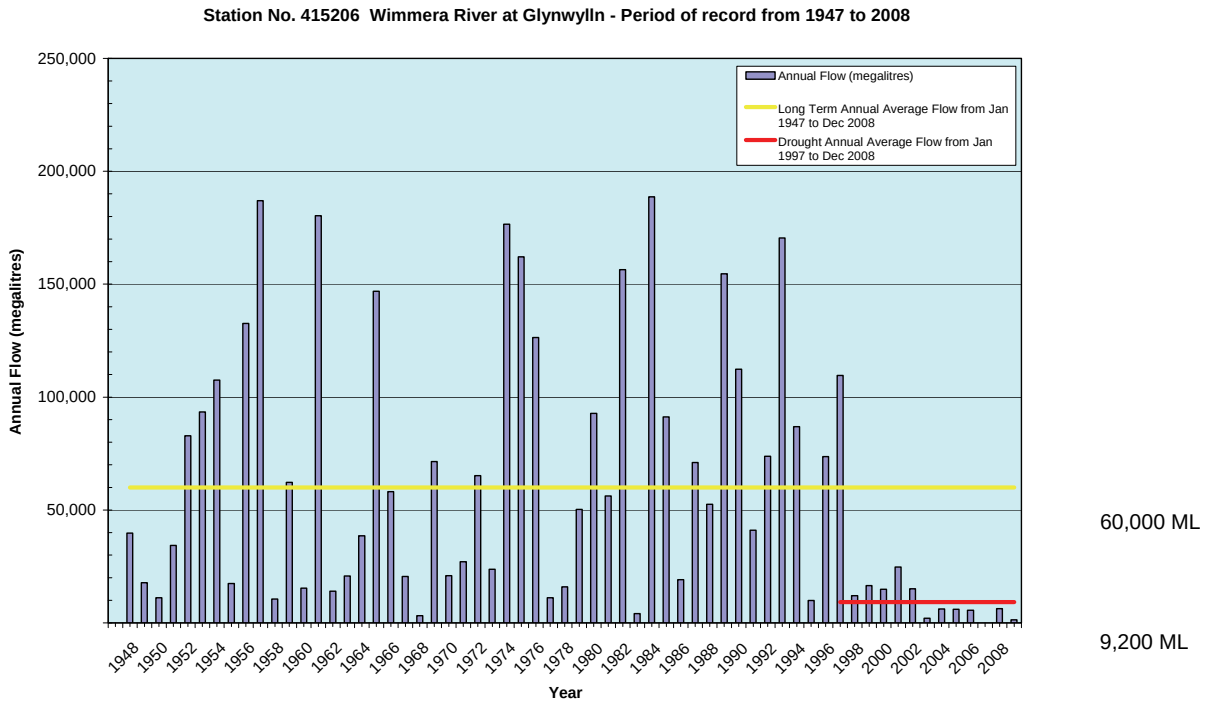


Figure 1-13 depicts annual flows in the Mitchell River at Glenaladale, which is approximately 25 kilometres upstream of Bairnsdale. Annual flows in the Mitchell River over the past 12 years have been 65% of the long term average. Flows in 2008 were lower still at 46%. In contrast to users in northern and western Victoria, urban and rural water users in the Mitchell basin were mostly unrestricted throughout the year because consumptive use is low compared to the total surface water resource.

Figure 1-13 Annual streamflow at Mitchell River

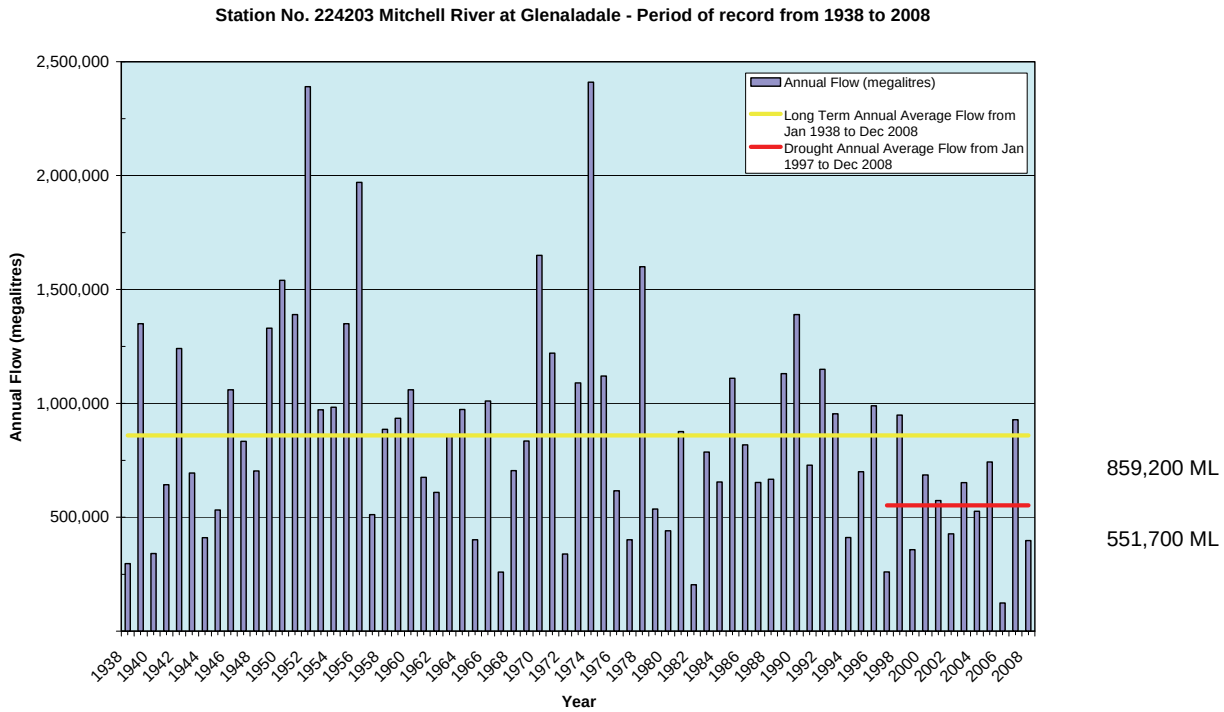


Figure 1-14 depicts annual inflow to Melbourne's harvesting reservoirs in the Yarra and Thomson basins. Since 1997, the average annual inflows to Melbourne's storages have been 64% of the long term average. Inflows in 2008 were again below the average experienced in the past 12 years. The system's failure to recover prolonged Melbourne's water shortage. Stage 3a restrictions continued throughout the year, as did the temporary qualifications of the Yarra and Thomson River environmental entitlements. The qualifications reduced environmental flows in these rivers to supplement Melbourne's supplies.

Figure 1-14 Annual streamflow at Melbourne's storages

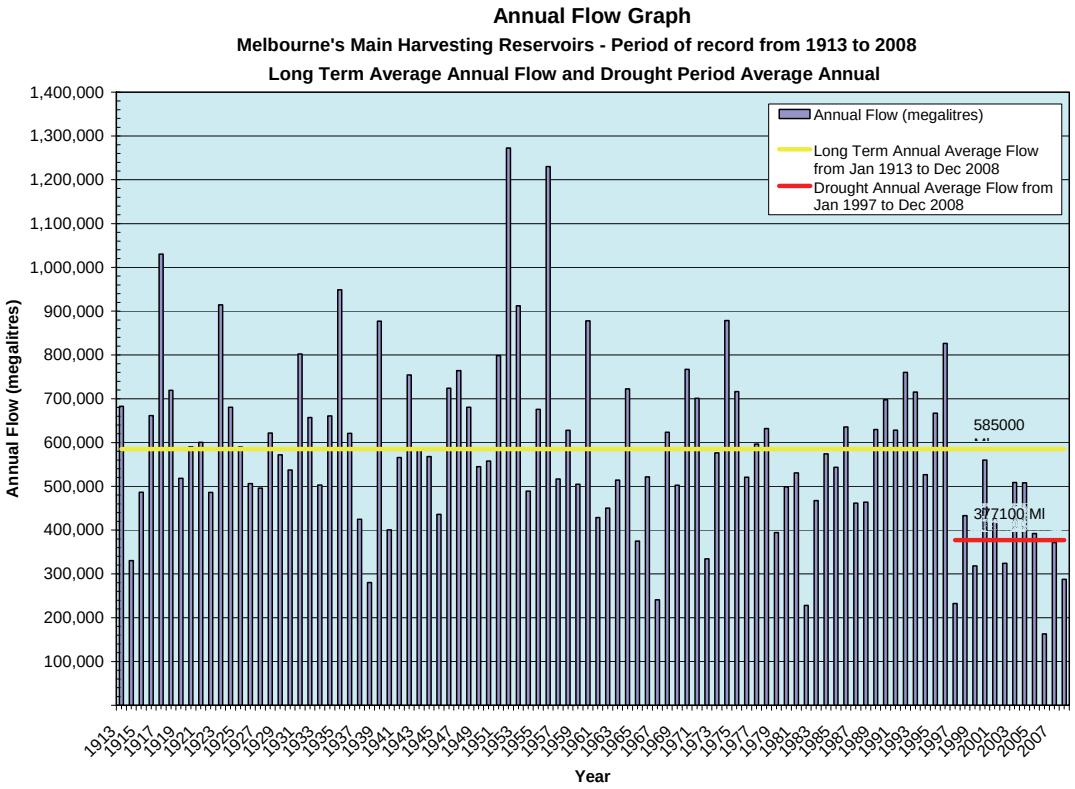


Figure 1-15 depicts annual flows in the Werribee River at Ballan, the last 12 years of which have been 34% of the long term average. Flows in 2008 were extremely low at 488 ML. This is less than 10% of the annual average flow of the last 12 years. Low storage levels combined with low inflows meant that very little of the Werribee basins's surface water was available for use. The severe water shortage required a range of contingency measures to be implemented across the basin to supplement supplies. Irrigators in the Bacchus Marsh and Werribee irrigation districts received only a 5% allocation, while Western Water relied completely on Melbourne's water supply system to supply its towns.

Figure 1-15 Annual streamflow at Werribee River

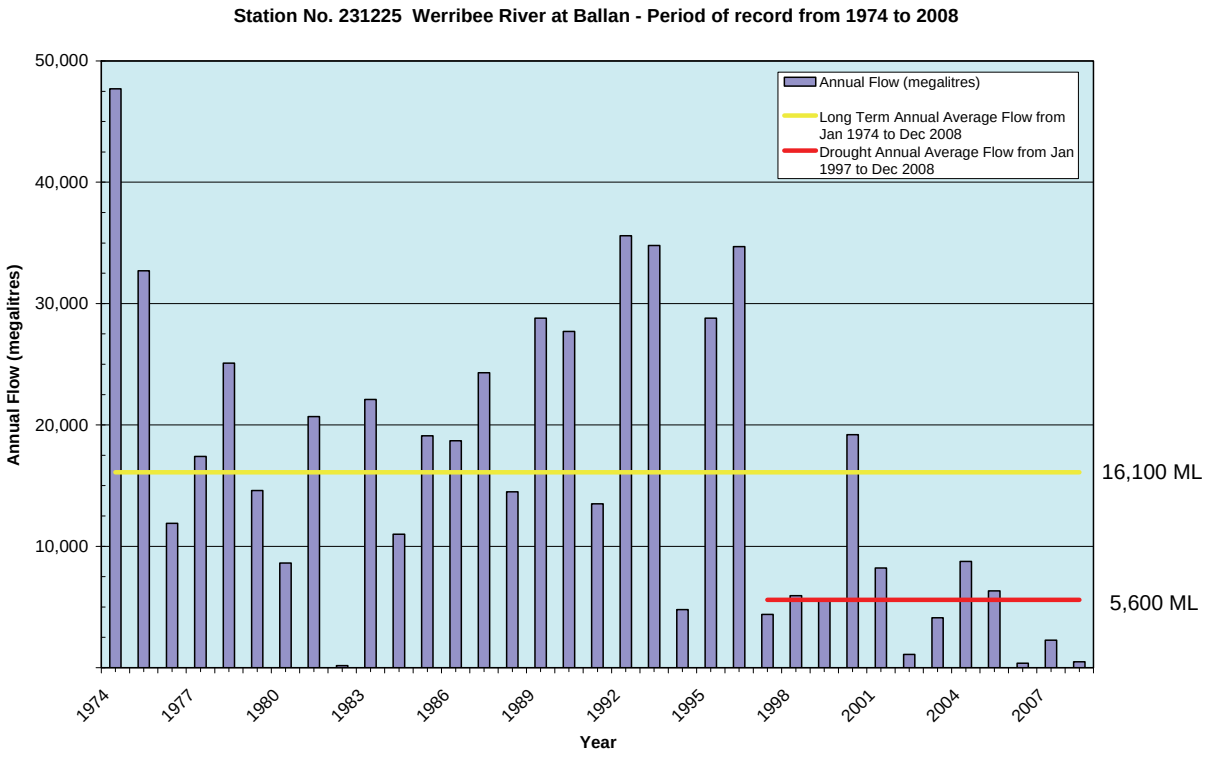
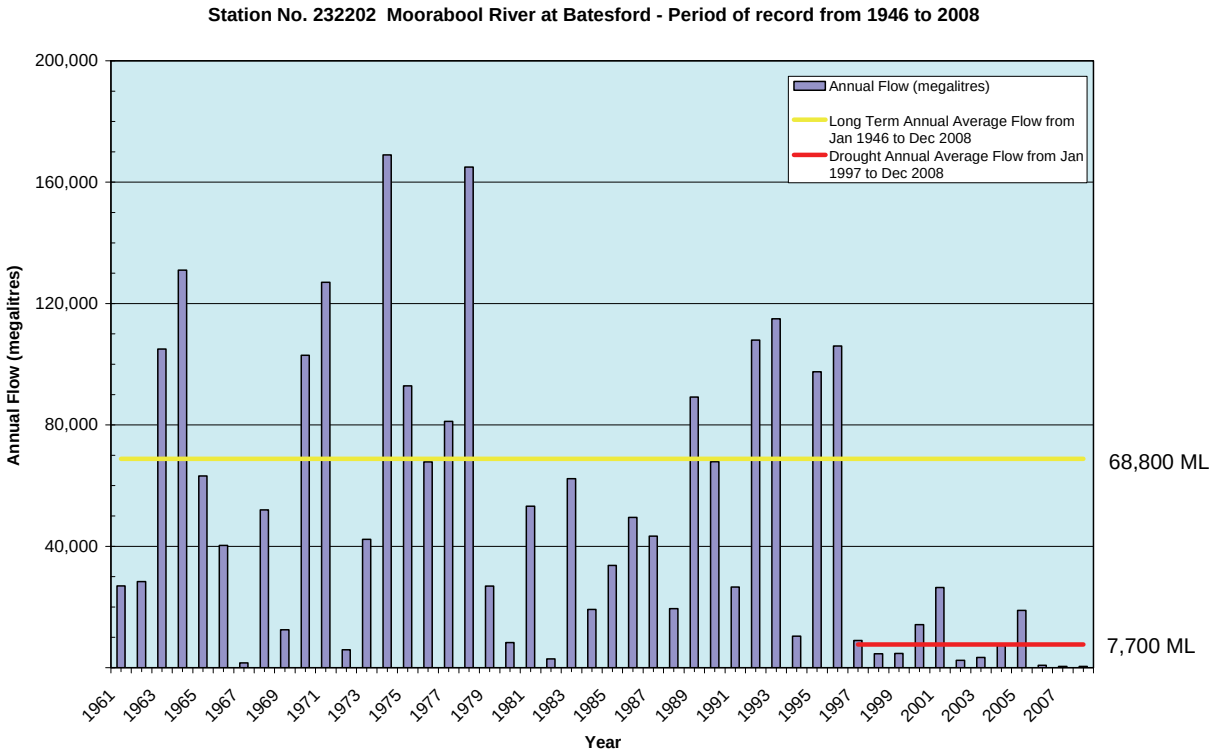


Figure 1-16 depicts annual flows in the Moorabool River at Batesford. Over the past 12 years, annual flows here have been 15% of long term average. Flows in 2008 were 451 ML. This was the third consecutive year where flows were less than 1% of the long term average. The extremely low streamflows can be largely attributed to a qualification of rights which waived passing flow requirements downstream of Lal Lal Reservoir and West Moorabool Reservoir to supplement supplies for Ballarat and Barwon Water.

Figure 1-16 Annual streamflow at Moorabool River



Note: Unlike the other figures, this figure shows readings taken downstream from water storages.

1.2.2 Bushfires

Severe bushfires swept across parts of eastern and central Victoria in February 2009, directly impacting water supplies for a number of towns.

The bushfires severely damaged water infrastructure in a number of towns in the Goulburn basin including Kilmore, Broadford, Wandong, Heathcote Junction, Buxton and Marysville. Goulburn Valley Water responded to the emergency situation and managed to continue supplies with little interruption to its towns. It also reinstated supplies for Buxton and Marysville by the time residents returned to these communities.

Around 30% of Melbourne's catchments were damaged by the bushfires, however the catchments of the two most important water storages, Upper Yarra and Thomson, were protected and largely unaffected. As a safeguard against poor water quality, Melbourne Water moved billions of litres of water to Cardinia Reservoir, away from the bushfire zone. It also temporarily stopped harvesting water from the Silver and Wallaby Creeks catchments from February to June 2009. Melbourne's supplies continued without major interruptions during and after the event.

Water supplies were also temporarily cut to Boolarra, in the Latrobe basin, due to the substantial demand for water for fire fighting from the Boolarra Water Treatment Plant. Gippsland Water installed temporary emergency water standpipes in Boolarra, Traralgon South and Jeeralang Junction for five months to ensure the community had access to safe drinking water.

Fires also threatened towns in north-east Victoria, including Beechworth, Yackandandah and Myrtleford however water supplies were not significantly impacted.

1.2.3 Blue-green algal blooms

In 2008/09 there were 17 high alert blue-green algae outbreaks.

Blue-green algae (cyanobacteria) is a common seasonal occurrence in Victoria and a natural component of most aquatic systems, including streams, lakes, estuaries and the sea.

Many factors trigger blue-green algal blooms including nutrient loads, low inflows, low storage volumes and higher than normal temperatures.

With Victoria's record-breaking drought continuing in 2008/09, low inflows, low storage volumes and higher than normal temperatures were the predominant contributing factors to the outbreaks. More than half of the outbreaks occurred in the first half of 2009 when rainfall for much of Victoria was 40% to 60% of the long term average.

The number of high alert blooms for both drinking and recreational water was low when compared to the last five years of data. This is an interesting result as 2008/09 had the low inflows, low storage volumes and higher than normal temperatures that were the predominant contributing factors to the outbreaks in previous years.

The lower number of blooms may be due in part to some water bodies drying up completely and the very low levels of precipitation reducing the amount of nutrients entering the water body. Although the numbers of individual blooms were down, there was a major event with a regional bloom in the River Murray.

Blue-green algal blooms are monitored regularly by water corporations and local waterway managers. Table 1-3 summarises the significant high alert blue-green algal blooms recorded in 2008/09. A high alert status indicates that direct use for drinking water, domestic purposes, stock watering and recreational activities (swimming, diving etc.) should be avoided. Under a high alert blue-green algal bloom, water corporations must notify the public and activate their risk management plans for drinking water supplies to ensure that either treatment removes the algae or the water source is taken off-line.

Table 1-3 High alert blue-green algal blooms for 2008/09

Basin	Location	Major use	Reporting body	Duration	Actions
Barwon	Barwon River (between Baums Weir and Breakwater Road)	R	Corangamite CMA	January to April 2009	Access to the Barwon River was closed from Baums Weir to Breakwater Road.
	McLeods Water Holes	R	City of Greater Geelong	January 2009	Warning signs erected and public notified via media releases. Regular monitoring occurred.
Bunyip	Karkartook Lake	R	Parks Victoria	July 2008 to October 2009	Warning signs erected and regular monitoring.
Corangamite	Lake Cobden	R	Corangamite Shire	January to May 2009	Warning signs erected and public notified via media releases.
Hopkins	Lake Gillear Wildlife Reserve	R	Parks Victoria	July to November 2008	Warning signs erected and regular monitoring
Loddon	Bakers Creek Reservoir	R	Parks Victoria	July to October 2008	Public gates closed and warning signs erected.
Moorabool	Lal Lal Reservoir	D, D&S	Central Highlands Water	February to March 2009	Stakeholders notified.
Murray	River Murray	D, I, R, D&S	Goulburn Murray Water, Lower Murray Water and Goulburn Valley Water	March to April 2009	Coordination arrangements for Regional blooms put in place. Stakeholders were notified, monitoring conducted, public notified via media releases. All relevant agencies notified and warning signs erected.
Otway Coast	Simpson Historical Park Dam	R	Corangamite Shire	July 2008 to June 2009	Warning signs erected and regular monitoring.
Ovens	McCall-Say Reservoir	D, D&S	North-East Water	February to May 2009	Notification as required and ongoing monitoring.
	Diddah Diddah Reservoir	D	North-East Water	April to May 2009	Reservoir taken offline.
South Gippsland	Lance Creek	D	South Gippsland Water	February 2009	Monitoring and powdered activated carbon dosing.
East Gippsland	Lake Tyers	R	East Gippsland Water	June 2009	Ongoing monitoring.
Tambo	Gippsland Lakes	R	Department of Sustainability and Environment	February to March 2009	Weekly monitoring.
Werribee	Lake Merrimu	D	Southern Rural Water	March to April 2009	Public notified via media releases. Stakeholder agencies notified, routine monitoring.
Yarra	Yan Yean Reservoir	D	Melbourne Water	July to December 2008	Reservoir not in use.
	Royal Botanic Gardens – Ornamental Lake	PR	Royal Botanic Gardens	December 2008 to June 2009	Warning signs erected and regular monitoring.

Legend:

D Drinking water
D&S Domestic and stock
R Recreation
I Irrigation
PR Passive recreation

1.3 Storages

Victoria's major water storages are capable of holding around 11,165,000 ML. This figure is less than the 11,540,000 ML reported in 2007/08 because Lake Glemaggie's volume was revised due to sediment build-up and Lake Mokoan was drained in preparation for decommissioning. The revised total of Melbourne's storage capacity is 1,810,500 ML. This is higher than the 1,773,000 ML figure reported in 2007/08 due to the reconnection of Tarago Reservoir to the Melbourne system. The combined capacity of the state's regional storages is 9,355,000 ML.

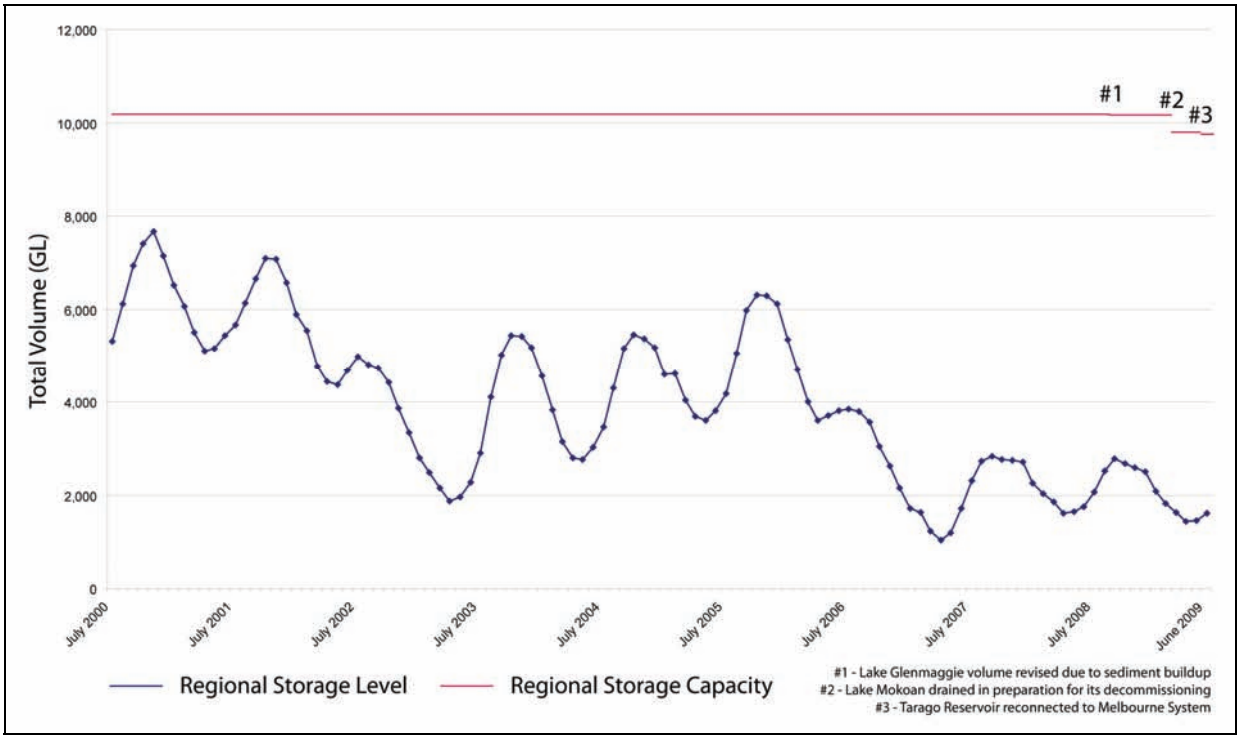
Victoria's storage capacity well exceeds annual use in any one year. For example, Melbourne's total water consumption in 2008/09 was around 371,000 ML, which is about 20% of the volume it can hold in its storages. This large storage capacity is necessary to manage the yearly streamflow fluctuations in Victoria's rivers in order to provide continuous and reliable water supplies.

As shown in Figure 1-17 the total volume of water stored in Victoria's major regional reservoirs started the year at 2,081,435 ML (22% of capacity) and ended at 1,621,394 ML (17% of capacity). Levels peaked in September and declined over summer and autumn as inflows receded and water was released from the reservoirs for irrigation and urban use. Despite inflows being well below average, the observed filling pattern was relatively consistent with previous years, with peak storage levels in 2008/09 similar to those of 2007/08.

Storage levels at the end of the year varied greatly across the state. Storages in the Campaspe, Glenelg, Wimmera, Loddon, Maribyrnong and Werribee basins were less than 10% full at the end of June 2009. Storages in the Ballarat, Bendigo, Broken, Geelong, Goulburn and Murray systems were also low at between 10% and 20% full. In contrast, storages in the Ovens, Latrobe and South Gippsland basins were between 54% and 67% full.

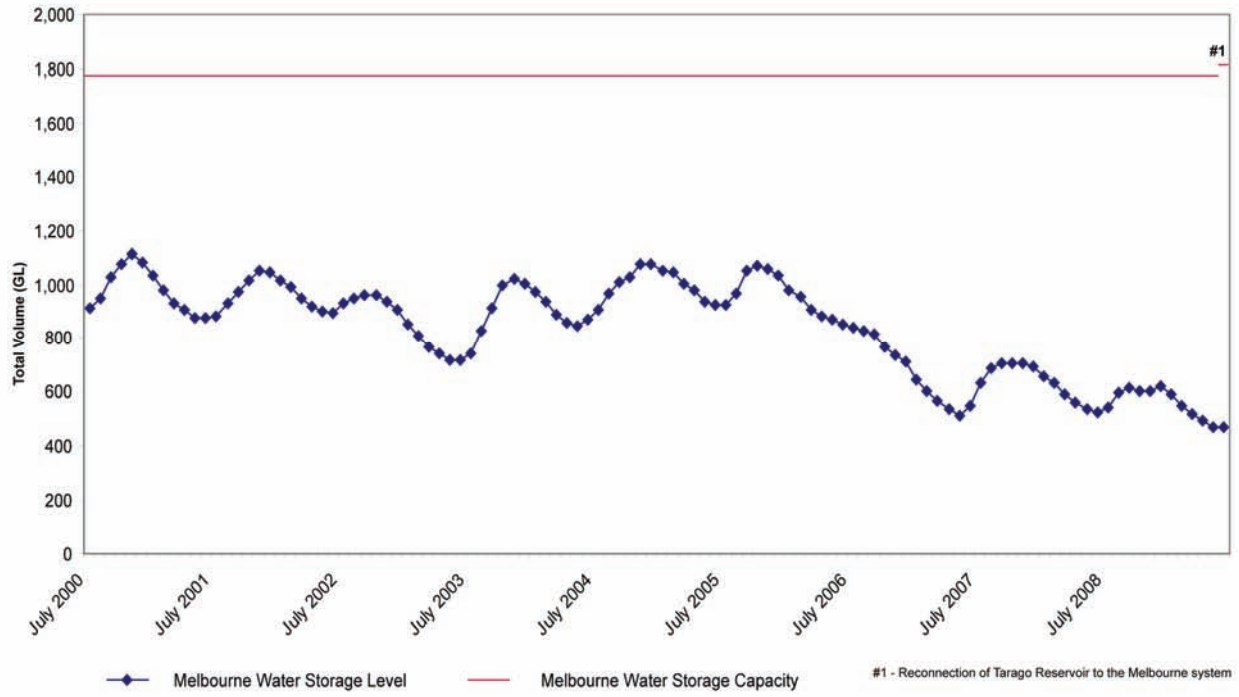
Information on storage levels in individual basins is set out in Appendix B and in the basin water accounts.

Figure 1-17 Volume in major regional corporation storages from 1 July 2000 to 30 June 2009



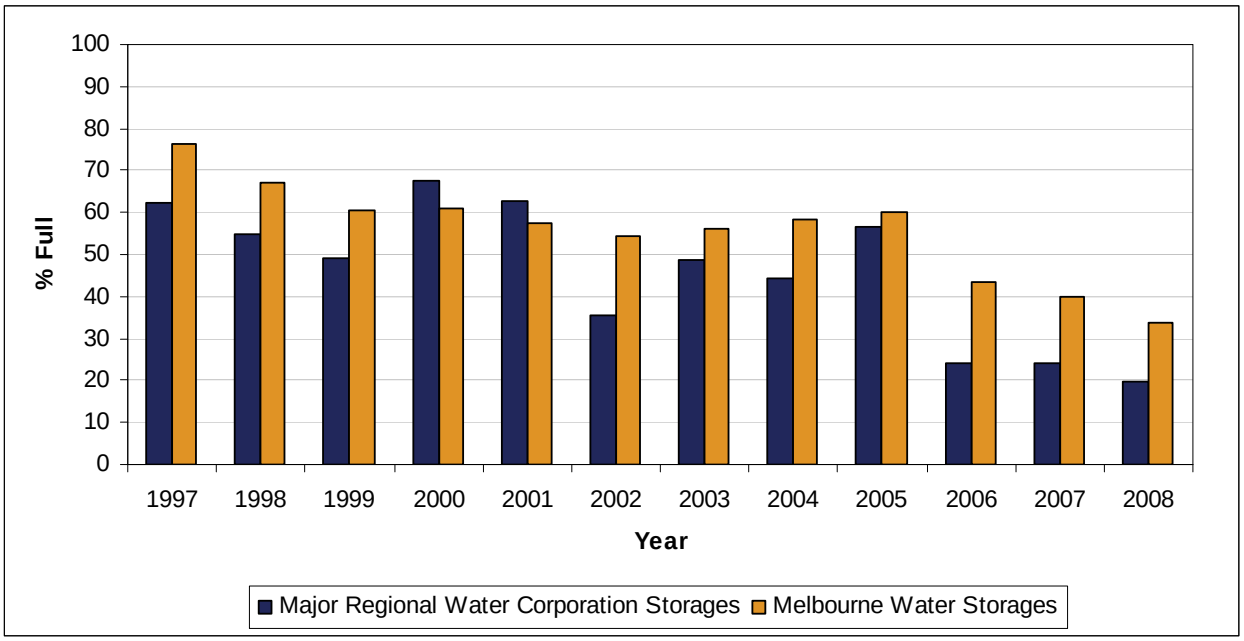
Melbourne's water storages started the year at 542,355 ML (30.6% of total storage capacity of 1,773,000 ML), decreased by 52,623 ML during 2008/09 and ended the year at 470,894 ML (26% of the total storage capacity of 1,811,000 ML, including the Tarago Reservoir). The increase in total storage capacity, as shown in Figure 1-18, reflects the reconnection of Tarago Reservoir to the Melbourne water storage system in June 2009. While storages recovered over winter and spring to 618,235 ML (35% of total storage capacity of 1,773,000 ML), this volume was still 90,280 ML lower than the level reached in 2007/08. Measures such as continuing Stage 3a level restrictions through 2008/09 and retaining a proportion of environmental water in storage as a drought contingency measure prevented the storages from falling to lower levels.

Figure 1-18 Volume in Melbourne Water Corporation storages from 1 July 2000 to 30 June 2009



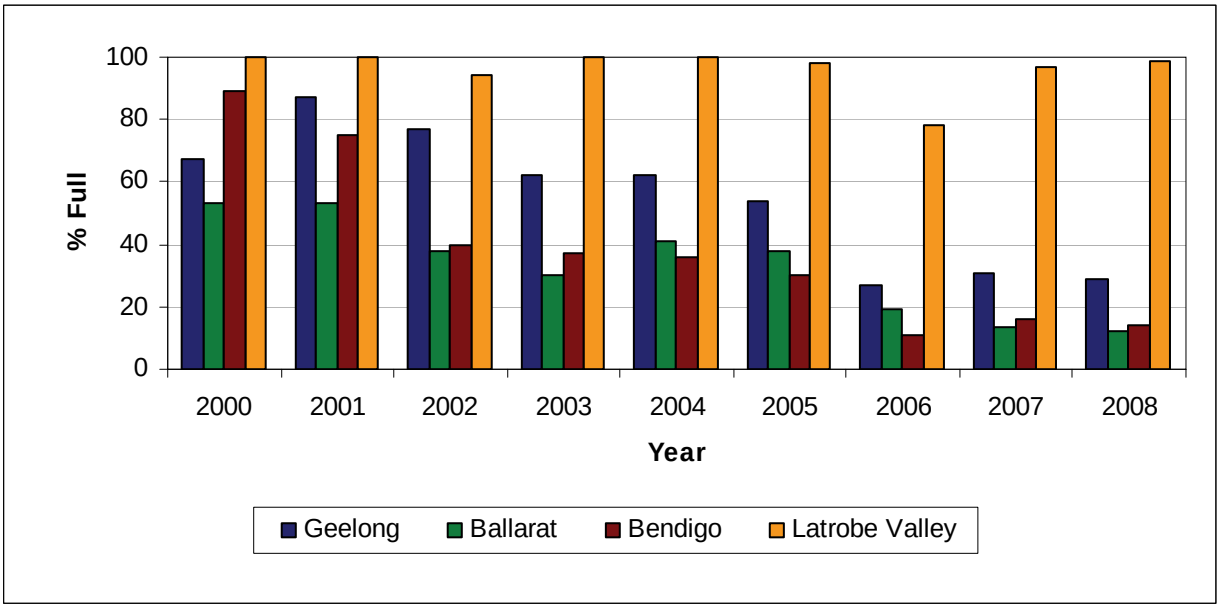
The total volume of water stored in Victoria's major reservoirs in October provides a good indication of water availability in a year because this is when levels are usually at their maximum. Figure 1-19 presents October storage levels, as a percentage of storage capacity, from 1997 to 2008 for Melbourne and Victoria's major regional water corporation reservoirs. It shows that October storage levels have generally declined over the last 12 years as inflows have been insufficient for systems to recover. Levels in 2008 were the lowest recorded since 1997. A significant drop in levels occurred between 2005 and 2006 when winter and spring rainfall was extremely low.

Figure 1-19 Water stored in reservoirs at the end of October, 1997-2008 (shown as a percentage of total storage capacity)



October storage levels from 2000 to 2008 for selected regional centres are shown in Figure 1-20. With the exception of the Latrobe Valley, storage volumes in Victoria's regional cities have generally declined in the past nine years. The failure of winter and spring inflows in 2006 caused a significant drop in levels for the state's major regional centres. During 2008, levels for Geelong and Bendigo reduced slightly compared with 2007, while a failure of inflows to Ballarat's storages meant that levels continued to decline in 2008. Ballarat's storages were holding 12% of capacity at the end of October.

Figure 1-20 Water stored in key regional cities' reservoirs at the end of October, 2000-2008 (shown as a percentage of total storage capacity)



Notes:
The following storages are used for each of the centres:

- Geelong: Barwon Water's share of the Lal Lal Reservoir, plus the volumes in the Wurdee Boluc, West Barwon, Korweinguboora, Bostock and Stony Creek Reservoirs
- Bendigo: Coliban Water's share of Lake Eppalock, plus the volumes in the Upper Coliban, Lauriston and Malmsbury Reservoirs
- Ballarat: Central Highland Water's share of the Lal Lal and White Swan Reservoirs
- Latrobe Valley: the Moondarra Reservoir.

1.4 Groundwater

The consumption of groundwater from Victoria's aquifers is managed according to geographical area. The principal management unit for groundwater in Victoria is the groundwater management unit (GMU), the boundaries of which often fall across more than one river basin. A GMU can be a:

- **Groundwater management area (GMA)**: an area where groundwater has been intensively developed or has the potential to be. GMA boundaries are defined for the purposes of ongoing management.
- **Water supply protection area (WSPA)**: an area declared under the *Water Act 1989* to protect its groundwater or surface water resources through the development of a management plan.
- **Unincorporated area (UA)**: an area where limited development or use of groundwater has occurred. This is usually because the resource is low yielding, or its quality has limited its use, or there is limited information about resource availability. UAs are important for the supply of domestic and stock water.

At present, there are 66 GMUs in Victoria, of which 25 are WSPAs, 38 are GMAs and three are unincorporated areas. Management plans have been approved for eight WSPAs. In 2008/09 consultative committees were established and management plans begun for Warrion, Koo-Wee-Rup and Yarram WSPAs. Development of the Upper Ovens WSPA management plan was also commenced; this will be the first combined surface water and groundwater management plan.

A recent refinement to the management framework has been the introduction of Local Management Rules (LMRs), which describe how the responsible water corporation will manage the water resources. LMRs set out the local terms and conditions – designed to protect entitlements, the resource and the environment – that are consistent with the overall objective for each system.

In addition to the management units, a groundwater sharing agreement is in place between South Australia and Victoria where aquifers straddle the state borders. The agreement began in 1985 as groundwater is the only reliable water source in the region and there is increasing demand for its use. The designated area is a 40-kilometre-wide strip centred on the border and extending its full length, and is managed under the *Groundwater (Border Agreement) Act 1985*.

In recent years, a shift has occurred in the way groundwater, its availability and potential are viewed. Groundwater was once viewed by many as being secondary to surface water. However it is now recognised as a critical, albeit largely unseen, resource in the state's whole-of-water approach to resource management.

The location of aquifers is unrelated to surface water basins, with some aquifers extending beneath several. Nevertheless for the purpose of the basin accounts, groundwater use has been apportioned according to the surface area by basin. See Chapter 5 for an explanation of the method used.

Groundwater aquifers vary in size and volume throughout Victoria. They lie beneath all parts of the state but do not always hold usable water. Groundwater's potential for use is generally dependent on its salinity and how much of it can be extracted (aquifer yield).

While groundwater can be reliable, its overuse can result in failure of supply. Groundwater has value when it is extracted for a range of uses including irrigation, commercial, urban or stock watering. It also has value when left in situ where it may support groundwater-dependent ecosystems, contribute to base flow in streams and wetlands, or support a variety of terrestrial flora.

Victoria monitors approximately 2,500 bores in order to understand groundwater level trends. Additionally, the rural water corporations conduct monthly monitoring of approximately 500 bores. The need for greater security of this renewable resource has increased the need for the state to improve the management framework for groundwater and upgrade its monitoring network.

Improving the understanding of the extent, availability and quality of the state's groundwater resources is one of the primary objective of the State Observation Bore Network (SOBN) refurbishment project. Through the project, over 105 new state observation bores were constructed in 2008/09 in key groundwater management areas. A further 15 failed bores have been removed from the network, protecting the integrity of the groundwater resource and the surrounding environment.

During 2008/09, groundwater quality samples were also collected from 214 key state observation bores to determine water quality baseline conditions. The quality sampling considered potential hazards and land use impacts and is part of an ongoing program to provide the Department of Sustainability and Environment with data that can be used as a benchmark for future sampling.

Some 26 management units displayed declining trends in groundwater levels in 2008/09 compared with 14 in 2007/08. While this can be attributed to steady demand for groundwater, external factors such as climate change and lack of recharge during the ongoing drought are also causing a decline in water levels and are outside the scope of the groundwater management framework.

Drought and climate change affect all aquifers as recharge to groundwater is largely dependent on rainfall. The short and long term trends in groundwater management units need to be considered in light of 15 years of reduced rainfall and recharge. Declining trends are likely to be caused by a combination of reduced rainfall infiltration and groundwater extraction. For some management areas, restrictions were enforced to ensure groundwater levels did not continue to decline.

Declining groundwater levels also affect the environment as baseflow to waterways, wetlands and other groundwater-dependent ecosystems are reduced. Key actions developed in the Northern and Western Sustainable Water Strategies aim to improve the management of groundwater-dependent ecosystems. They consider the needs of the environment when determining Permissible Consumptive Volumes and making licensing decisions. Sustainable management of the groundwater resources will result in optimisation of the volume extracted and the value obtained from the resource, while minimising the impacts on other users and the environment.

In some areas of the state such as Murrayville, the resource is non-renewable. A management decision to continue to allow extraction was made and a volume of water is extracted each year, causing the aquifer to decline within the agreed limits set out in the management plan.

Water level trends using the past five or more years of data gathered from the State Observation Bore Network (SOBN) are presented in Figure 1-21, Figure 1-22 and Table 1-4.

Water metering is fundamental to responsible management of Victoria's water resources and all new groundwater licences must be metered. To improve water use compliance and accounting for existing licensed groundwater use, a statewide metering program was implemented in 2004. The metering program was initiated by the *Our Water Our Future* action plan whereby the Department of Sustainability and Environment provided a subsidy to install meters on licensed groundwater sites taking 20 ML per year or greater. Under the metering program, some 1,565 meters were installed.

Figure 1-21 Groundwater trends in WSPAs

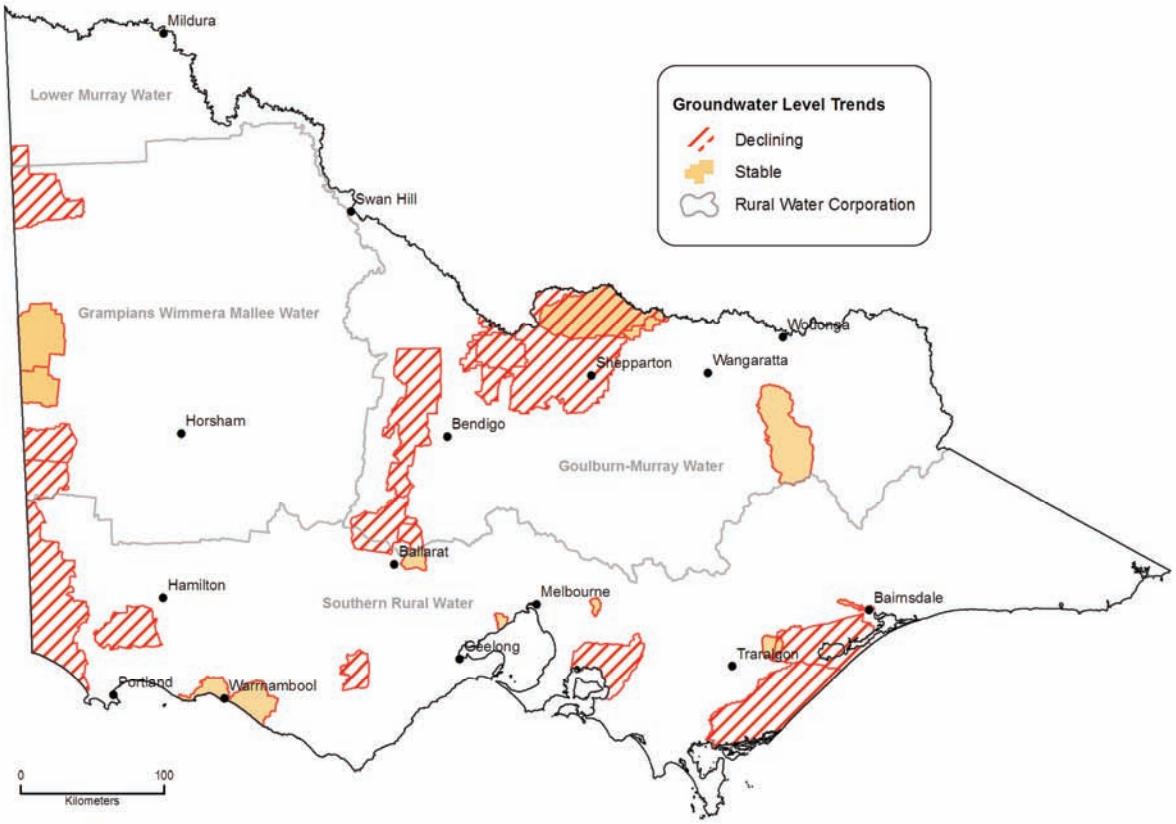


Figure 1-22 Groundwater trends in GMAs

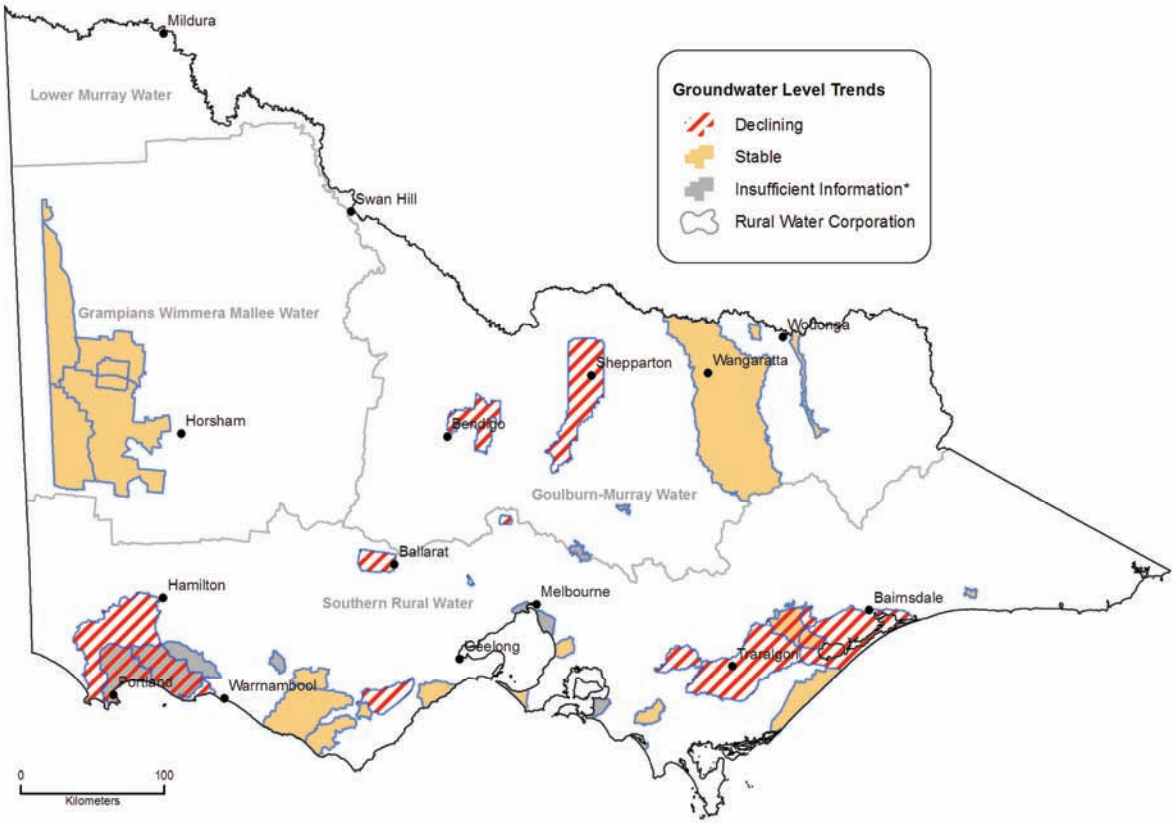


Table 1-4 Groundwater level trends in WSPAs

	SOBN coverage	Groundwater level trend 2008/09	Groundwater level trend 2007/08	Management activities
Goulburn Murray Water				
Campaspe Deep Lead	Adequate	Declining	Declining	R, MP, A*
Katunga	Adequate	Stable	Stable	R, MP
Mid Loddon	Adequate	Declining	Declining	LMR, A
Shepparton Irrigation Region	Adequate	Declining	Declining	MP
Spring Hill	Limited	Declining	Declining	R, MP, A
Upper Loddon	Limited	Declining	Declining	A
Upper Ovens	Limited	Stable	Stable	MP*
Grampians Wimmera Mallee Water(1)				
Apsley	Limited	Declining	Declining	A, MP*
Kaniva	Limited	Stable	Stable	A, MP*
Murrayville	Limited	Declining	Stable	MP
Neuarpur	Limited	Declining	Declining	MP, A, MP*
Telopea Downs	Limited	Stable	Stable	A, MP*
Southern Rural Water				
Bungaree	Adequate	Stable	Stable	
Condah	Adequate	Declining	Declining	A
Denison	Inadequate	Stable	Stable	
Deutgam	Adequate	Stable	Stable	R
Glenelg	Limited	Declining	Declining	
Koo-Wee-Rup	Adequate	Declining	Declining	MP*
Nullaware	Adequate	Stable	Stable	MP, A
Sale	Adequate	Declining	Declining	A
Wandin Yallock	Adequate	Stable	Stable	
Warrion	Adequate	Declining	Stable	MP*
Wy Yung	Adequate	Stable	Stable	
Yangery	Adequate	Stable	Stable	MP, A
Yarram	Limited	Declining	Declining	MP*

Management activities key:

MP Management plan
MP* Management plan being prepared
LMR Local management rules in development
R Restrictions on use
A* Resource appraisal commenced
A Resource appraisal completed

Note:

(1) The West Wimmera resource appraisal and subsequent management plan will cover the areas of Apsley WSPA, Kaniva WSPA, Neuarpur WSPA, Telopea Downs WSPA, Balrootan GMA, Little Desert GMA and Nhill GMA.

1.5 Conclusion

Rainfall was well below average in 2008/09. Streamflows across most of Victoria were also well below average in 2008/09, ranging between 8% and 57% of the long term average. Overall, 2008/09 streamflow was 32% of the long term average. This was 26% lower than 2007/08 streamflow and only 16% higher than 2006/07 streamflow.

This extended the current sequence of dry years to 12 and meant water availability across many parts of Victoria remained low. Storage levels in Victoria's major regional reservoirs had decreased slightly by the end of 2008/09 to hold 17% of capacity, while Melbourne's storages continued to decline, ending the year at 26% of capacity.

Streamflows, relative to long term averages, were highest in the Bunyip, Tambo, Snowy and Otway Coast basins. Melbourne's Yarra and Thomson reservoirs did not receive the inflows needed to improve water availability for the metropolitan region and continued to decline.

Severe bushfires swept across parts of eastern and central Victoria in February 2009 and, although they did affect water supply to several towns, water corporations were able to continue supply with only minor interruption.

The continuing dry conditions also affected groundwater resources, with 26 groundwater management units showing a long term trend of declining water levels. While this can be attributed to increased demands for groundwater, there are also external factors such as climate change and the impact of off-shore oil and gas extraction that may be causing these declines. Key actions developed in the sustainable water strategies aim to improve groundwater management according to the objectives set for each aquifer.

2 Management of scarce water resources

2.1 Living with less water

Victoria has now experienced 12 years of below average rainfall. During this period, a lack of very wet years has failed to offset the dry years and a change in seasonality has seen large decreases in autumn and winter rainfall. While periods of below average rainfall are not unusual, the loss of inter-annual variability and change in rainfall patterns make the recent climate unprecedented.

The climate of the last 12 years has resulted in a major reduction in streamflows and inflows into Victoria's major reservoirs, causing severe water shortages for communities and the environment across the entire state.

Victoria's water allocation framework provides measures to conserve and share water between users in response to dry seasonal conditions. Measures include water restrictions in urban areas, seasonal allocations in irrigation districts, restrictions, rosters and bans on users in unregulated catchments, and development of the water market.

The duration and severity of the low flows of the last 12 years has required the Victorian Government, water businesses and water users to take additional measures to respond not only to the ongoing water shortage, but to the risk that the recent low flows will continue. In 2008/09, a large number of measures were employed across the state to manage the impacts of ongoing reduced water availability. These measures are detailed in this chapter.

2.2 Role of government in responding to less water availability

The government plays an important role in assisting and guiding water businesses in times of serious water shortage and prolonged drought. Specifically, this role is to implement and expand water conservation measures and contingency responses, forge new agreements and new approaches to water management and sharing, and activate emergency plans to provide immediate short term relief to those most in need.

Victoria's water businesses are responsible for maintaining sufficient water supplies during drought and for implementing and funding contingency measures when required. Many businesses were again required to activate their dry inflow contingency plans in 2008/09 as water availability did not improve across much of the state. Many of the lessons learnt through managing scarce water resources since 2006/07 were applied as the dry conditions continued in 2008/09. The government again worked closely with the businesses throughout the year, monitoring the water supply situation and facilitating emergency response measures when required.

Water businesses are expected to manage water shortages within their bulk entitlements by implementing their drought response plans and making up shortfalls in water supply through the water market where possible. However, 2008/09 continued to be extremely dry in many parts of the state and required a high number of qualifications of rights to continue in many water systems. These included the large water systems in northern Victoria, such as the Murray and Goulburn systems, as well as Melbourne. The revised water sharing arrangements under qualifications helped ensure essential urban, rural and environmental needs were met and necessary contingency measures implemented in a consistent manner across the state.

In October 2008, the government announced a further $115 million in assistance to help rural communities battling the worst drought on record, bringing the government's support for farmers and rural communities to more than $400 million since 2006. Key features of the package included water rebates for irrigators worth $58 million, 50% subsidies on municipal rates and charges worth $15 million, a new $10 million drought employment program, a $10 million investment in much needed infrastructure and to boost local regional jobs, and a further $2 million in support of mental health services.

The government also plays an important role in long term water resource planning for Victoria. In 2004 it put in place a long term plan for water - *Our Water Our Future* - setting out 110 actions for sustainable water management aimed at every sector of the community, seeking to secure water supplies and sustain growth over the next 50 years.

The *Our Water Our Future* action plan committed to undertaking regional sustainable water strategies to plan for long term water security across Victoria. Each sustainable water strategy sets out a long term regional plan to secure water for consumptive uses while also safeguarding the future of its rivers and other water-dependent environmental values.

In June 2007, *The Next Stage of the Government's Water Plan*, the next phase of the *Our Water Our Future* was released. It provides long term solutions to secure Victoria's water supplies by building a desalination plant, saving water through upgrading irrigation channels, expanding the water grid to pipe water around the state and extending conservation programs and recycling.

2.3 Victoria's regional sustainable water strategies

Victoria's continuing drought in 2008/09 served to highlight the need to plan for a future in which water resources are limited while population continues to grow.

During the year work on developing sustainable water strategies for the northern, Gippsland and western regions continued. Implementation of the Central Sustainable Water Strategy commenced in 2006. Stakeholder engagement

and consultations associated with development of the Northern Sustainable Water Strategy were well advanced by the end of the reporting period.

Actions for inclusion in the Northern Sustainable Water Strategy were being developed to protect the region's key agricultural, environmental and urban values. Not only does the region support rural cities and smaller communities, but it is also a key producer of foods for domestic and export consumption.

Early results of planning for water resource management under differing climate scenarios generally indicated that significant reductions in water available for both consumptive and environmental uses could occur across northern Victoria.

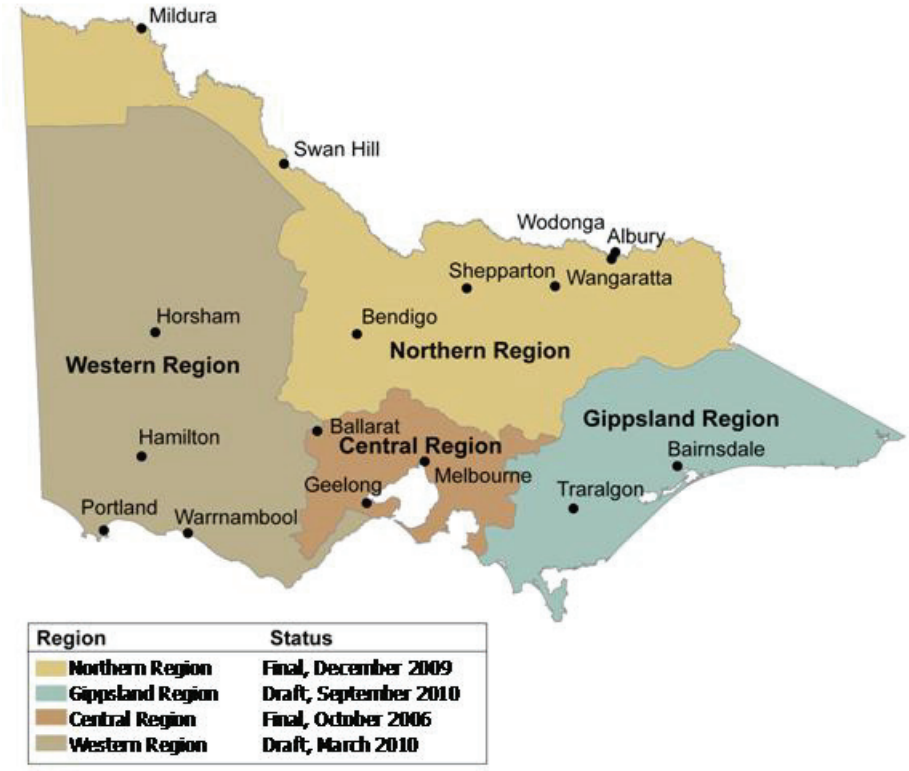
Early scoping work on the Gippsland and Western sustainable water strategies was also undertaken in 2008/09.

Western Sustainable Water Strategy is addressing the key issues of protecting environmental assets including rivers, wetlands, estuaries and aquifers, while preparing for the impacts of climate change and land use change on water supplies.

In the Gippsland region similar issues are being addressed, as well as issues associated with coal mining, oil and gas production and unallocated water held in Blue Rock Reservoir.

Figure 2-1 shows the sustainable water strategy regions and their status.[3] Sustainable water strategies are reviewed every seven to ten years.

Figure 2-1 Victoria's sustainable water strategy regions and their implementation status



2.4 Victoria's water plan

Launched in the first half of 2007, *Our Water Our Future: The Next Stage of the Government's Water Plan* is the blueprint for augmenting Victoria's water supply.

Two components of the plan were completed in 2008/09 which helped augment water supplies in Bendigo, Ballarat and Melbourne. Firstly, following its connection to Ballarat in May 2008, the Goldfields Superpipe completed its first full financial year of operation in 2008/09 with 15,648 ML of water transferred from the Goulburn system to Lake Eppalock and the Sandhurst Reservoir in Bendigo. It also provided in excess of 11,000 ML to the Ballarat and district water supply system. Secondly, Tarago Reservoir was reconnected to the Melbourne water supply system on 24 June 2009.

These two projects are examples of extending the water grid to interconnect water supply systems and increase the diversity of water supplies available to communities.

[3] As at September 2010.

Pipelines are a key component of the water plan and will provide townships and surrounds with greater security of supply by expanding the Victorian water grid. Examples of interconnections completed in 2009 or in the planning phase are shown in Table 2-1.

In northern Victoria work continued on renewing irrigation infrastructure with the installation of more than 1,000 on-farm meters and the removal of 141 old metered outlets. Over 1,100 farm irrigation assessments were completed and over 340 business cases for on-farm works were finalised.

Under the Northern Victoria Irrigation Renewal Project, 117 service points, 11 kilometres of channel and 38 regulator gates were closed. These form some of the early works under the project that will help contribute to system-wide savings of 225,000 ML per annum.

In 2008/09 the proponents of the desalination plant proceeded to the tender phase after planning and approval processes required by state and federal authorities were completed. Tender assessments were carried out and a successful bidder selected.

Table 2-1 Components of water grid and their supply impact

Project name	Supply impact	Project type	Supply objective	Completion date
Tarago Reservoir	Up to 15,000 ML/annum on average	Link	Increase supplies by 15,000 ML/annum for Melbourne through the construction of a water treatment plant to ensure that the water meets potable water quality standards; modifications to the dam and outlet structures and through the upgrade of the transfer network to allow efficient distribution of the resource	June 2009
Wimmera Mallee Pipeline	Savings of approx 103,000 ML/annum	Efficiency	Save previous system losses through evaporation and groundwater infiltration by replacing 17,500 kilometres of earthen irrigation channel with 8,800 kilometres of pressurised pipeline	May 2010
Sugarloaf interconnector	Up to 75,000 ML/annum	Link	To link the Goulburn River and Sugarloaf Reservoir and deliver Melbourne's annual share (one third) of the water savings generated by the Northern Victoria Infrastructure Renewal Project (up to 75,000 ML)	February 2010
Hamilton – Grampians interconnector	2,000 ML/annum	Link	Connect Rocklands Reservoir with Wannon Water's existing Grampians Headwork's Pipeline to supply the Hamilton system with up to 2,000 ML	June 2010
Desalination plant	150,000 ML/annum	New supply	Will boost water supplies by 150,000 ML each year, providing around one third of Melbourne's current water needs	End of 2011
Melbourne – Geelong interconnector	Up to 16,000 ML/annum	Link	Connect Geelong to Melbourne's water supply system providing up to 16,000 ML/annum to Geelong	End of 2011
Northern Victoria Infrastructure Renewal Project	Stage 1: System wide savings of 225,000 ML/annum	Efficiency	Stage 1: Install more efficient irrigation infrastructure to recover 225,000 ML of water currently lost through leaks, evaporation and system inefficiencies	Stage 1: Expect completion June 2012
Eastern Treatment Plant upgrade	Up to 100,000 ML/annum Class A recycled water	New source (wastewater treatment upgrade)	Upgrade the Eastern Treatment Plant's treatment process that will improve the quality of the coastal discharge at Boags Rocks to meet environment protection requirements. The treatment upgrade will produce Class A recycled water which will be available as a fit-for-purpose resource	End of 2012

Legend:

Link	New pipeline connecting water supply to storage
Efficiency	Infrastructure installation to reduce water losses through evaporation, seepage and groundwater infiltration
New supply	Water which previously did not exist in the Victorian water supply system
New source	Potential supply of non-potable water, recycled to tertiary level

2.5 Urban water restrictions

All Victorian towns are subject to a scale of water restrictions based on the Victorian Uniform Drought Water Restriction Guidelines. While the guidelines have four stages of restrictions, urban water businesses have the ability to grant exemptions to make minor adjustments to a stage of water restriction. The drought response plans of the Melbourne urban water businesses and the water restrictions by-laws of the regional urban water businesses therefore include two extra stages of restrictions – intermediate Stage 3a and Stage 4 Ex (Stage 4 with exemptions) – with increasing levels of severity. The Melbourne drought response plan applied Stage 3a throughout 2008-2009 and several regional water businesses applied Stage 4 Ex at different times during the year.

The trigger points for each stage of water restrictions are outlined in the drought response plan of each water business for each water supply system. These plans also include contingency measures for temporary water supplies or savings beyond Stage 4.

The number of towns on water restrictions reduced during 2008/09, mainly due to an increase in groundwater use. At 1 July 2008, some 366 towns were on some form of water restrictions. By 30 June 2009, that number had decreased to 337, with 47 towns on Stage 4 restrictions. Under the guidelines, Stage 4 restrictions prohibit a range of activities, including:

- the watering of any public, residential or commercial garden or lawn
- the watering of sports grounds
- cleaning of vehicles with water with the exception of windows, mirrors and lights
- cleaning of building facades or windows with water
- filling any new pond, lake or swimming pool.

As indicated above, a number of water businesses introduced exemptions to Stage 4 restrictions for their towns (Stage 4 Ex) to reduce the impacts on local communities.

Each urban water business also has a permanent water savings plan which applies at all times and sets basic conditions around water use when water restrictions are not in place. At June 2009, approximately 170 towns were not on water restrictions but were subject to permanent water saving rules.

Figure 2-2 summarises the number of towns on restrictions over 2007/08 and 2008/09, and the level of those restrictions.

Figure 2-2 Number of Victorian towns on restrictions from July 2007 to June 2009

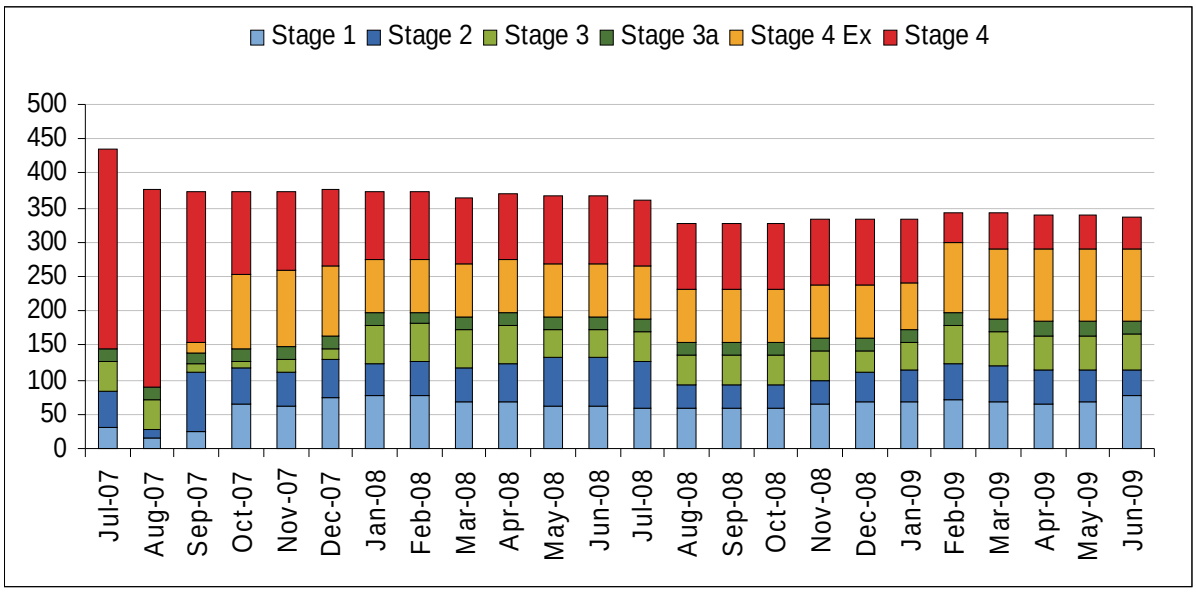
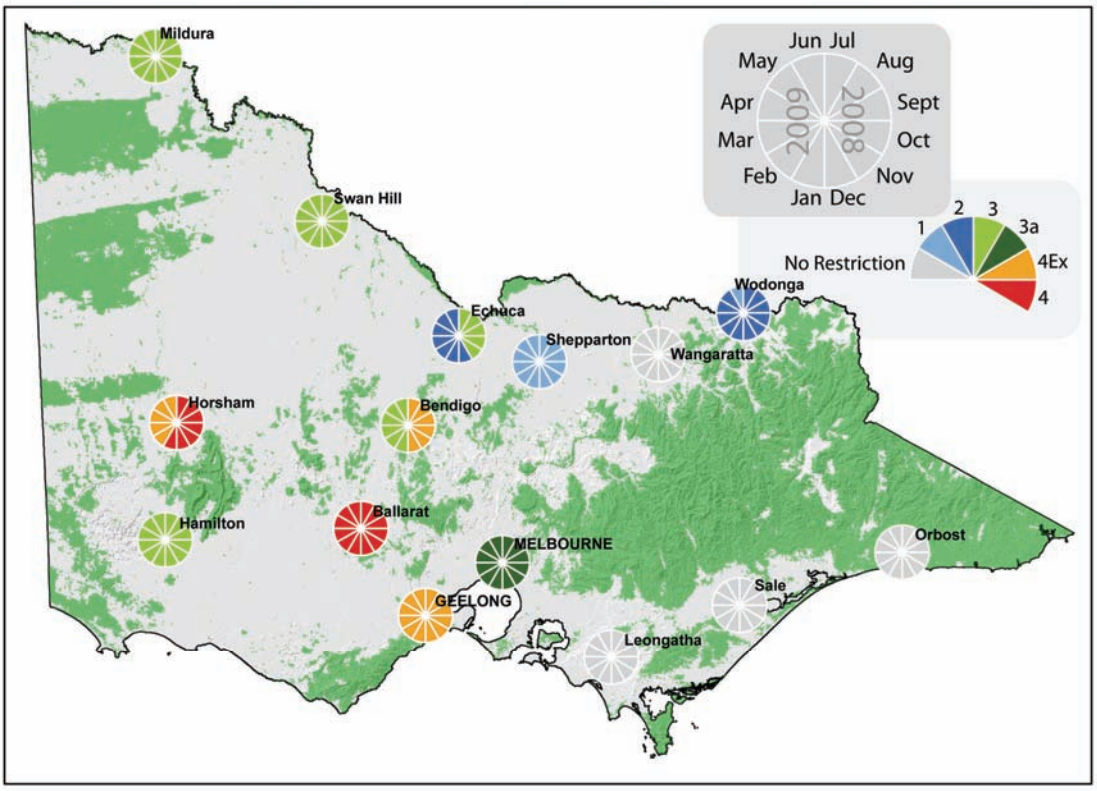


Figure 2-2 shows that restrictions have eased marginally in 2008/09 compared with 2007/08. As a result, water consumption increased marginally compared with 2007/08. Urban water businesses reported that metered water use was 3.5% or 20,542 ML higher in 2008/09 compared with 2007/08.

Figure 2-3 shows the level of restrictions for the major population centres and the manner in which they changed over 2008/09. Towns finished the year on either the same level or a lower level of restriction than they began. For example, Horsham began the year in July 2008 on Stage 4 restrictions, which was eased to Stage 4 with exemptions in February, and staying at that level for the rest of the year. Towns in East and South Gippsland and Latrobe basins ended the year on permanent water savings measures.

Figure 2-3 Changes in restrictions levels for major towns, 2008/09



2.6 Seasonal allocation of water in irrigation districts

The amount of water made available to irrigators in regulated systems each year is determined by seasonal water allocations. The seasonal allocation differs from urban restrictions in that every year each irrigator is allocated a share of the available resource which will vary from year to year. An irrigator's seasonal allocation can be used at any time throughout the irrigation season.

Seasonal allocations in declared water systems are expressed as a percentage of high reliability and low reliability water shares. Water entitlements in the regulated systems of northern Victoria were converted to high and low reliability water shares when unbundled on 1 July 2008. Unbundling extended to the Werribee/Bacchus Marsh and Thomson/Macalister water systems on 1 July 2009.

Initial allocations are made early in the irrigation season based on the current volume of water in storage, estimated inflows during the season and the amount of water required to provide for subsequent years. Allocations are reviewed by rural water corporations throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water corporations do not know until late spring how much water will be available for use.

The 2008/09 seasonal allocations for Victoria's irrigation districts are shown in Table 2-2. The end of season allocations were lower in 2008/09 than in 2007/08 in all irrigation systems. All irrigation systems, except the Thomson-Macalister system, received allocations less than 100%. Allocations were nil in seven irrigation districts.

For a second year in a row all irrigation systems in northern Victoria started with a zero allocation. The Murray system recorded its lowest ever final allocation of 35% of high reliability water shares. This was down from the 43% in 2007/08 and the 95% allocation in 2006/07.

The Thomson-Macalister irrigation district was the only water system to receive more than a 100% allocation in 2008/09. It received a 100% allocation against high reliability water shares and a 10% allocation against low reliability water shares.

Table 2-2 Seasonal irrigation water allocations

Irrigation system		Initial allocation August 2008 (% of entitlement)	Mid season allocation February 2009 (% of entitlement)	Final allocation May 2009 (% of entitlement)	2007/08 final allocation (% of entitlement)
Murray – gravity and pumped (% HRWS)		0	35	35	43
Goulburn (% HRWS)		0	30	33	57
Broken (% HRWS)		0	0	0	71
Campaspe (% HRWS)		0	0	0	18
Loddon (% HRWS)		0	0	0	5
Bullarook Creek (% HRWS)		0	0	0	0
Wimmera (% entitlement volume)		0	0	0	0
Thomson – Macalister (% HRWS)		80	95	100	200(1)
Thomson – Macalister (% LRWS)		0	0	10	
Werribee (% HRWS)		2	5	5	8
Bacchus Marsh (% HRWS)		2	5	5	8
Maribyrnong (% licence volume)	(Southern Rural Water)	0	0	0	0
	(Melbourne Water)	0	0	0	0

Note:
HRWS – High reliability water share
LRWS – Low reliability water share
(1) Water entitlements in the Thomson-Macalister system in 2007/08 had not been converted to high and low reliability water shares.

Lower seasonal allocations and reduced water availability for urban purposes led to an increase in the amount of water traded on the water market as rural customers and urban water businesses sought to augment their water supply.

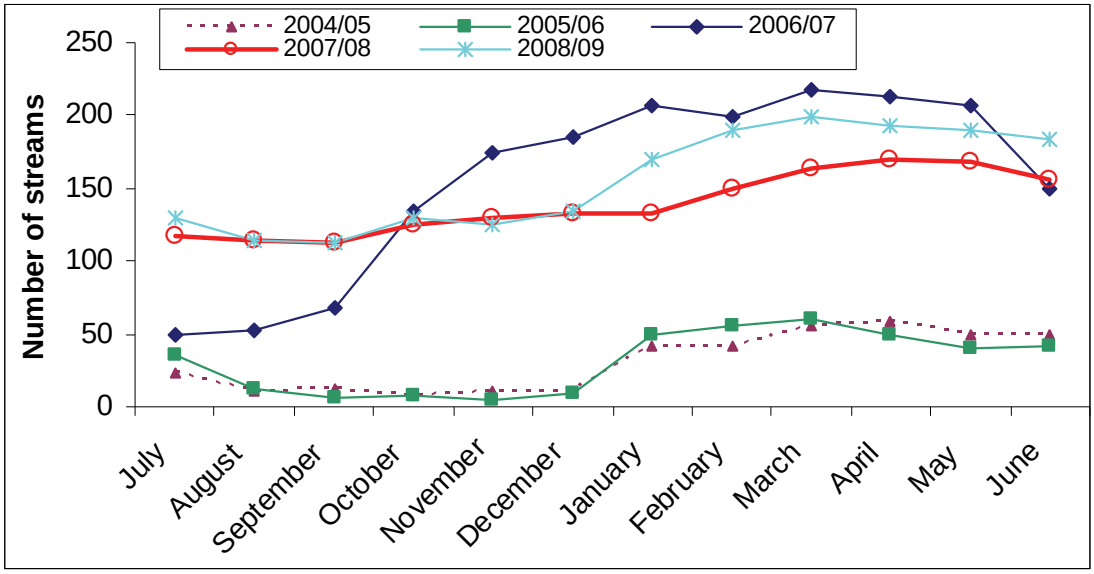
2.7 Restrictions on diversions from unregulated streams

When streamflow in an unregulated stream drops below a specified threshold, water corporations have the power to impose restrictions, rosters and bans on the water taken from streams by licensed diverters. Rosters and restrictions set out the order in which licence holders are allowed to take water and the quantity allowed to be taken (e.g. 75% of licensed volume). When water is particularly scarce, bans are imposed on diversions from waterways.

Restrictions on diversions from unregulated streams typically fluctuate over the course of the year, depending on rainfall and streamflows. Restrictions and bans are usually most severe in summer and autumn and are more likely to be lifted over the winter and spring seasons.

Restrictions on diversions in 2008/09 broadly followed this trend. While the magnitude of restrictions during winter and spring was similar to that of 2007/08, restrictions over summer and autumn were generally higher than those experienced during 2007/08. Restrictions were at their most severe in summer and autumn, with an increase in February through to April. Restrictions peaked in March 2009, with 199 unregulated streams on some form of restriction or ban. In June 2009, users on 184 streams were on some form of restriction compared to 156 in June 2008.

Figure 2-4 Number of Victorian unregulated streams on restrictions



2.8 Seasonal allocations of groundwater in water supply protection areas

Seasonal allocations are announced in accordance with the groundwater management plans developed for a number of water supply protection areas (WSPAs). An allocation of less than 100% of the licensed entitlement may be put in place to achieve one or more of the following:

- reduce the risks from falling groundwater levels. Risks can include increased pumping costs, bores drying up and compromising access to domestic and stock groundwater, and potential long term irreversible impacts on the quality of the resource if all entitlement is extracted
- allow the resource to be shared between all users
- recognise and reduce the social and environmental costs of lowering groundwater levels.

For 2008/09, seasonal allocations applied for the following management areas:

- Katunga WSPA – 70% allocation
- Spring Hill WSPA – 80% allocation (zone 1002) and 50% allocation (zone 1003)
- Campaspe Deep Lead WSPA – 65% allocation.

2.9 Emergency water supply network

In locations where water shortages became critical, the government and water corporations ensured that emergency water supply points were available to eligible customers.

In 2008/09 no new points were added to the 270 water supply points operating throughout 2007/08. These continued to be accessed by rural customers who carted water to their properties for domestic and stock purposes and for emergency use. In the north-west region where 91 water supply points were in operation in 2008/09, some 83 of these bores were metered throughout the year.

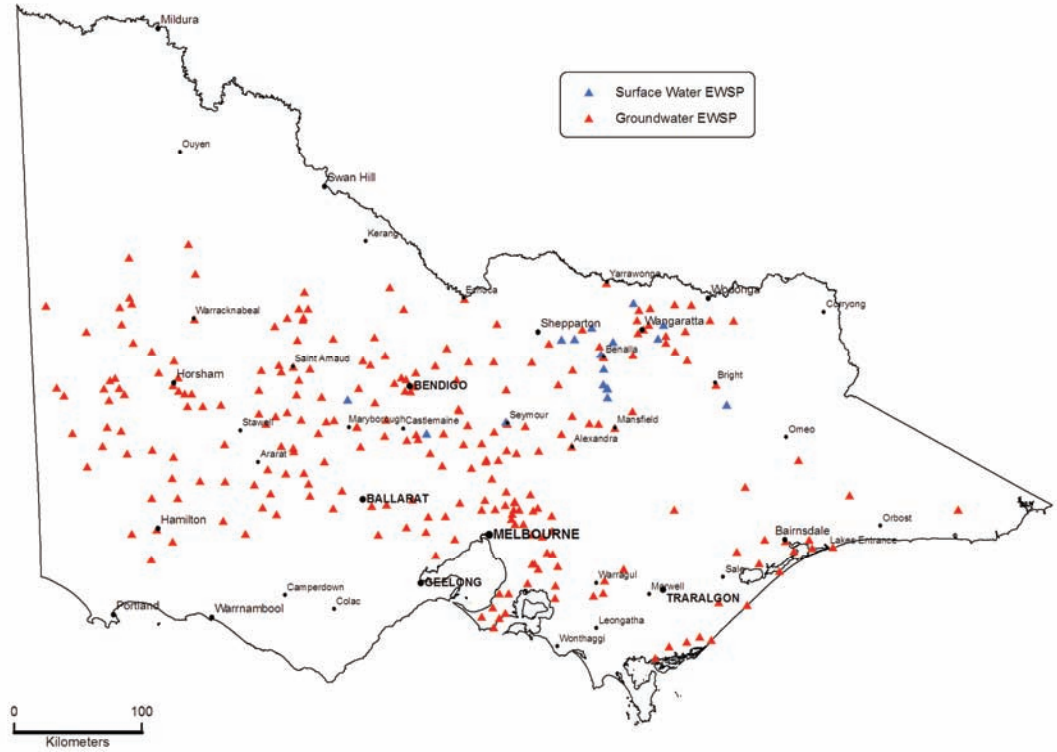
Emergency water supply points comprise a combination of municipal drought relief bores, urban surface water standpipes and surface extraction points on channels and streams.

Since 2006, the government invested $6.2 million (GST inclusive) towards the growth of the network and access to the information and mapping that supports it.

The aim of the emergency water supply points program is to ensure that landholders do not have to travel more than 20 kilometres to access emergency water in the most drought-affected areas. In some instances, some supply points are fitted with Country Fire Authority standard fittings to allow access in case of an emergency.

Local councils are responsible for maintaining water supply points.

Figure 2-5 Emergency water supply point network 2008/09



2.10 Water carting

Water carting is another option used by water coroporations to augment supplies when local sources cannot meet the demand. Doing so, however, is a time-consuming and expensive exercise and is therefore usually only implemented as a last resort to supply smaller towns. Table 2-3 summarises the towns that received carted water in 2008/09.

Table 2-3 Towns receiving carted water 2008/09

Basin	Water authority	Town receiving water	Source of water	Period	Volume
Ovens	North East Water	Springhurst(1)	Wangaratta	March to June	0.13 ML per week
Ovens	North East Water	Bundalong(2)	Yarrawonga	July to August, May and June	20 KL per day
Goulburn	Goulburn Valley Water	Broadford	Seymour	July to August	53 ML
Goulburn	Goulburn Valley Water	Kilmore and Wandong(3)	Seymour	11 to 12 February	1 ML
Campaspe	Coliban Water	Axedale	Bendigo	All year	0.04 - 0.08 ML per day
Loddon	Coliban Water	Raywood(4) and Sebastian	Bendigo	All year	0.03 - 0.14 ML per day
Loddon	Coliban Water	Serpentine and Jarklin	Bendigo	All year	0.02 - 0.06 ML per day
Wimmera	GWMWater	Clear Lake	GWMWater system	All year	500 L per day
Wimmera(5)	GWMWater	Rural customers	GWMWater system	All year	Approximately 70.8 ML
Werribee	Central Highlands Water	Blackwood	Colebrook Reservoir	February to May	0.8 ML
Loddon	Central Highlands Water	Lexton	Ballarat, Learmonth	February to June	0.05 ML per day
Moorabool	Barwon Water	Meredith	Lethbridge	All year	0.2 - 0.6 ML per day

Notes:
(1) Carting required due to an algal bloom in Springhurst Reservoir.
(2) Carting required due to lowering of Lake Mulwala for maintenance works.
(3) Carting required due to fire damage to the Kilmore water treatment plant.
(4) Carting to Raywood began in December.
(5) Part of GWMWater extensive rural water carting program (see below).

GWMWater continued to implement its extensive rural water carting program in 2008/09. It provided emergency water supplies to rural customers in the Wimmera Mallee system who did not receive a house dam fill due to the ongoing dry conditions. Under the program, GWMWater provided 28 kilolitres of water for domestic use every second month. Water was carted from town storages or from other strategic carting sites. Water was also available for carting by customers for intensive industries, stock watering and crop spraying. Overall, some 3,008 deliveries were made to GWMWater customers in 2008/09, totalling approximately 70.8 ML of water.

Goulburn-Murray Water also provided water carting services for domestic and stock purposes across all regions due to the limited availability of water and to maximise operating system efficiency.

2.11 Augmenting water supply systems

A number of water businesses across the state upgraded their systems to augment their water supplies in response to the continuing water shortages. While many of the emergency contingencies initiated in 2007/08 were again employed in 2008/09, a number of important infrastructure projects completed during the year increased both short and long term security of water supplies for both urban and rural customers. Details of these projects are shown in Table 2-4.

A significant amount of work was also completed on the $688 million WImmera Mallee Pipeline Project in 2008/09. By the end of June 2009, GWMWater had completed works on supply systems 1, 2, 7 and 5, and about 70% of supply systems 3, 4 and 6; overall about 90% of the pipeline was complete. Once completed in 2010, the project will have constructed almost 9,000 kilometres of reticulated pipeline to replace more than 16,000 kilometres of existing, highly inefficient open channels.

Table 2-4 Infrastructure augmentations to improve water availability 2008/09

Basin	Water business	Infrastructure	Description
Otway Coast	Barwon Water	Groundwater bores	Construction of bores, pre-treatment plant, pump stations and transfer mains for the Anglesea Borefield project continued in 2008/09. Construction of three of seven production bores and transfer/collection mains (28.6 kilometres of 32.1 kilometres) was completed. The project is due for completion in March 2010
Loddon	Central Highlands Water	Groundwater bores	The Moolort Groundwater project involved drilling and installing production bores and connecting to the Tullaroop raw water pipeline to supply Maryborough. The project was completed in August 2008
Loddon	Central Highlands Water	Groundwater bores	The Coomora Groundwater project involved drilling and installing a production bore and connecting to a pipeline to supply Daylesford. The project was completed in June 2009
Hopkins	Central Highlands Water	Groundwater bores	The Raglan Groundwater project involved drilling and installing a production bore and connecting to the Beaufort supply system. The project was completed in June 2009
Bunyip	Melbourne Water	Treatment Plant	The Tarago Reservoir was reconnected to Melbourne's water supply network with the commissioning of the Tarago Treatment Plant in July 2009. Water from Tarago Reservoir receives full treatment and can supply Melbourne with up to 20 GL of water per annum
Goulburn/ Yarra	Melbourne Water	Pipeline	Construction of a 70 kilometre pipeline linking the Goulburn River near Yea to the Sugarloaf Reservoir in Melbourne's north-east will provide an average 75 GL of supply to Melbourne. The project is due for completion in February 2010
Loddon	Coliban Water	Alternative supply pipeline	Coliban Water completed the construction of a pipeline to transfer recycled water from Epsom Recycled Water Plant to Spring Gully Reservoir
Campaspe/ Loddon	Coliban Water	Pipeline	Coliban Water is constructing a 13.8 kilometre pipeline and pumps to increase capacity of the existing Eppalock to Sandhurst pipeline. The project is due for completion in December 2009, with Stage 1 completed in 2008
Campaspe/ Loddon	Coliban Water	Pipeline	Coliban Water completed the construction of a pipeline and upgrade of the chlorination facility to connect the township of Axedale to the Bendigo water supply system.
Mitchell	East Gippsland Water	Storage lining/ replacement	East Gippsland Water completed works including lining and covers on storages at Wy Yung and Sunlakes to reduce evaporation losses and improve water quality. The 90 ML storage at Eagle Point was replaced with two 6 ML steel tanks
Goulburn	Goulburn Valley Water	Pipeline	Construction of the Broadford pipeline to transfer water from the Goulburn River to Broadford was completed in December 2008
Goulburn	Goulburn Valley Water	Pipeline	Construction of a pipeline from Alexandra to Thornton and Eildon began
Broken	Goulburn-Murray Water	Pipeline	Lake Mokoan was decommissioned, with Broken system supplies maintained from Lake Nillahcootie
Wimmera and Mallee	GWMWater	Pipeline	Construction of the Wimmera Mallee Pipeline continued. Supply Systems 1, 2, 7 and 5 were completed and about 70% of Supply Systems 3, 4 and 6 completed at the end of June 2009. Overall about 90% of the pipeline was complete by the end of 2008/09
Murray, Wimmera and Mallee	Lower Murray Water/FMIT	Pipeline	Replacement of the Robinvale irrigation district water delivery system progressed in 2008/09 with the construction of high pressure pipelines 85% complete and the high pressure pump station 30% complete
Murray, Wimmera and Mallee	Lower Murray Water/FMIT	Metering	Replacement of district irrigation meters continued, allowing improved measurement and management
South Gippsland	Melbourne Water	Treatment plant	A desalination plant will be built to service Melbourne, Geelong, and towns in the Westernport and South Gippsland region. The plant will add an additional 150 GL per annum to Melbourne's water supply system and will be transferred via an 85 kilometre pipe to Melbourne
Kiewa/Ovens	North East Water	Pipeline	Construction of 16 kilometre pipeline from Wodonga to Chiltern
Kiewa	North East Water	Treatment plant	Upgrade of Wodonga Water treatment plant from direct filtration plant to dissolved air flotation
Kiewa	North East Water	Alternative supply pipeline	North East Water commissioned works to provide alternative supply to Wodonga industry. Some 70% of the installation of pumps and pipework to connect industry to fit-for-purpose water supplied from the wastewater treatment plant was completed
South Gippsland	South Gippsland Water	Groundwater bores	South Gippsland Water constructed a bore on Racecourse Road to supplement supplies to Leongatha

Basin	Water business	Infrastructure	Description
Thomson	Southern Rural Water	Automation	To improve system operational efficiency, automation of the main supply carrier and interface with the hydro power station was undertaken and completed
Hopkins	Wannon Water	Reservoir	Construction of additional 290 ML storage at Dales Road to improve security of supply to Warrnambool commenced in April 2009
Glenelg	Wannon Water	Pipeline	Construction of 53 kilometres of pipeline from Rocklands Reservoir to Hamilton commenced in 2009
Glenelg	Wannon Water	Pipeline	Construction of 29 kilometres of pipeline from Casterton to Coleraine was completed in 2009 to provide improved water quality and security of supply for Coleraine
South Gippsland	Westernport Water	Groundwater bores	Westernport Water is constructing three bores in the Corinella aquifer. In 2008/09 two bores were developed and field testing undertaken
Yarra	Yarra Valley Water	Alternative supply pipeline	The first 1.6 kilometres of a pipeline from Craigieburn Aurora treatment plant to new residential development was completed
Tambo	East Gippsland Water	Stoarge lining	Installation of a liner and floating cover at the Sunlakes storage at Lakes Entrance to reduce losses from the water supply system

2.12 Qualification of rights

Rights to water are clearly specified in bulk entitlements, environmental entitlements, water shares and licences (refer to Chapter 3 for details of Victoria's allocation framework). However, in extremely dry years where there is an imminent risk to water supplies, the Minister for Water can declare a water shortage and qualify these rights to maintain essential supplies to towns and rural communities. These powers are specified in section 33AAA of the *Water Act 1989*.

The qualification of rights is used by the government as a last resort approach to managing low water availability: it takes water off one class of water user, often the environment, to supply another and generates uncertainty for everyone. Qualifications were important, however, in securing water supplies in many parts of the state in 2008/09 as the dry conditions continued. To minimise the impacts of qualifying rights, a water business applying for the qualification needed to demonstrate that:

- it could not meet the critical needs of its customers under its bulk entitlement
- all other reasonable contingency options had been identified and implemented
- the impacts on other parties had been assessed and adequate remedial actions identified.

There were 16 qualifications of rights in place across 13 basins during 2008/09. These are summarised in Table 2-5 while more detail is provided in the relevant basin water accounts.

Sixteen qualifications in place at the end of 2007/08 continued in 2008/09. One additional qualification was declared during the year (in the Thomson basin) however the Minister for Water also amended two existing qualifications.

Qualifications played an especially important role in ensuring domestic supplies in the major northern Victorian water systems, particularly at the start of the season when none of the systems had enough water to announce an allocation under bulk entitlements rules. They also facilitated the implementation of contingency measures that increased seasonal allocations to levels at which the water market would be viable. Water on the Yarra and Thomson rivers was retained in storage under qualifications to provide additional reserves for Melbourne.

In total, seven qualifications expired throughout the course of the year. This included six on the major northern Victorian systems, which expired on 30 June 2009.

The Minister for Water also qualified rights to groundwater entitlements in WSPAs in 2008/09. In the Deutgam WSPA, the Minister for Water qualified rights to 0% of licensed entitlement and suspended rights to take water for domestic and stock use until 30 June 2009. A small number of exemptions were applied as part of the qualification. In the Campaspe Deep Lead WSPA, licence volumes were increased by setting it at 65% to support farming enterprises suffering from low surface water availability in the region. The Campaspe Deep Lead WSPA is also subject to seasonal allocations under the management plan as outlined in section 2.8.

Table 2-5 Qualifications of surface water rights in 2008/09

Basin	Number of qualifications in place	Qualification type							
		New diversion point provided	Extended pumping/ diversion times	Reduced passing flow requirements	Differential access by priority entitlements	Modified cap	Access to unallocated water provided	Environmental water traded on market	Volume carried over
Murray	1								
Broken	1								
Goulburn	1								
Campaspe	1								
Loddon	2								
Wimmera and Glenelg	1								
Thomson	3								
South Gippsland	2								
Maribyrnong	1								
Yarra	1								
Moorabool & Barwon	1								
Werribee	1								
Total	**16**								

2.13 Conclusion

Victoria's rainfall pattern over the last 12 years is unprecedented. Streamflows in 2008/09 were mostly lower than those experienced in 2007/08 and most parts of the state continued to experience well below average conditions. This required the government, water businesses and communities to continue to play an active role in managing reduced water availability. The large number of actions taken by water corporations and access to the water market in northern Victoria ensured essential supplies were maintained throughout the year and water resources remained at a sustainable level for commencing the 2009/10 season.

Actions taken to ensure the longevity of groundwater supply included the qualification of rights in the Deutgam and Campaspe Deep Lead WSPAs as well as seasonal restrictions in three WSPAs in line with their management plans.

3 Water for consumptive use

3.1 Victoria's water allocation framework

Victoria's water entitlement system consists of well-defined rights to water and markets to reallocate water between uses.

The government retains the overall right to the use, flow and control of all Victoria's surface water and groundwater resources. The Minister for Water is responsible for issuing entitlements in accordance with the *Water Act 1989*.

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 delivery and use.

3.1.1 Bulk entitlements

A bulk entitlement is a right to use and supply water which may be granted to water corporations, the Minister for Environment and other specified bodies (e.g. electricity companies) with secure tenure in perpetuity.

Bulk entitlements are issued with a range of conditions and obligations set out under Part 4 of the *Water Act 1989*. Bulk entitlements can be held in relation to water in a waterway, water in storage, works of a water corporation, and groundwater. To date, bulk entitlements have generally covered surface water systems.

A bulk entitlement is usually specified in one of two ways:

- 'source' bulk entitlement – an entitlement to harvest water directly from a water source. It typically describes the different sharing arrangements at that source. Source entitlements can cover multiple storages operated in an integrated way within a river basin.
- 'delivery' bulk entitlement – an entitlement to be supplied water from another water corporation's dam or within a system that is regulated by the works of another corporation.

3.1.2 Environmental entitlements

An environmental entitlement is a right to water granted to the Minister for Environment for the purpose of maintaining an Environmental Water Reserve or improving the environmental values and health of the water ecosystems and other users that depend on environmental condition.

Environmental entitlements are issued by the Minister for Water under section 48B of the Water Act. Before the the Act was amended to provide for environmental entitlements, a number of bulk entitlements were issued to the Minister for Environment for environmental water in systems.

Environmental entitlements form part of the Environmental Water Reserve. They enable active management of water to meet specific environmental needs such as fish spawning triggers or maintaining critical habitat during drought.

The objective of the Environmental Water Reserve is to preserve the environmental values and health of water ecosystems, including their biodiversity, ecological functioning and quality of water and other uses that depend on environmental condition. It is the responsibility of the holder of an environmental entitlement to manage it accordingly.

3.1.3 Water shares

The reform of Victorian entitlements in declared water systems meets the National Water Initiative requirement that access to water be separately specified to access to land.

Traditional water rights and take and use licences in declared water systems have been unbundled into three entitlements:

- water share – a legally recognised, secure share of the water available to be taken from a defined water system. A water share is specified as a maximum volume of seasonal allocation that may be made against that share.
- delivery share – the right to have water delivered by a water corporation and a share of the available flow in a delivery system. A share in terms of unit volume per unit of time of the total amount of water that can be drawn from a water system at a certain point.
- water use licences – the right to use water on a specific piece of land. Water-use registration is an authorisation to use water for purposes other than irrigation.

Entitlements in declared systems in Victoria are automatically recorded in the Water Register, the public register of all water-related entitlements in Victoria.

The right to take water in declared systems is not tied to land. Despite this, the government has determined that 90% of water shares must still be associated with land in a declared system. This is achieved through setting a non-water user limit of 10% or as determined by the government from time to time.

Water shares are classed according to their reliability, which is defined by the frequency with which full seasonal allocations are expected to be available. Most water shares are either high reliability or low reliability. Each water

system has separate 10% limits for high reliability and low reliability shares that can be held as unassociated water shares.

3.1.4 Water licences and section 8 rights

A water licence is a licence to take and use water. A water licence can be held by any individual, business or corporation and allows water to be taken from a range of surface water and groundwater sources. Small catchment dams used for purposes other than domestic and stock also require a licence.

In addition to the entitlements that are formally issued, the Water Act enables individuals to take water for domestic and stock purposes from a range of surface water and groundwater sources without a licence. These domestic and stock rights are defined in section 8 of the Water Act and are not formally issued.

The Water Act also legally recognises the amount of water set aside to meet environmental benefits through the Environmental Water Reserve. More details are provided in Chapter 4.

3.2 Consumptive entitlements

Table 3-1 presents a summary of Victoria's consumptive entitlements in both 2008/09 and 2007/08. The total volume of consumptive entitlements changes each year as new entitlements are issued or existing entitlements are modified.

Most basins in the state are capped and therefore only minor changes occur in the total number of entitlements from one year to the next. No new entitlements are created in capped catchments unless the entitlement is purchased from an existing user, ensuring no net increase in entitlement in a capped catchment. The volume of bulk entitlements decreased marginally in 2008/09, mainly due to a decrease in entitlements from the Murray basin to Goulburn-Murray Water and Lower Murray Water (formerly Lower Murray Water, Sunraysia Rural Water and First Mildura Irrigation Trust). While there was a decrease in surface water entitlements, groundwater entitlements increased compared with 2007/08.

The minor change in the volume of licences may be explained by improvements in record keeping by the water businesses, making the current year's estimate more accurate. The increase in groundwater licences results from both an audit of licences across the water corporations responsible for groundwater licensing and the introduction of new groundwater licences in 2008/09.

The impact of small catchment dams reduced compared with 2007/08, a result of farm dams harvesting less water during low flow conditions.

Table 3-1 Consumptive water entitlements in Victoria as at 30 June

Entitlement	Volume 2008/09 (ML)	Volume 2007/08 (ML)
Surface water		
Bulk entitlements(1)	6,008,150	6,065,030
Licences(2)	328,657	330,742
Small catchment dams (mainly domestic and stock)(3)	405,200	494,700
Groundwater licences	1,012,370	950,620
Total water entitlements	**7,754,377**	**7,841,092**

Notes:

(1) An estimate of the total volume of bulk entitlements granted as at 30 June 2009. Total volume does not include environmental entitlements.

(2) Includes only licences issued for unregulated rivers. Licences within regulated water supply systems are not included as they are part of rural water businesses' bulk entitlements.

(3) An estimate of water taken by small catchment dams in 2008/09 includes domestic and stock dams and also small catchment dams for commercial and irrigation use. The latter are required by the *Water Act 1989* to be licensed (or registered), a process that is currently underway. The 2008/09 estimate reflects estimates of prior years and therefore it is likely that some water has been double counted. This is because some water previously classified as from a small catchment dam may now also be counted as a licensed volume.

3.3 Water availability and use

The volume and use of Victoria's water resources for 2008/09 is summarised in Table 3-2.

It is important to note that the water use data presented in this overview and in the Victorian Water Accounts is reported as the volume of water diverted from a water source. It is not the 'use' on a farm or in a town, it is the bulk volume of water extracted from a stream or groundwater bore.

In previous years, the volume of water entitlements issued in Victoria has been far less than the available resource. Table 3-2 however shows that the available streamflow in 2008/09 reduced to 8,244,900 ML, which is not much higher than the 6,742,010 ML of entitlements issued across the state.

The substantial difference between the volume of issued entitlements and volume of water used in 2008/09 demonstrates an important feature of the water allocation framework: an entitlement does not necessarily guarantee that the entitlement volume will always be available for use. An entitlement holder must meet all the conditions attached to that entitlement including meeting passing flow obligations and sharing any shortfall of the available water with other entitlement holders, including the environment. In 2008/09 water businesses addressed each shortfall by

drawing on their reserves in storage and reducing their customers' use of water (through urban restrictions and irrigation allocations) to ensure they operated within the conditions of their entitlements. As a consequence, the total volume of water extracted by water businesses and individuals from waterways across the state was significantly less than the total resource.

The range of drought contingency measures by water businesses is discussed in Chapter 2 and the basin water accounts.

Table 3-2 Victoria's water availability and water taken for consumptive use in 2008/09

	Surface water[1] (ML)	Groundwater[2] (ML)	Recycled water (ML)
Total resource	8,244,900	1,069,990	377,210
Entitlement	6,742,010	1,012,370	Not available
Water used	2,883,440	448,740	115,560

Notes:

(1) Catchment inflow as shown in each basin water balance in the Victorian Water Accounts 2008/09, excluding inter-basin transfers, irrigation return flows and recycled water.

(2) The actual groundwater resource (i.e. the volume of water in aquifers) is unknown and therefore for the purposes of the *Victorian Water Accounts 2008-2009*, the total resource has been assumed to be the total volume of entitlements allocated.

3.3.1 Diversions under surface water consumptive entitlements

Consumptive entitlements are used for many different purposes however they can broadly be classified as either:

- irrigation
- domestic and stock
- urban and commercial
- power generation (which has its own category due to the water-intensive nature of its operations).

Table 3-3 and Figure 3-1 show the diversions made under consumptive entitlements for each of the above four categories.

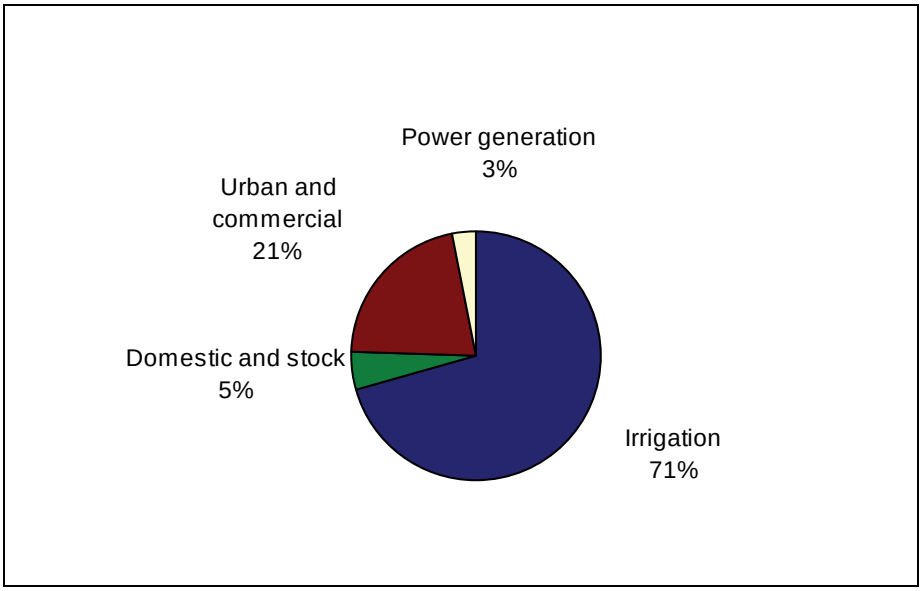
Table 3-3 Surface water diversions made under consumptive entitlements 2008/09

Consumptive end use	Volume of water diverted (ML)
Irrigation	2,036,110
Domestic and stock	139,610
Urban and commercial	615,950
Power generation	91,780
Total consumptive diversions 2008/09	2,883,450
Total consumptive diversions 2007/08	2,984,660

As demonstrated in Table 3-3, the volume of water taken under consumptive bulk entitlements in 2008/09 reduced compared to 2007/08. The reduction in 2008/09 was mainly as a result of lower seasonal allocations in the irrigation districts and lower domestic and stock use. Water diverted for urban and commercial use and power generation increased compared with 2007/08.

Irrigation is still by far the highest category of water use in the state, comprising 71% of all diversions (Figure 3-1). This portion has declined slightly in recent years due to lower allocations (resulting in less water being diverted for irrigation), and is less than the 75% in 2007/08.

Figure 3-1 Total surface water diversions for consumptive purposes in Victoria, 2008/09



3.3.2 Urban surface water consumption

Consumption in urban areas is often measured by the metered volume of water delivered to customers. This figure is less than the water use figures presented in Table 3-3 and Figure 3-1 because water is lost in the distribution network through evaporation and leakage between the point of diversion and point of delivery.

Metered urban water consumption in Victoria increased as water restrictions were marginally eased during 2008/09. Total urban water consumption by residential and non-residential users increased by 3% in 2008/09 compared to 2007/08. The largest increases were in regional Victoria, with regional residential and non-residential customers increasing their water consumption by 16% and 12% respectively. Melbourne residential and non-residential customers decreased their water consumption by 2% and 3% respectively.

Table 3-4 Urban metered water consumption in Victoria 2008/09

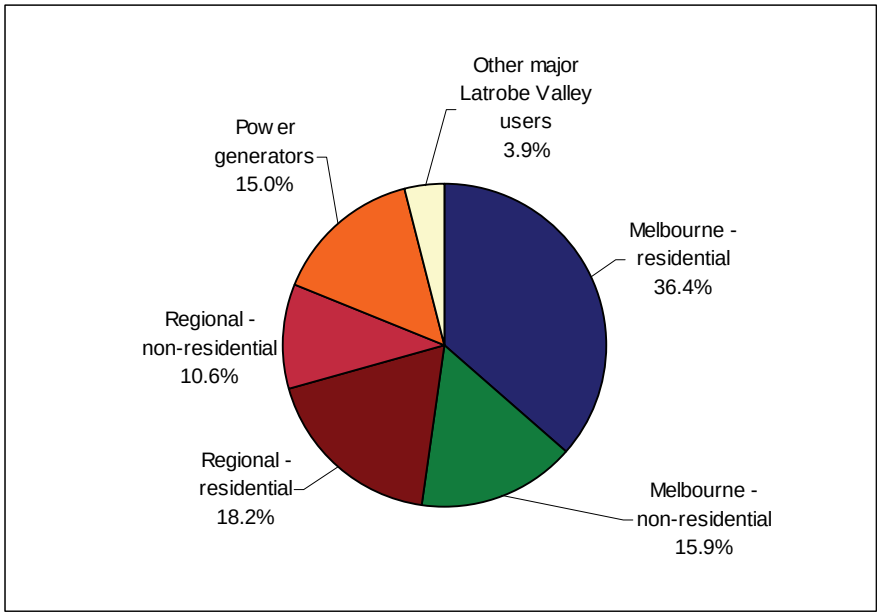
	2008/09 (ML)	2007/08 (ML)	% change
Melbourne – residential	222,570	228,190	-2%
Melbourne – non-residential	97,230	100,290	-3%
Regional – residential	111,290	95,780	16%
Regional – non-residential	64,180	57,430	12%
Power generators(1)	91,780	86,340	6%
Other major Latrobe Valley industrial users	23,952	22,430	7%
Total urban consumption	**611,002**	**590,460**	**3%**

Note:

(1) Water consumption for power generators with their own bulk entitlements represents the volume of water diverted under those bulk entitlements and not necessarily what was ultimately used for power generation.

Table 3-4 is represented as a pie chart in Figure 3-2.

Figure 3-2 Consumptive uses of urban and commercial metered water in Victoria, 2008/09



3.3.3 Consumption by major users

The *Water Act 1989* and *Water Industry Act 1994* require urban water corporations and the metropolitan retailers to publicly report on major urban water customers. These water businesses published in their annual reports the number of customers that fell into a range of water consumption bands. Table 3-5 presents a summary of the major water user information reported for 2008/09.

The number of customers using more than 50 ML in 2008/09 has decreased by more than 8% compared to 2007/08. This decrease in major water users, particularly those using between 50 ML to 300 ML of water per year, can be attributed to a range of factors, including the significant savings made through water efficiency improvements in the non-residential sector.

Table 3-5 Major urban water users in Victoria 2008/09 and 2007/08

Water consumption	**Number of customers**	
	2008/09	**2007/08**
Equal to or greater than 50 ML and less than 100 ML	152	160
Equal to or greater than 100 ML and less than 200 ML	62	75
Equal to or greater than 200 ML and less than 300 ML	24	28
Equal to or greater than 300 ML and less than 400 ML	17	17
Equal to or greater than 400 ML and less than 500 ML	8	7
Equal to or greater than 500 ML and less than 750 ML	11	12
Equal to or greater than 750 ML and less than 1,000 ML	3	4
Greater than 1,000 ML	13	13
Total customers	**290**	**316**

The largest non-residential users of water in Melbourne were originally targeted through the Top 200 Program in which Melbourne's top 200 non-residential water consumers were required to reduce their water consumption. The Top 200 Program proved successful and in 2007, as part of the permanent water saving rules, the Water Management Action Plan (waterMAP) program was implemented. WaterMAP holders have saved 15 GL since the program commenced in 2007.

3.4 Urban water conservation measures

3.4.1 Water Smart Gardens and Homes Rebates Scheme

A key component of the state's water conservation strategy is the Water Smart Gardens and Homes Rebate Scheme. Since January 2003, the scheme has provided over 243,900 rebates for urban water customers and saved almost 2.4 billion litres of potable water each year (to 30 June 2009).

Rebate numbers are higher in 2008/09 because of a special offer in March to May 2009 on the basket of goods, allowing $30 rebates for a spend of $50 instead of the normal $100. Water audit numbers were also up because of audit retrofit programs conducted by some of the water corporations.

Table 3-6 Rebates approved in 2008/09, 2007/08 and 2006/07 under the Water Smart Gardens and Homes Rebates Scheme

Product	Rebates 2008/09	Rebates 2007/08	Rebates 2006/07
AAA shower rose	375	513	2,112
AAA shower rose(1)	577	345	n/a
Dual flush toilet	1,532	1,845	3,389
Greywater permanent tank system	618	790	704
High pressure cleaning device(2)	0	55	705
Hot water recirculator(1)	58	45	n/a
Rainwater tank to toilet system	271	172	399
Rainwater tanks ($150 rebate)	4,462	5,191	4,385
Water conservation audit(3)	10,289	5,446	822
Rebate when purchasing $100 worth of goods	27,717	14,554	19,847
Large tank rebates: 2,000 – 3,999 (previously 4,999) litres (connected to toilet or laundry)(4) (5)	668	850	241
Large tank rebates: > 4,000 (previously 5000) litres (connected to toilet or laundry)(4) (5)	810	749	172
Large tank rebates: > 4,000 (previously 5,000) litres (connected to toilet and laundry)(4) (5)	1,303	1,320	278
Total number of rebates	48,680	31,875	33,054

Notes:
(1) Rebate commenced 1 July 2007.
(2) Rebate finished June 2006.
(3) Rebate increased to $50 on 1 January 2007.
(4) Rebate commenced on 1 January 2007.
(5) Large tank sizes changed to 4,000 litres from 1 July 2009.

3.4.2 Urban residential water consumption

Victoria's urban residential water consumers have responded to the ongoing drought by reducing their water consumption by modifying their behaviour, complying with urban water restrictions, and through accessing rebates for water saving and harvesting devices.

As mentioned in section 3.4.3 in this document, Melburnians were also asked to go a step further by aiming for a per capita daily water consumption of 155 litres.

Table 3-7 provides urban residential water consumption figures for the top 20 population centres within Victoria. Total volumes of water consumed have been obtained from the 2008/09 annual reports of relevant water corporations while the average volumes of consumption have been calculated by the Department of Sustainability and Environment.

The data presentated in Table 3-7 is not intended to be comparative in view of the different levels of restrictions applying, different climatic conditions driving demand for water and different dwelling densities across the population centres. Information within the table on water restrictions applicable to locations in 2008/09 adds context to the water consumption levels for each location.

At a different scale Figure 3-3 provides a geographical context in which differing water consumption levels are recorded.

Locations identified in the table may incorporate surrounding districts. Refer to the table's notes to establish whether additional locations are accounted for in locations identified above.

Table 3-7 Urban residential water consumption and water restriction levels for the top 20 population centres in Victoria, 2008/09

Location	Permanent population	Average residential consumption (L) per capita per day[1]	Total residential consumption (ML)[1]	Water restrictions levels
				July 2008 / August 2008 / September 2008 / October 2008 / November 2008 / December 2008 / January 2009 / February 2009 / March 2009 / April 2009 / May 2009 / June 2009
Bacchus Marsh	19,040	169	1,174	
Bairnsdale	25,350	293	2,713	
Ballarat & district	95,693	161	5,627	
Bendigo	84,845	188	5,822	
Colac & district	14,953	334	1,821	
Cowes & district	13,440	201	987	
Echuca	12,935	280	1,321	
Geelong[2]	255,798	178	16,652	
Horsham	13,441	230	1,127	
Melbourne	3,844,179	159	222,568	
Melton	50,937	167	3,112	
Mildura[3]	42,011	436	6,685	
Moe/Newborough[4]	15,056	311	1,709	
Morwell/Traralgon & surrounds[5]	43,015	298	4,673	
Shepparton[6]	40,920	338	5,042	
Sunbury/Macedon	63,183	150	3,473	
Wangaratta	19,763	263	1,897	
Warragul/Drouin	17,997	257	1,690	
Warrnambool	28,433	242	2,212	
Wodonga[7]	33,277	224	2,723	

Legend	
Permanent water savings rules	
Stage 1	
Stage 2	
Stage 3	
Stage 3A	
Stage 4 with exemptions	
Stage 4	

Notes:

(1) Totals appearing in this column are sourced where possible from 2008/09 annual reports for the relevant water corporations.

(2) Geelong also includes Lara, Batesford, Waurn Ponds, Fyansford and adjoining semi-rural development, Leopold, Drysdale, Clifton Springs, Portarlington, Indented Head, St Leonards, Queenscliff, Point Lonsdale, Ocean Grove, Barwon Heads, Torquay, Jan Juc, Anglesea, Winchelsea and Birregurra.

(3) Mildura also includes Merbein and Irymple.

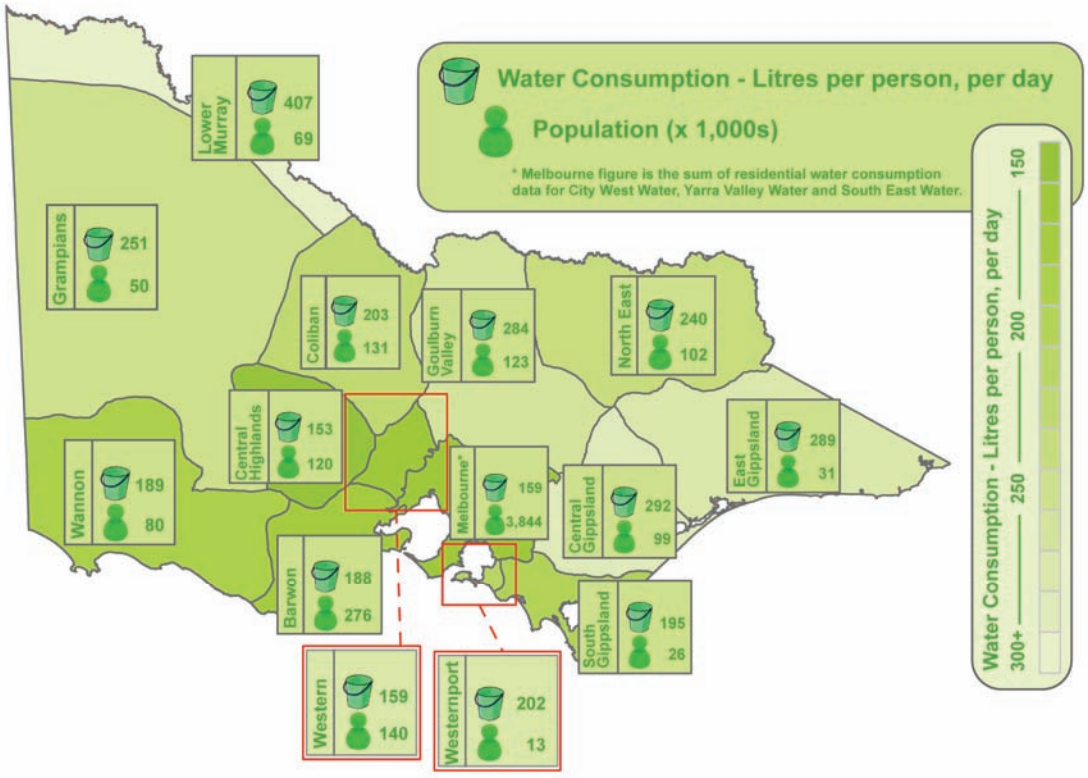
(4) Comparison of the population reported for Moe/Newborough in Table 3.7 in the Victorian Water Accounts 2007-2008 with the table above will show a significant decrease. The population reported in 2007/08 was incorrect.

(5) Morwell/Traralgon and surrounds include Churchill, Cowwarr, Glengarry, Hazelwood North, Morwell, Rosedale, Toongabbie, Traralgon, Traralgon South, Tyers and Yinnar.

(6) Shepparton also includes Congupna and Tallygaroopna.

(7) The consumption figures for Wodonga are the average of the last three years' metered volumes sold. All figures have been rounded.

Figure 3-3 Per capita per day water consumption by water corporation



3.4.3 Target 155

The Target 155 campaign was launched by Premier John Brumby and Water Minister Tim Holding in November 2008.

Target 155 is a voluntary campaign to reduce Melbourne's average residential consumption to less than 155 litres per person per day.

Combined with Stage 3a water restrictions, Target 155 was designed to achieve similar savings to Stage 4 water restrictions while offering the community greater flexibility in how to achieve the target.

Target 155 is based on a highly successful campaign in south-east Queensland which saw a large reduction in residential water consumption. A similar program was also used in Ballarat.

Based on consumption levels at November 2008, the average per person per day use in Melbourne was around 180 litres over summer, while throughout the year it was approximately 165 litres.

Melburnians used less than 155 litres per person per day for 22 out of 31 weeks of the campaign to 2 July 2009.

However there was high water use during the January and February heatwaves which significantly skewed the average for a few weeks. The average use by Melburnians between 1 December 2008 and end of June 2009 was 157 litres per person per day.

3.4.4 Schools Water Efficiency Program

Savings of potable water continued in 2,200 primary and secondary schools connected to the reticulated water supply system. Operating since 2006, the Schools Water Efficiency Program (SWEP) offers schools the opportunity to identify and implement low cost solutions to achieve indoor water savings. Savings can be achieved through measures such as flow control valves on taps and water fountains and identifying and repairing leaks.

Registration for the SWEP finished in June 2009 by which time 1,737 schools had registered. Of these, 1,735 had completed the audit and over 1,195 had completed all works. The program has achieved an average water savings per school of about 10%, saving more than 276 ML per year by the end of 2008/09.

In May 2008 the Department of Education and Early Childhood Development mandated that all of Victoria's public schools participate in SWEP. This action has ensured that all public schools participated in the program unless major changes or renovations were occurring at the school.

3.4.5 Stormwater and Urban Water Conservation Fund

By the end of 2008/09 a total of $10 million in funding was committed under the Stormwater and Urban Water Conservation Fund for 68 projects in metropolitan and regional Victoria.

Based on the estimates provided by the project proponents, approximately two gigalitres per annum of potable water will be saved.

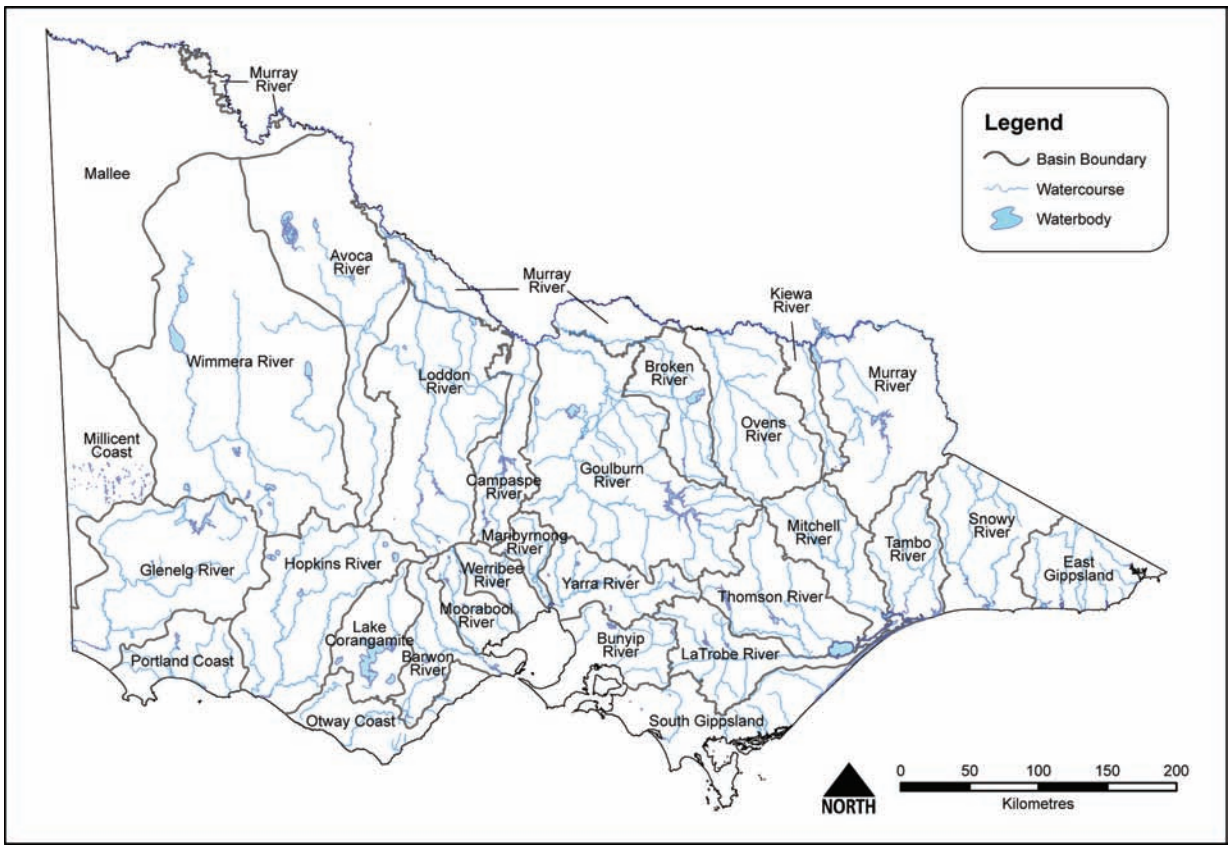
In addition, a further $14 million was made available for projects after non-government investment was leveraged.

Projects under the program to date have delivered significant financial returns, with potable water substitution achieved in 2008/09 at a direct cost to government of approximately $260 per megalitre.

A number of projects are considered to be of particularly high value and will potentially serve as demonstration projects for the development of water sensitive cities and towns.

3.5 Surface water entitlement and use

Figure 3-4 River basins in Victoria



The following information on water taken from Victoria's rivers is summarised according to river basins as defined by the Australian Water Resource Council (AWRC). The exception to this 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. The extent of each of Victoria's river basins is shown in Figure 3-4. Refer to the Victorian Water Accounts in Part 2 of this report for details of water availability and use in each basin.

Water businesses have an obligation to report on water diversions against their entitlements in their annual reports. These annual reports can be found on the website of each water business.

The Victorian Water Accounts in Part 2 of this report show water use against each bulk entitlement and an assessment of compliance with the entitlement volume. Some bulk entitlements have an upper limit described, for example as a five-year or 10-year rolling average. The outcome of the compliance calculation is reported in the relevant basin chapter.

The information on water diversions against water business entitlements in Part 2 is as reported in water business annual reports except where water businesses have provided updated information.

Table 3-8 shows the volume of entitlements and water used under bulk entitlements, licences and rights in each basin and the volume diverted from waterways in 2008/09. The volume diverted in each basin is within the entitlement volume.

As a result of the ongoing drought, the volume of water taken under bulk entitlements in 2008/09 was 40% of the entitlement volume. Water taken from basins such as the Campaspe, Loddon, Glenelg, Wimmera, Werribee, Moorabool, Corangamite and Maribyrnong was again well below average because water availability was severely limited in those basins.

Table 3-8 Volume allocated and taken under surface water entitlements in 2008/09

Basin	Bulk entitlements[1]			Unregulated river licensed diversions[1]			Small catch-ment dams
	Entitlement volume[2] (ML)	Volume taken[3] (ML)	Volume taken (% of entitlement volume)	Entitlement volume (ML)	Volume taken (ML)	Volume taken (% of entitlement volume)	Volume taken[4] (ML)
Murray	2,095,070	902,960	43%	29,090	4,200	14%	6,500
Kiewa	1,160	500	43%	18,590	4,200	23%	3,900
Ovens	58,410	21,650	37%	24,500	7,600	31%	15,900
Broken	47,600	10,470	22%	9,800	200	2%	15,800
Goulburn	2,139,990	688,990	32%	40,260	5,200	13%	47,500
Campaspe	140,090	5,930	4%	9,240	100	1%	19,100
Loddon	135,110	3,160	2%	27,950	100	0%	21,500
Avoca	380	120	32%	3,620	1,600	44%	12,700
Mallee	0	0	n/a	0	0	n/a	0
Wimmera	206,470	15,160	7%	2,490	1,800	72%	14,400
East Gippsland	620	130	21%	910	330	36%	1,100
Snowy	2,200	810	37%	3,940	1,470	37%	3,400
Tambo	3,650	40	1%	4,180	1,340	32%	3,900
Mitchell	5,900	4,490	76%	16,290	14,820	91%	4,500
Thomson	458,940	327,060	71%	12,010	5,130	43%	7,000
Latrobe	216,840	137,760	64%	16,740	8,490	51%	20,500
South Gippsland	15,620	7,180	46%	13,290	8,100	61%	24,300
Bunyip[5]	0	3,130	n/a	17,670	6,030	34%	15,500
Yarra	411,250	244,390	59%	45,290	15,200	34%	15,900
Maribyrnong	9,920	740	7%	1,900	360	19%	5,600
Werribee	36,190	3,540	10%	1,220	220	18%	4,900
Moorabool	43,100	2,800	6%	2,050	1,510	74%	15,300
Barwon	55,730	24,230	43%	4,870	1,670	34%	30,900
Corangamite	0	0	n/a	992	67	7%	6,800
Otway Coast	19,230	14,100	73%	8,940	2,670	30%	12,800
Hopkins	630	220	35%	9,610	2,310	24%	31,000
Portland Coast	0	0	n/a	2,085	67	3%	16,200
Glenelg[6]	5,006	1,615	32%	1,030	250	24%	28,300
Millicent Coast	0	0	n/a	100	100	100%	0
Total	**6,109,106**	**2,421,175**	**40%**	**328,657**	**95,134**	**29%**	**405,200**

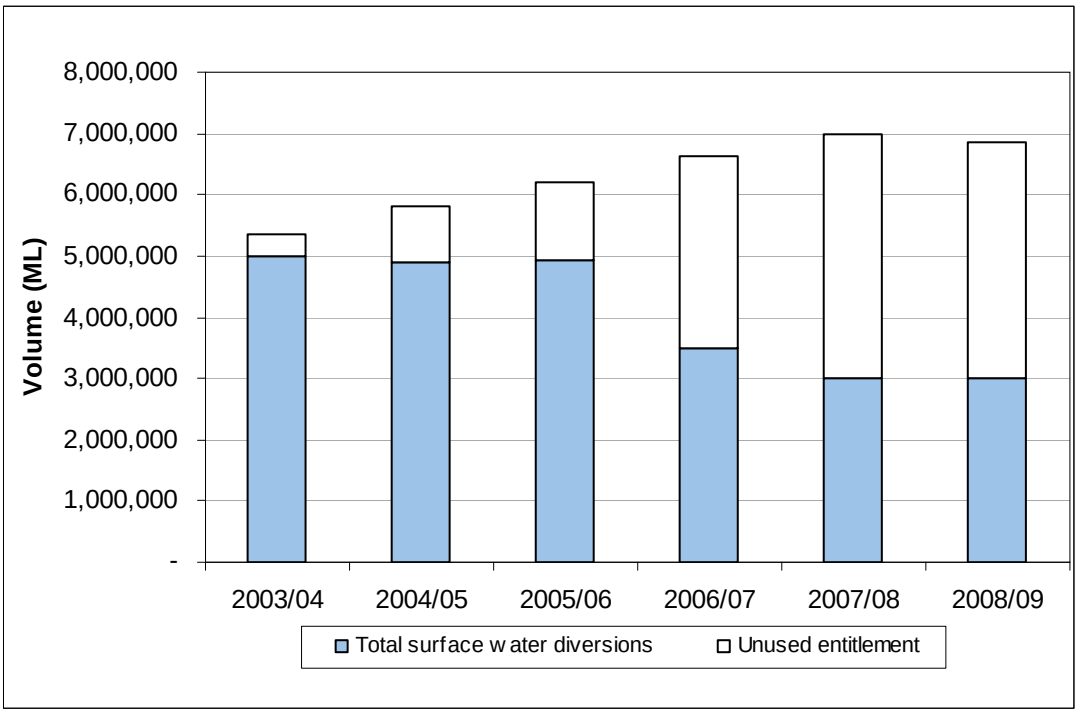
Notes:
(1) Bulk entitlement volume and use rounded to nearest 10 ML.
(2) Estimate of the total volume of bulk entitlement granted as at 30 June 2009. Estimate is for an average year and is not adjusted for trade, caps that are climatically adjusted, or caps that are long term rolling averages. Includes environmental and consumptive entitlements.
(3) Includes water taken under bulk entitlements and water taken under historical rights.
(4) Refers to the total volume of usage from small catchment dams, (i.e. for both domestic and stock and irrigation and commercial use).
(5) The bulk entitlements in this basin had not been finalised by 30 June 2008.
(6) Water taken under the Wimmera and Glenelg rivers bulk entitlement cannot be split into each river basin and is therefore included only under the Wimmera basin for reporting purposes in this table.
n/a: not applicable

Figure 3-5 shows the volume of water diverted under surface water entitlements over the six years to 2008/09. The volume of entitlements differs for the reasons outlined in section 3.2. For the first three years, the volume diverted under these entitlements remained largely stable as most irrigation seasonal allocations remained at or around 100% or more and urban restrictions were lower and isolated to specific regions in the state.

As a result of the ongoing drought, water availability reduced slightly in 2008/09, resulting in reductions in irrigation allocations compared with 2007/08. While the severity of some urban restrictions eased marginally, widespread restrictions remained in place in 2008/09. This included an increase in the number of unregulated streams with irrigation bans or other restrictions compared with 2007/08. The total volume of water diverted in 2008/09 increased

marginally by some 3,980 ML (0.1%) compared with 2007/08. This increase is mainly as a result of increased diversions from the Lower Murray (to former Sunraysia Rural Water) and to the Melbourne water retailers (from the Yarra River).

Figure 3-5 Surface water entitlements and associated diversions



3.6 Groundwater use

Groundwater extraction can be limited by the Minister for Water. The Minister may gazette a permissible consumptive volume (PCV), which is the annual maximum volume of water that may be taken in an area. On 3 July 2008, the Minister for Water declared PCVs for 32 GMAs to cap groundwater extraction and on 29 June 2009 amended nine PCVs. The first bulk entitlement for groundwater was signed by the Minister for Water on 30 June 2009. The entitlement allows Barwon Water to extract 35,000 ML of groundwater over any five year period.

Ongoing drought, reduced recharge, the associated depletion of soil moisture and increased reliance on groundwater to augment urban supplies contributed to declining water levels in several Victorian aquifers.

Full details of water entitlements and use from each GMA and WSPA during 2008/09 are presented in Appendix A. In summary:

- Total groundwater entitlement is approximately 1,012,000 ML across the state.
- The total groundwater use across the state, including domestic and stock, was approximately 448,740 ML, which is comparable to the volume used in 2007/08 (464,420 ML).
- In 2008/09 the total volume of licensed groundwater extracted from GMAs and WSPAs was approximately 358,200 ML (not including UAs). This includes metered use of 314,900 ML and estimated use of 43,300 ML. This is a slight decrease of 3% when compared with 2007/08 (370,900 ML).
- Users in the Shepparton WSPA access groundwater from its shallow system and groundwater pumping has been encouraged to combat rising groundwater levels and control salinity. Drought and climate change, coupled with groundwater pumping, have reduced the risk of rising groundwater levels. The volume extracted in this area fell almost 35% due to falling groundwater levels. This follows a 20% drop in extractions from the previous year.
- Domestic and stock use is estimated to account for approximately 11% of total groundwater use, which is equal to the estimated domestic and stock use in 2007/08.
- In Victoria's GMAs, licensed groundwater entitlements totalled 255,040 ML with total use of 128,980 ML consisting of 66,880 ML of metered extractions and an estimated 42,960 ML of unmetered extractions. Estimated domestic and stock use in these areas was 19,130 ML.
- Licensed groundwater entitlements in WSPAs totalled 644,195 ML. Total use of 270,540 ML consisted of 248,000 ML of metered extractions, an estimated 310 ML of unmetered extractions and estimated domestic and stock use of 22,230 ML.
- Estimated groundwater entitlement in the unincorporated areas was approximately 113,140 ML, with approximately 49,220 ML extracted. This is similar to 2007/08 where entitlement was approximately 120,000 ML

and 44,800 ML was extracted.

- The total volume of groundwater extracted for urban use in 2008/09 was 25,750 ML, which is approximately 5.5% of the total groundwater extracted.
- Approximately 64 towns are reliant on groundwater as either a supplementary or primary water supply, which is consistent with 2007/08. The largest of these is Geelong with extraction of 12,438 ML. In 2007/08, Barwon Water initiated an investigation to source additional groundwater supplies from the Jan Juc GMA to secure a future water supply for the area. A bulk entitlement was issued on 30 June 2009 to supplement existing supplies. Groundwater extraction will commence in the Jan Juc GMA in 2009/10. Figure 3-6 shows the location of towns where groundwater is used for urban water supply.

Permanent and temporary trade of groundwater occurred across the state, with 26 permanent trades totalling 1,782ML and 241 temporary trades totalling 20,751ML. The majority of groundwater trading occurred in the northern region of Victoria.

Figure 3-6 Location of towns where groundwater is used for urban supply

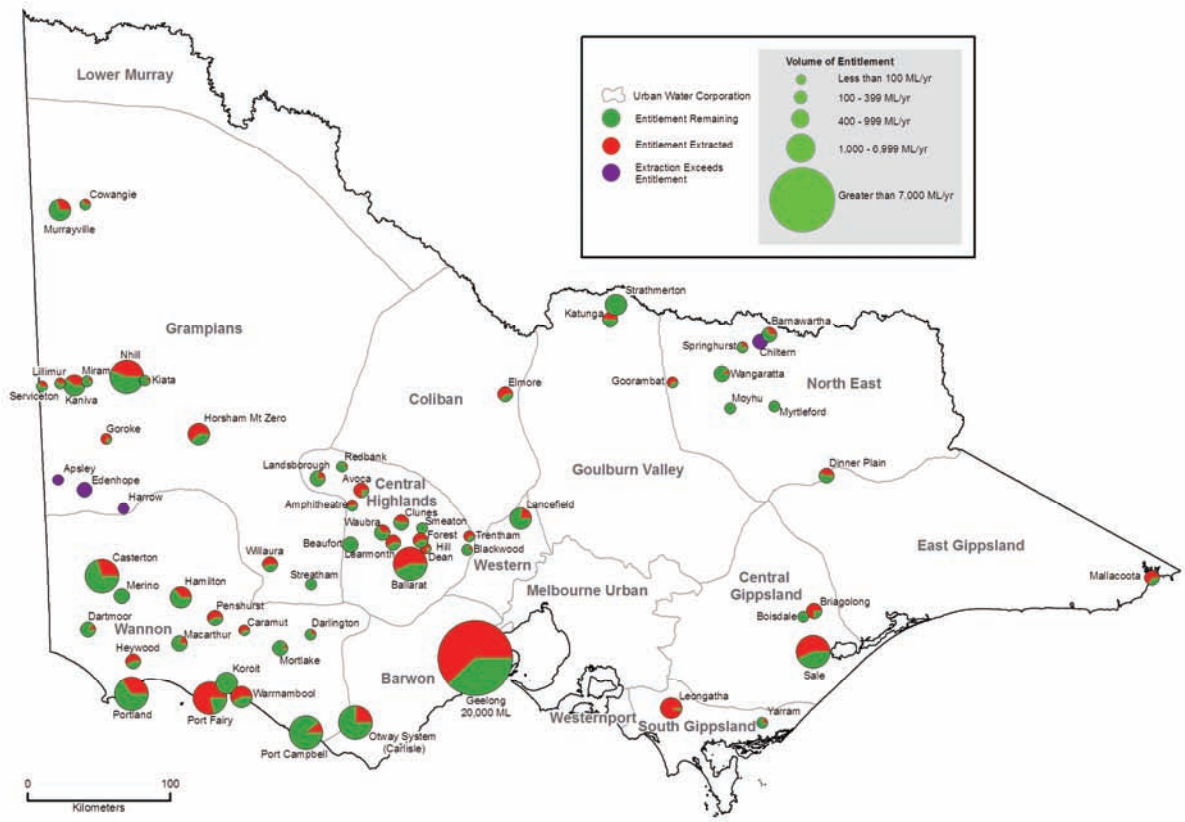
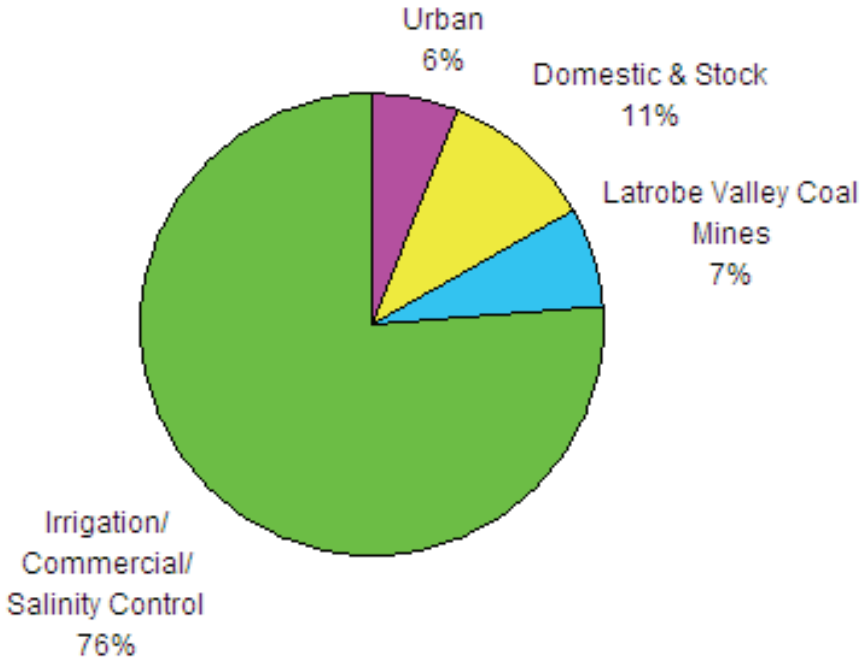


Figure 3-7 shows groundwater extraction by use in GMAs and WSPAs.

Figure 3-7 Groundwater extraction by use in GMAs and WSPAs



3.7 Water trade and movement

During 2008/09, water holders in Victoria moved water around the state and between neighbouring New South Wales and South Australia. Water holders are able to move their water using the following mechanisms:

- transfer and variation of water shares
- allocation trade
- bundled entitlement transfers.

Movement of water associated with each of these mechanisms is difficult to compare because they refer to different water products and are therefore summarised separately in this account.

3.7.1 Water share transfers and variations

Water entitlements in the regulated systems of northern Victoria were unbundled on 1 July 2007. Unbundling separated a holder's entitlement to take a volume of water from the right to use that water on land and have the water delivered. On 1 July 2008, the southern regulated systems of Thomson/Macalister and Werribee were also unbundled. Water shares (the unbundled entitlement to take an ongoing share of the water resource) can be transferred to another person (with a water share transfer) and can be associated with a different parcel of land or disassociated from land (with a water share variation).

The volume of water shares transferred or varied in Victoria during 2008/09 is summarised in Table 3-9.

This table shows movement of water shares according to where they are intended to be used rather than where they are sourced. The source of water shares now rarely changes, however the use may change frequently as holders choose to move their water.

Table 3-9 Water share transfers and variations, 2008/09[1][2]

Location	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Murray	135,853	160,272	-24,420	35,937	49,159	-13,222
Ovens	633	737	-104	211	230	-19
Broken	774	806	-32	150	156	-6
Goulburn	50,876	84,899	-34,023	27,982	40,563	-12,581
Campaspe	1,518	2,716	-1,198	876	1,041	-165
Loddon	5,531	13,698	-8,168	8,768	18,191	-9,423
Non water users[3] (northern Victoria)	106,879	38,935	67,944	46,990	11,574	35,416
Non water users[3] (southern Victoria)	443	0	443	275	55	220
Thomson/Macalister	31,899	32,342	-443	15,103	15,323	-220
Werribee	274	274	0	93	93	0
All Victoria 2008/09	**334,679**	**334,679**	**0**	**136,384**	**136,384**	**0**
All Victoria 2007/08[4]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:

(1) This table summarises all water share transfers and variations recorded in the Victorian Water Register during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table. Variations may not involve a change of ownership.

(3) When water shares are disassociated from land they are classified as being in the Non Water User Category.

(4) Details of water share transfers and variations for 2007/08 are not available due to changes in reporting systems and unbundling of the Thomson/Macalister and Werribee systems on 1 July 2008.

The volume of high reliability water shares transferred or varied in the northern basins was 302 GL compared with 33 GL in the south. Water markets in northern Victoria are more developed than the south where there is a larger volume of entitlements, more irrigators and a longer history of trading water.

Water shares continued to be disassociated from land with a record volume of water shares moving to the non water user category. A total of 104 GL moved into the non water user category during 2008/09, compared with 70 GL in 2007/08. This included transfers to Coliban Water and Central Highlands Water for Bendigo and Ballarat, transfers to the environment, some purchases by investors. The largest category was irrigators disassociating their water shares to increase their management options.

3.7.2 Allocation trade

In the unbundled systems, water share holders can buy and sell allocation (seasonal allocation made against water shares) through a trade of allocation. The volume of allocation trade in Victoria during 2008/09 is summarised in Table 3-10. This table shows allocation trade according to where the water is stored or sourced, rather than where it is intended to be used. This is appropriate because a trade of allocation doesn't mean that the water will necessarily be used in that location in that year.

Table 3-10 Allocation trade in Victoria, 2008/09[(1)(2)(3)]

Basin	Bought (ML)	Sold(ML)	Net transfer to basin (ML)
Murray	337,857	168,303	169,554
Ovens	1,405	1,405	0
Broken	1,565	1,565	0
Goulburn	211,263	166,580	44,683
Campaspe	3,322	1,145	2,177
Loddon	106	78	28
Thomson/Macalister	20,032	20,032	0
Werribee	53	53	0
New South Wales	7,155	242,890	-235,735
South Australia	22,642	3,350	19,292
All Victoria 2008/09	**605,401**	**605,401**	**0**
Northern Victoria 2007/08[(4)]	**478,353**	**478,353**	**0**

Notes:

(1) This table shows allocation trade statistics from the Victorian Water Register for all trading zones (regulated, unregulated and groundwater). This table is for approved trades only. Some trades were still in progress at year end and will be finalised in 2009/10.

(2) Some 15,259 ML of allocation trades were recorded in the Victorian Water Register that are not included in this table because they relate to temporary transfers of bundled entitlements. These allocation trades included trades of 1,584 ML of surface water entitlements which are included in Table 3-11 and 13,675 ML of groundwater trades that are included in Appendix C.

(3) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

(4) Allocation trade data for 2007/08 only includes northern Victoria since the Thomson/Macalister and Werribee systems were unbundled on 1 July 2008.

A total of 621 GL of allocation was traded on the Victorian water market during 2008/09. This included 601 GL of trade in northern Victoria and 20 GL in southern Victoria. Overall Victoria was a net buyer of allocation, importing 216 GL of allocation from New South Wales and South Australia. This was a significant increase in the net volume imported from 2007/08 of 73 GL.

3.7.3 Surface water bundled entitlement transfers

Despite most irrigation entitlements in Victoria now being unbundled, there are still a number of bundled entitlements (i.e. entitlements where the right to take and use water are not separated) in existence. Bundled entitlement holders are able to transfer part or all of their entitlement on either a permanent or temporary basis. The volume of permanent and temporary transfers of surface water bundled entitlement during 2008/09 is summarised in Table 3-11.

The temporary market for bundled entitlement was more active than the permanent, with 4,136 ML transferred on a temporary basis compared with 339 ML of permanent transfers. Most transfers occurred in the Kiewa basin in the north and the Yarra basin in the south.

Table 3-11 Surface water bundled entitlement transfers, 2008/09[1]

Basin	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin	Bought (ML)	Sold (ML)	Net transfer to basin
Goulburn[2]	2	2	0	40	40	0
Broken[2]	0	0	0	0	0	0
Campaspe[2]	0	0	0	0	0	0
Loddon[2]	0	0	0	0	0	0
Murray[2]	0	0	0	183	183	0
Ovens[2][3]	61	76	-15	480	480	0
Kiewa[2][4]	89	111	-22	881	881	0
Avoca	0	0	0	0	0	0
Mallee	0	0	0	0	0	0
Wimmera	0	0	0	0	0	0
East Gippsland	0	0	0	0	0	0
Snowy	0	0	0	53	53	0
Tambo	4	4	0	10	10	0
Mitchell	0	0	0	192	192	0
Latrobe	3	3	0	537	537	0
Thomson	0	0	0	203	203	0
South Gippsland	0	0	0	2	2	0
Bunyip	12	12	0	281	281	0
Yarra	130	130	0	585	585	0
Maribyrnong	0	0	0	0	0	0
Moorabool	0	0	0	2	2	0
Barwon	0	0	0	543	543	0
Corangamite	0	0	0	0	0	0
Otway Coast	0	0	0	0	0	0
Hopkins	1	1	0	144	144	0
Portland Coast	0	0	0	0	0	0
Glenelg	0	0	0	0	0	0
Millicent Coast	0	0	0	0	0	0
All Victoria 2008/09	**301**	**339**	**-37**	**4,136**	**4,136**	**0**

Notes:

(1) This table shows the volume of permanent and temporary transfers of bundled entitlement during 2008/09.

(2) Temporary transfers of bundled entitlement in the northern Victorian basins were recorded in the Victorian Water Register as allocation trades between unregulated zones during 2008/09. Even though these transfers were recorded as allocation trades, they have been included in this table rather than Table 3-10 because they are surface water bundled entitlement transfers and should be compared with similar transactions. Data for all permanent transfers and for temporary transfers in the other basins have been provided from water corporation records.

(3) 15 ML of bundled entitlement was transferred out of the Ovens basin as the net loss covers the additional losses incurred in extracting the water further downstream. This volume is effectively returned to the environment.

(4) 22 ML of bundled entitlement was transferred out of the Kiewa basin as the net loss covers the additional losses incurred in extracting the water further downstream. This volume is effectively returned to the environment.

Urban water businesses that participated in the water market in 2008/09 were Central Highlands Water, Coliban Water, Goulburn Valley Water, Gippsland Water, GWMWater and North East Water. Goulburn Valley Water was the most active in terms of the numbers of trades, selling over 9,150 ML of temporary water to irrigators from a number of its bulk entitlements in 37 different transactions. Coliban Water purchased over 13,015 ML of permanent water and 12,200 ML of temporary water. Details of trades are reported in the Victorian Water Accounts for each of the bulk entitlements held by water businesses.

3.8 Recycled water

The volume of water recycled by Victoria's water businesses for use external to treatment plants in 2008/09 increased to a total of 96,636 ML. This represents more than one quarter of the total volume available for reuse at the end of the wastewater treatment process. An additional 18,898 ML was recycled for use within the wastewater treatment process, which increases the proportion of recycled water to 31% of wastewater available for recycling. Note, however, the volumes and percentages used in the following paragraphs only refer to recycled water supplied for use external to the treatment plants.

There was a marginal increase of 691 ML of water recycled for use in 2008/09 compared to 2007/08. The total volume of 377,212 ML of wastewater produced in 2008/09 was lower than the 389,550 ML produced in 2007/08.

In 2008/09, the volume of water recycled by the Eastern Treatment Plant was 22,262 ML, which was an increase on the 21,136 ML recycled in 2007/08. Under the Eastern Irrigation Scheme, Melbourne Water sells Class C recycled water to private sector operator TopAq, which further treats the water to Class A standard and delivers the water to horticultural, recreational and industrial users.

The volume of water recycled by the Western Treatment Plant reduced from 56,778 ML in 2007/08 to 54,847 ML in 2008/09. This decrease is largely attributable to lower use of recycled water by agriculture, decreasing from 27,481 ML in 2007/08 to 23,888 ML in 2008/09.

Including the treatment plants operated by the Melbourne metropolitan retailers, the volume of water recycled in Melbourne was 65,439 ML or 23%. The percentage of recycled water is higher outside Melbourne where weather conditions, the availability of land and access to potential purchasers (i.e. agricultural producers) are more favourable. Excluding the wastewater recycled in Melbourne, the remainder of the state recycled 34%, or 31,197 ML, of the wastewater available for reuse. This is higher the 29,022 ML in 2007/08.

Table 3-12 Volume of wastewater recycled in 2008/09

Basin[1]	Total volume of wastewater produced	Volume recycled excluding within process (ML)	% of wastewater recycled excluding within process	Volume recycled within process (ML)	% of wastewater recycled including within process
Murray	7,456	3,387	45%	0	45%
Kiewa	214	124	58%	0	58%
Ovens	1,790	816	46%	0	46%
Broken	292	292	100%	0	100%
Goulburn	6,840	6,645	97%	0	97%
Campaspe	1,308	1,149	88%	0	88%
Loddon	5,426	3,932	72%	1	72%
Avoca	121	121	100%	0	100%
Mallee	n/a	n/a	n/a	n/a	n/a
Wimmera	1,376	1,387	101%	1	101%
East Gippsland	35	35	100%	0	100%
Snowy	217	217	100%	0	100%
Tambo	730	730	100%	0	100%
Mitchell	1,347	1,347	100%	0	100%
Thomson	358	317	89%	0	89%
Latrobe	18,343	593	3%	0	3%
South Gippsland	4,467	319	7%	5	7%
Bunyip	133,986	10,952	8%	14,823	19%
Yarra	9,011	429	5%	1,792	25%
Maribyrnong	2,480	1,375	55%	389	71%
Werribee	146,685	58,054	40%	330	40%
Moorabool	n/a	n/a	n/a	n/a	n/a
Barwon	23,373	2,058	9%	1,453	15%
Corangamite	1,624	398	24%	35	27%
Otway Coast	1,259	322	26%	60	30%
Hopkins	4,957	585	12%	9	12%
Portland Coast	2,330	144	6%	0	6%
Glenelg	1,147	866	76%	0	76%
Millicent Coast	42	42	100%	0	100%
Total 2008/09	**377,212**	**96,636**	**26%**	**18,898**	**31%**
Total 2007/08	**389,550**	**95,945**	**25%**	**17,406**	**29%**

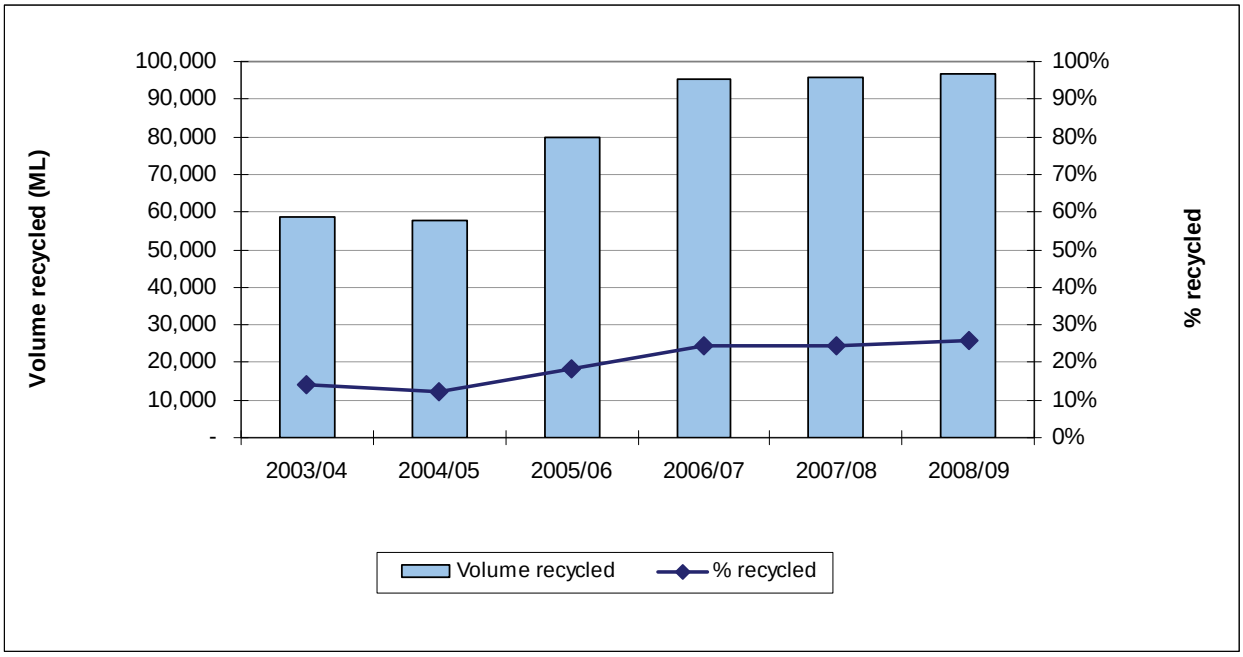
Notes:

(1) Recycled water is reported in the river basin where the wastewater is treated. For example, most of the wastewater treated in the Werribee and Bunyip river basins comes from other river basins.

n/a: Not applicable as there are no wastewater treatment plants within the basin.

Figure 3-8 shows the trend in recycled water over the past five years. In 2003/04 and 2004/05, the volume recycled was slightly less than 60,000 ML, with Melbourne contributing 20,000 ML to 25,000 ML. In the next two years, as demand for recycled water increased due to the drought and more recycling schemes came on line, the volume of water recycled grew substantially, as did the percentage recycled. Melbourne recycled more than 65,000 ML in 2008/09, three times the volume it recycled in 2003/04. Regional Victoria continued to reuse around 34% of the wastewater it produced which, depending on the volumes entering the treatment plants, ranged from around 29,000 ML to 38,000 ML per annum.

Figure 3-8 Recycled water volume and percentage 2003/04 to 2008/09 (excluding recycled water used 'within process')



3.9 Conclusions

Victoria's water entitlement system is made up of well-defined rights to water and markets to reallocate water between users. The total volume of water defined in entitlements in Victoria in 2008/09 was 7,754,367 ML.

More than 9,600,000 ML of surface water, groundwater and recycled water was available for use in 2008/09. The majority of this was surface water, of which 8,244,900 ML was available across the state. This is less than one third of the long term annual average and only slightly more than in 2006/07.

Low surface water availability restricted the volume of water taken for consumptive use. In 2008/09, Victorian water users diverted 2,883,440 ML, less than half of their total surface water entitlement.

Irrigation remained by far the highest category of water use in the state, comprising 71% of all water use. This is despite irrigators being severely restricted in a number of systems.

Low seasonal allocations in the large irrigation districts of northern Victoria ensured the water market was again very active in 2008/09. The majority of water share transfers and variations were from the Murray and Goulburn basins: a net transfer of 24,420 ML of high reliability water shares and 13,220 ML of low and spill reliability water shares from the Murray basin; and 34,020 ML and 12,580 ML of high and low reliability transfers respectively from the Goulburn basin. The volume of high reliability water shares transferred or varied in the northern basins was 302 GL compared with 33 GL in the south. A total of 621 GL of allocation was traded on the Victorian water market during 2008/09. This included 601 GL of trade in northern Victoria and 20 GL in southern Victoria. Overall Victoria was a net buyer of allocation, importing 216 GL of allocation from New South Wales and South Australia from the Murray.

Groundwater use across the state in 2008/09 was also well below entitlement volume at 448,740 ML. This can be attributed to restrictions being placed on groundwater extraction in a number of groundwater management units. The majority of groundwater was extracted under licences within GMAs and WSPAs.

A total of 115,534 ML of wastewater was recycled in 2008/09. This is slightly higher than the volume recycled in 2007/08. Although the volume of wastewater recycled in Melbourne was more than double the volume recycled in regional Victoria, the proportion of wastewater recycled was higher in regional Victoria.

4 Water for the environment

4.1 The environment's share of water

The Environmental Water Reserve (EWR) is the legal foundation upon which water is set aside to maintain the environmental values of rivers, wetlands and streams. Over the last four years, the EWR in many rivers has been reduced by qualifying rights during extreme water shortages to ensure water supplies to some townships.

Rivers have naturally variable flow regimes, reflecting the rainfall and run-off within their catchments. Environmental benefits for rivers can be achieved through seasonal flow regimes and should not be assessed solely on the total volume of water leaving a basin.

The Victorian Water Accounts in Part 2 sets out the basis of the EWR for each basin, which can include water set aside through:

- entitlements for the environment
- passing flow requirements
- streamflow or groundwater management plans
- water leaving the basin, under the section titled 'Rainfall, flows and storages'.

Reporting of the groundwater EWR will be progressively introduced into the Victorian Water Accounts in future years.

4.2 Entitlements for the environment

In 2008/09 the Environment Minister held 13 entitlements for the environment. The use of water held under these entitlements is set out in Table 4-1. Where relevant, the use of this water is described more fully in the separate basin chapters in Part 2.

One new environmental entitlement was created in 2008/09: the Tarago and Bunyip Rivers Environmental Entitlement 2009. This entitles the Minister for Environment and Climate Change to a share of flow into Tarago Reservoir and aims to provide increased environmental flows along the Tarago and Bunyip rivers. As set out in Table 4-1, of the entitlements in place for 2008/09, two were amended with an effective date of 2 April 2009 and 9 April 2009 respectively:

- An amendment to the Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Conversion Order to create an additional 31,512 ML of rules-based water. This amendment reflected water savings from the completion of Wimmera Mallee Pipeline project stages and brings the total water held in this entitlement up to 40,560 ML of water held in storage and 34,739 ML of rules-based water.
- An amendment to the Bulk Entitlement (River Murray – Snowy Environmental Reserve) Order 2004 created an additional 706 ML of environmental water held by the Minister for Environment and Climate Change. This additional water is used to provide increased flows in the Snowy River via a substitution arrangement with the River Murray system.

Victoria is meeting its obligations to provide improved environmental flows in the Snowy River through the establishment of environmental bulk entitlements in the Murray, Goulburn and Broken rivers. These entitlements continue to have water added to them as water savings become available from projects such as irrigation upgrades and the decommissioning of Lake Mokoan, as demonstrated by the amendment in 2008/09 to the Bulk Entitlement (River Murray – Snowy Environmental Reserve) Order 2004. Allocations under these entitlements are used within the Murray and Goulburn rivers to supply consumptive users who would otherwise have been supplied through water diverted from the Snowy River. This water is then shared between the Snowy River and the River Murray to improve environmental flows.

The Barmah-Millewa Forest Environmental Water Allocation is not strictly an environmental entitlement but has many similar characteristics. It is a significant operational rule embedded in consumptive entitlements and is part of the EWR. Under arrangements approved by the Murray-Darling Basin Authority, Victoria and New South Wales contribute environmental water for the long term sustainability of the forest and wetland. Five per cent of water carried over from the entitlement each year is deducted to account for loss of water through evaporation.

Table 4-1 Entitlements for the environment in storage in 2008/09 (ML)

Entitlement	Entitlement at 30 June 2009 A	2008/09 allocation B	Allocation carried over from 2007/08 C	Trade in from CEWH D	Trade in from the Living Murray E	Trade in from DSE water shares F	Donated water G	Total water available in 2008/09 B+C+D+E+F+G	Water used in 2008/09 H	Carried over to 2009/10 B+C+D+E+F+G-H
River Murray										
– Flora and Fauna	27,600	9,660	7,626	3,124	3,000	101	16	23,527	18,166[1]	5,361
– Living Murray	100,412	0	0					0	0	0
Wimmera and Glenelg Flora and Fauna Entitlement	75,299[2]	7,890	3,796	0	0	0	0	11,686	1,390	10,296
Snowy River – Victorian components: • 14,812 ML from the Goulburn System – Snowy Environmental Reserve • 6,988 ML from the River Murray – Snowy Environmental Reserve • 990 ML from the Broken System – Snowy Environmental Reserve	23,496	7,333	12,679	0	0	0	0	20,012	10,932	9,080
Thomson River[3]	10,000	2,000	5,874	0	0	0	0	5,874	0	5,874
Loddon River										
- High reliability	2,000	120	380	0	0	0	0	500	500	0
- Low reliability	2,105	0	0					0	0	0
Yarra River	0	0	0	0	0	0	0	0	0	0
Tarago and Bunyip rivers[4]	0	0	0	0	0	0	0	0	0	0
Silver and Wallaby creeks	0	0	0	0	0	0	0	0	0	0
Goulburn River – Living Murray	141,046	0	0	0	0	0	0	0	0	0
Campaspe River – Living Murray	5,085	0	0	0	0	0	0	0	0	0

Notes:

(1) This figure does not include an estimated 300 ML used in the Campaspe River as part of an inter-valley transfer in 2008/09 because modelling has not been completed to confirm this volume.

(2) This figure consists of 40,560 ML of water held in storage and 34,739 ML of rules-based water.

(3) 2,000 ML not available for the environment to use, kept in storage as part of the emergency contingency plans in place during 2008/09 due to qualification of rights. Used to mitigate any risks associated with the decrease in environmental flows. .

(4) Created in 2008/09. The entitlement in Tarago Reservoir of 10.3% of inflows and 3,000 ML of storage is not available until Melbourne comes off Stage 3A restrictions.

4.3 Drought conditions and environmental water

Victoria's continuing drought demanded that water, which would under different circumstances be used for the environment, be used to ensure the continuation of supply to some urban centres reaching critically low levels of supply. Qualifications of rights, enacted by the Minister for Water, are the legal instrument through which such arrangements are made.

As part of the qualification of rights, environmental risk assessments are undertaken to identify the risks to ecological values from reduced flows. The environmental risk assessments are, where necessary, used to establish emergency monitoring and releases to mitigate impacts.

Qualifications are generally only a short term emergency management measure. Qualifications cease when there is no longer a water shortage, as declared by the Minister for Water. This can be achieved when water supplies are secured through augmentation projects or inflows are sufficient to allow storages to recover.

The EWR was reduced through ten qualifications of rights on the following rivers in 2008/09: Bullarook Creek, Loddon River; Goulburn River, Campaspe River, Coliban River, Creswick Creek, Tullaroop Creek, Moorabool River, Powlett River, Tarwin River and Maribyrnong River.

In order to assist securing Melbourne's water supplies before the desalination plant is commissioned, the Minister for Water had qualified rights in the Yarra and Thomson Rivers in October 2007 and December 2007 respectively. These remained in place throughout the 2008/09 year. The qualifications retained 17 GL of the environment's water in the Yarra storages and 10 GL in Thomson Reservoir. They also reduced environmental flows in the Yarra by up to 10 GL per year and the Thomson by up to 10 GL per year. The environmental risks of the qualification of rights were assessed in detail and emergency monitoring and environmental release arrangements established to mitigate the potential risks to ecological values.

As part of the qualification of rights that reduced passing flows in the Moorabool system, the Corangamite Catchment Management Authority negotiated with Central Highlands Water to receive an environmental emergency contingency allocation. This provided the Moorabool River with 400 ML of water in 2008/09. Of this, 320 ML was used to mitigate risks associated with the qualification and 80 ML was carried over to the 2009/10 water year.

As well as these qualifications, an amendment to the Wannon Water Bulk Entitlement (Hamilton) Conversion Order 1997 reduces passing flow requirements in Grampians headworks streams to secure Hamilton's drinking supplies during severe drought scenarios until the Hamilton-Grampians pipeline is complete.

4.4 Compliance with passing flow requirements

Each water business is required to report on whether it has complied with its obligations to pass flows at dams, weirs and other extraction points specified in bulk entitlements. Generally a high level of compliance was reported during 2008/09 and details are in the basin water accounts in Part 2 of this report. As discussed above in section 4.3, the Minister for Water qualified rights in some systems in 2008/09, including a reduction or removal of obligations to meet passing flow requirements.

Water businesses reported a number of actions were underway in 2008/09 to help improve the level of compliance reporting, including:

- installation of infrastructure and instrumentation
- improved instrumentation and monitoring specifically for passing flow requirements
- spot water quality sampling.

4.5 Total flow at basin outlet

Table 4-2 shows the total amount of water in each basin together with the amount of water that leaves the basin after water is extracted for consumptive use. This is expressed as a proportion of the annual flow of water that would have left the basin if there were no extractions.

Given the highly variable and seasonal nature of flows in Victorian rivers and the complex demands made of them by water extractions for consumption, the total volume of water leaving a basin is not a reliable indicator of river health or other environmental benefits. While this water may have environmental benefits, it does not entirely comprise water protected under the EWR. It also includes water not used under consumptive entitlements and, in some cases, water traded out of a system.

In 2008/09 the basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow were the Loddon (1%), Werribee (2%), Wimmera (0%), Avoca (0%) and Moorabool (3%). The Loddon, Werribee and Avoca basins also had less than 6% of water leaving the basin in 2007/08.

The proportion of annual flow leaving the basin was greater than 90% in 2008/09 in seven basins, down from eight basins in 2007/08. All except the Kiewa were in the south of the state.

Across the state the proportion of total flow leaving the basins has reduced from 66% in 2007/08 to 57% in 2008/09. However, the volume of water leaving the basins decreased by 36% from 7,314 GL in 2007/08 to 4,669 GL in 2008/09, reflecting substantially lower basin inflows.

Figure 4-1 Basin outflows 2003/04 to 2008/09

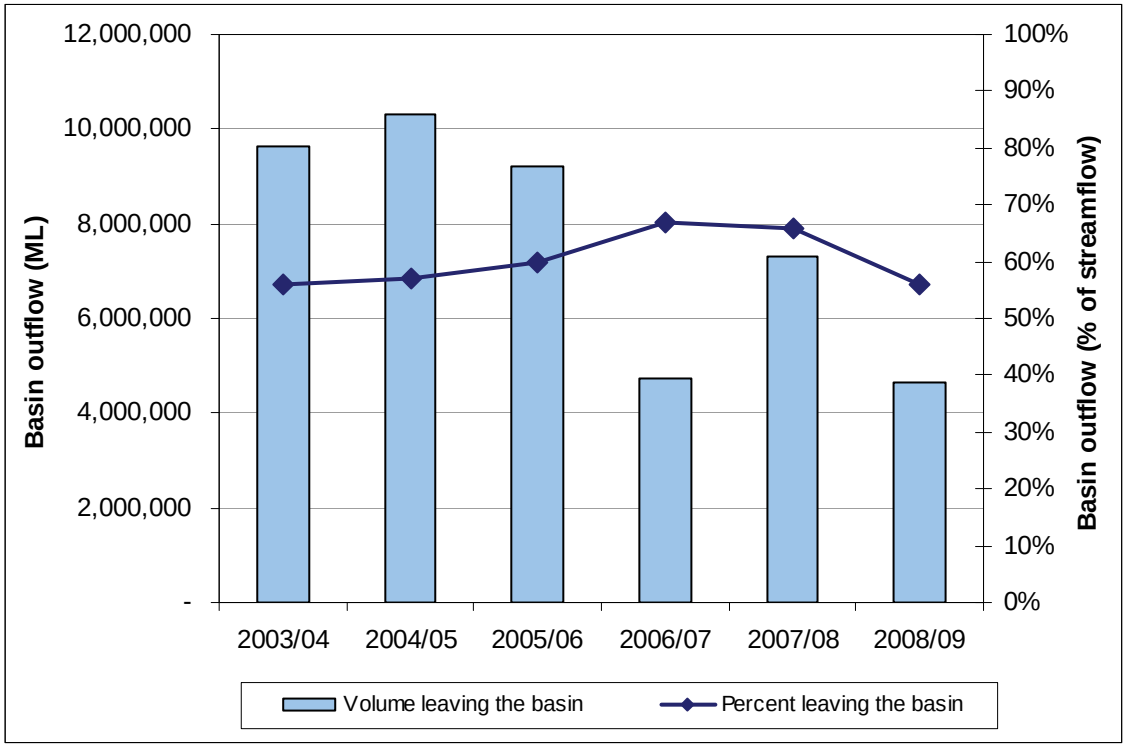


Table 4-2 Volume leaving the basin 2008/09

Basin	Outflow to	2008/09			2007/08	
		Streamflow if no extractions (ML)	Total volume leaving the basin (ML)	Proportion of total flow leaving the basin in 2008/09 (%)	Total volume leaving the basin (ML)	Proportion of total flow leaving the basin in 2007/08 (%)
Murray[1]	River Murray (South Australia)	1,977,900	510,500	26%	404,500	13%
Kiewa[2]	River Murray	302,300	279,200	92%	292,800	90%
Ovens	River Murray	498,600	430,500	86%	525,900	89%
Broken	River Murray	51,200	12,900	25%	21,800	33%
Goulburn	River Murray	933,400	145,900	16%	230,200	18%
Campaspe	River Murray	46,100	3,500	8%	11,700	12%
Loddon	River Murray	31,300	300	1%	3,400	6%
Avoca[3]	Lake Bael Bael and the Marshes	24,200	0	0%	0	0%
Mallee[4]	River Murray	not available	not available	not available	not available	not available
Wimmera[3]	Lakes Hindmarsh and Albacutya	48,700	100	0%	100	0%
East Gippsland	Bass Strait	150,700	149,100	99%	464,900	100%
Snowy (Victoria only)[5]	Bass Strait	538,000	531,600	99%	888,100	99%
Tambo	Gippsland lakes	170,700	163,400	96%	139,500	95%
Mitchell	Gippsland lakes	365,800	340,700	93%	590,700	97%
Thomson	Gippsland lakes	408,300	164,100	40%	927,600	78%
Latrobe	Gippsland lakes	416,200	284,200	68%	426,700	74%
South Gippsland	Bass Strait, Western Port	454,000	409,100	90%	494,700	92%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	296,800	279,600	94%	372,600	94%
Yarra[6]	Port Phillip Bay	395,000	135,400	34%	153,100	40%
Maribyrnong	Port Phillip Bay	20,000	4,000	20%	11,000	42%
Werribee	Port Phillip Bay	14,500	300	2%	500	2%
Moorabool	Port Phillip Bay	28,700	1,000	3%	1,300	3%
Barwon	Port Phillip Bay, Bass Strait	82,700	41,100	50%	112,300	62%
Corangamite[3]	Corangamite lakes	53,200	43,600	82%	43,900	71%
Otway Coast	Bass Strait	479,100	446,100	93%	591,000	95%
Hopkins	Bass Strait	166,000	121,500	73%	117,900	56%
Portland Coast	Bass Strait	141,900	121,200	85%	297,400	94%
Glenelg	Bass Strait	149,600	49,900	33%	189,900	62%
Millicent Coast[4]	South Australia	not available	not available	not available	not available	not available
Total		**8,244,900**	**4,668,800**	**57%**	**7,313,500**	**66%[7]**

Notes:

(1) This table includes only the Victorian component of Murray basin streamflow and Victoria's contribution to the environment's share of total flow. In this case the environment's share is taken to be Victoria's contribution to flow at the Victorian/South Australian border.

(2) Includes the NSW share of Kiewa River flows under the Murray-Darling Basin Agreement.

(3) For the purpose of this table, flow leaving the basin is taken as flow entering the terminal lakes.

(4) There are no significant streams in this basin.

(5) The total inflow is the flow entering from NSW and flows from Victorian tributaries of the Snowy River. Water extracted from the Snowy River within NSW is not included.

(6) Transfers of water into this basin are not included in the total flow.

(7) Proportion of flow leaving the basin inadvertently shown as 59% in Table 4-2 in the *Victorian Water Accounts 2007-2008*.

4.6 Streamflow management plans

Streamflow management plans (SFMPs) determine how river water will be shared between consumptive uses and the environment in declared water supply protection areas in unregulated systems. There were six SFMPs in effect in Victoria at the start of 2008/09, all of which are located in the Yarra basin. Preparatory work continued on a number of others with the focus on rivers with high environmental values that are flow-stressed.

A precursor to the establishment of an SFMP is the declaration by the Minister for Water of a water supply protection area (WSPA) under Section 27 of the Water Act 1989. WSPAs protect the area's surface water resources through the development of a management plan that aims for equitable management and long term sustainability of the resource. One WSPA was declared during 2008/09. The Upper Ovens Catchment WSPA was declared on 2 October 2008 for both groundwater and surface water as a precursor to developing a joint groundwater and streamflow management plan.

Community consultative committees were appointed for three WSPAs in 2008/09 to begin the development of management plans for the Woori Yallock Creek WSPA, Little Yarra and Don Rivers WSPA and Upper Ovens Catchment WSPA.

Compliance with each approved SFMP is reported annually by the relevant water corporation to the Minister for Water and the relevant catchment management authority.

Table 4-3 lists each basin where SFMPs are under development and reports the progress made towards the finalisation of SFMPs within them.

Table 4-3 Status of streamflow management plans

Basin	**Work undertaken in 2008/09**
Kiewa	Reviewed under the Northern Region Sustainable Water Strategy
Ovens River above Myrtleford	WSPA declared, community consultative committee appointed and development of the management plan commenced
Goulburn: King Parrot Creek Yea River Sevens Creek	Reviewed under the Northern Region Sustainable Water Strategy
Thomson: Avon River	Continuing work
Latrobe (upper)	Continuing work
South Gippsland: Tarra River	Continuing work
Yarra: Diamond Creek, Hoddles Creek, Plenty River Pauls/Steels/Dixons Creeks, Olinda Creek and Stringybark Creek	All approved and operational
Woori Yallock Creek and Little Yarra/Dons Creeks	Community consultative committees appointed and development of management plans commenced
Maribyrnong (upper)	Continuing work
Barwon: Main stem and tributaries to the south including Leigh River, but excluding Moorabool River	Continuing work
Otway Coast: Gellibrand River	Continuing work
Hopkins: Merri River	Continuing work
Upper Wimmera River	Continuing work

4.7 Donations

One way in which water can be provided to the EWR is through donations of water to the environment, made via a number of means. Depending upon the nature of the transfer (including whether the transfer is permanent or temporary, and whether it is in a declared or non-declared system) a donation may involve the transfer of water to parties including the Minister for Environment and Climate Change, the Minister for Water, the local catchment management authority, or the secretary of the Department of Sustainability and Environment.

Some 116 ML of water were donated to the environment in 2008/09: 16 ML were used to protect drought refuges and River Red Gums at the Living Murray icon site, Hattah Lakes; and100 ML were donated by community members to provide water to Little Lake Boort. This watering allowed Little Lake Boort to continue to provide important drought refuges and to act as an important community asset.

4.8 Trade in environmental water

The Minister for Environment and Climate Change may trade allocations of environmental water when he is of the opinion that this would benefit the EWR (under section 48L(2) of the Water Act 1989). In 2008/09 trade in environmental water occurred through the Commonwealth Government, the Living Murray program and internal trades.

The Commonwealth established a Commonwealth Environmental Water Holder (CEWH) under the Water Act 2007 (Cth) in order to recover water for the environment through water purchase and investment in infrastructure. The CEWH may eventually hold significant volumes of water in Victorian storages for environmental purposes.

The CEWH delivered 3,124 ML to Victorian sites in 2008/09. Some 2,124 ML were used to help water Hattah Lakes providing drought refuge for plants and animals and to prevent further decline of River Red Gums. The remaining 1,000 ML were delivered to another Living Murray icon site, Lindsay-Wallpolla and Mulcra Islands, to prevent further decline of River Red Gums and to maintain drought refuges for birds, frogs, turtles and fish.

The Living Murray program, run by the Murray-Darling Basin Authority, aims to recover 500 billion litres of water to restore and protect six icon sites along the River Murray. In Victoria this program can provide environmental water to Barmah Forest, Gunbower Forest, Hattah Lakes and Lindsay-Wallpolla and Mulcra Islands. In 2008/09 the Living Murray program provided 3,300 ML for drought refuge for plants and animals and to prevent further decline in River Red gums at Hattah Lakes and Lindsay-Wallpolla and Mulcra islands.

4.9 Conclusion

2008/09 was the third full year of the EWR in operation.

The ongoing drought has presented a number of challenges for the use of environmental water. Managing the balance between the water needs of urban and rural consumers and the environment remained a critical issue during 2008/09.

The EWR was reduced through 10 qualifications of rights in 2008/09 to allow water, which under normal circumstances would be used for environmental purposes, to be used supply townships that reached critically low levels of supply.

The environmental values of rivers, already under great stress because of continuing low inflows have been put at greater risk by the qualifications of rights. This has led to increased monitoring of environmental condition and a careful evaluation of priorities for use of the environment's water. Opportunities have been found to optimise the effectiveness of the reduced volumes available to the environment.

Helped by the realisation of water savings from government initiatives, an increase in water available for the environment in 2008/09 resulted in a 73% increase in environmental releases in 2008/09 compared to 2007/08. The volume of water released under environmental entitlements (excluding the Barmah-Millewa Forest Environmental Allocation) increased from 21,436 ML in 2007/08 to 37,153 ML in 2008/09.

Basin outflows in 2008/09 were lower as a percentage of total inflows as well as the total volume of water leaving than in 2007/08, with the outflows reducing from 7,314 GL in 2007/08 to 4,669 GL in 2008/09. Outflows in 2008/09 were lower than the 2006/07 outflows of 4,747 GL.

One WSPA, the Upper Ovens Catchment WSPA, was declared in 2008/09 and the development of three SFMPs began. Six SFMPs were in operation in 2008/09.

Part 2
Basin water accounts 2008/09

Part 2 presents an account of water in each of Victoria's 29 river basins during 2008/09.

Chapter 5 provides an outline of how the accounts are compiled and identifies the key assumptions and limitations of the data.

Chapters 6 to 34 report on each basin, providing:

- a basin summary, which reflects data contained within the Victorian Water Accounts as well as contextual information about what occurred in the basin in the reporting period
- the current management arrangements for water resources within the basin
- information on rainfall, inflows and storages in the basin in 2008/09
- a map of the basin
- the total water resources in each basin
- surface water, groundwater, recycled water and water for the environment in the basin
- drought contingency measures and seasonal allocations and restrictions on water use, diversions and extractions.

Alphabetical listing of Victoria's river basins

5 Overview of methodology

5.1 Introduction

This chapter outlines how the Victorian Water Accounts are constructed. It presents a number of important assumptions and limitations of the data in the accounts that should be read in conjunction with the information in each basin chapter.

The reporting unit of the Victorian Water Accounts is the river basin – surface water data is reported according to river basin boundaries as designated by the Australian Water Resource Council. This unit is consistent with Victoria's surface water allocation framework, which is predicated on achieving a sustainable balance between water that can be taken from the river for consumption and the water needed by the river itself to maintain its health at a level acceptable to the community.

Some data is not aligned with river basin boundaries and this data has been treated in various ways. For example, groundwater management units (GMUs) often do not fit neatly within river basins and require a different system of reporting. Groundwater is reported within each river basin according to its surface area within the basin to give an indication of the total resource and use.

The accounts present information on the location of diversions and extractions rather than use. Diversions may include (where relevant) urban diversions, irrigation district diversions, regulated licensed diversions, unregulated licensed diversions, environmental water diversions and small catchment dams. Because diversions are recorded at the point of offtake, not the point of end use, they include the volume of transmission losses that may occur prior to water being delivered to customers. Diversions are usually for consumptive uses, although some diversions are for other purposes, including environmental purposes.

All information for each of the 29 basins is provided for the period 1 July 2008 to 30 June 2009. The responsibilities for water management are reported in the Victorian Water Accounts as they existed during the 2008/09 period. Any changes to responsibilities since the end of June 2009 will be reflected in subsequent water accounts.

The accounts are generally reported in megalitres (ML): one megalitre equals one million litres. Volumes of surface water and groundwater entitlements, entitlement transfers and use from surface water entitlements have been reported to the nearest megalitre as required to assess compliance. All other values in the report, such as catchment inflows, the surface water balance and small catchment dam usage have been rounded to the nearest 100 ML to reflect the uncertainty in these values. Gigalitres (GL: one thousand megalitres) are only used where volumes are sufficient to express them in this way.

The *Victorian Water Accounts 2008-2009* does not provide information on water quality or environmental health of waterways unless it affects water availability and use. Details of river health programs are available from the relevant catchment management authorities. An assessment of the environmental health of rivers and streams in each of Victoria's river basins is available in the *Index of Stream Condition: the Second Benchmark of Victorian River Condition* (Department of Sustainability and Environment, 2005) (www.vicwaterdata.net). The benchmark is undertaken every five years and will be available in 2010.

5.2 Data sources

The Victorian Water Accounts are compiled from information obtained from:

- responses to specific data requests from water businesses, catchment management authorities, the Department of Sustainability and Environment, major users of water, alpine resorts and the Murray-Darling Basin Authority
- water consumption and recycled water data collected from water businesses by the Essential Services Commission
- hydrologic information from selected streamflow monitoring sites
- hydrogeologic information from selected groundwater monitoring sites
- climate information from selected rainfall and evaporation monitoring sites, provided by the Australian Bureau of Meteorology and Victorian water businesses
- estimated relationships between water use and climate or hydrologic data, which is produced by water supply system modelling
- water businesses' annual reports and related documents.

5.3 Comparison with 2007/08

This is the sixth year that the water accounts have been compiled. Water balance information for each basin in 2008/09 is presented alongside the values reported in 2007/08 for comparative purposes.

Differences between 2008/09 and previous years are, in most cases, the result of changes in climatic conditions or water use. However, as noted below, some differences are due to improvements in estimation methodologies or data collection methods. In some cases, minor errors, omissions or updates relating to the published 2007/08 data were

identified in preparing the 2008/09 data. In these cases, revised 2007/08 figures have been presented with accompanying notes explaining why those figures are different to what was reported last year.

In many cases, these revisions flow through to the water balance of the relevant basin. Where a revision to a 2007/08 number has already been explained in the table that provides input into the water balance (e.g. a bulk entitlement table), a note has not also been included accompanying the water balance table. Due to the catchment inflows in most cases being back-calculated based on the other items in the water balance, any change to one of those items will also impact the catchment inflow.

5.4 Methodology, key assumptions and limitations of data

A number of key assumptions and limitations of the data presented should be borne in mind when interpreting the accounts. Qualifications and interpretation of the data are provided, usually in the notes below each table. Notes are provided:

- where qualification of the data, or further information is warranted
- where the previous method to calculate or derive information has been revised
- to explain large or significant differences between 2008/09 values and those of the previous year/s
- where data is only applicable to some basins (such as streamflow management plans), in which case the affected basins contain references to the relevant items.

5.4.1 Surface water resources

Surface water is always reported in the basin from which it is extracted. However, the report usually (but not in every case) indicates if water is transferred to another basin (or basins) where it is temporarily stored or used. For example, Coliban Water has a bulk entitlement to divert water from Lake Eppalock, which is located in the Campaspe basin, and then transfer the water to Bendigo, which is located in the Loddon basin. For the purposes of the water accounts, the accounting for that water is undertaken at the point of diversion (i.e. the Campaspe basin) and not the point of use (the Loddon basin).

This similarly applies to Victoria's major cross-basin irrigation supply systems. Information on water supplied to the Rochester Irrigation Area, located at the downstream end of the Campaspe basin, is presented in the Goulburn basin, where its source of supply is located.

5.4.2 Groundwater resources

As noted earlier in this document, the management of groundwater in Victoria is based on allocating resources within:

- groundwater management areas (GMAs)
- water supply protection areas (WSPAs)
- unincorporated areas (UAs).

Groundwater is managed not only across areas, but also at different aquifer depths. In Gippsland, for instance, groundwater is drawn from different aquifers that lie at different depths. Aquifers are nominally attributed to a different groundwater management unit (GMU) and each GMU is reported individually in the water accounts.

The concentration of bores and groundwater use varies considerably across GMUs, which often fall across more than one river basin. It is not possible to accurately apportion groundwater entitlements and use to specific river basins.

In the State Water Reports for 2003/04, 2004/05 and 2005/06, where a GMU had more than 5% of its surface area located within a given basin, it was included in the 'Compliance with licensed groundwater volumes' table and the total volume of entitlement and use was reported. For example, the Goroke GMA is located in the Millicent Coast and Wimmera basins. In the 2005/06 report, the Goroke GMA's total entitlement limit of 2,200 ML was reported in each of the two basins. Whilst this approach ensured some reporting of groundwater within basins, it also resulted in groundwater entitlements and use sometimes being reported more than once.

The accounting for groundwater was revised in 2006/07, with the same method used for 2007/08 and 2008/09. The proportion of a GMU's surface area within a given basin has been used as a proxy for the proportion of the GMU's total entitlement and use that is located within the basin. For example, Cardigan GMA spans the Corangamite basin (where 19.5% of its surface area is located), the Barwon basin (19.8%) and the Hopkins basin (60.7%). Therefore, in the Corangamite basin, all volumes for the Cardigan GMA are accounted for by multiplying the total volume (e.g. entitlement volume, usage etc) by 19%. Two exceptions are the Portland GMA and Gerangamete GMA. The Portland GMA is known to have 6,222 ML of urban licensed volume and this is the only licence where usage was recorded in 2008/09. Therefore 100% of the Portland GMA urban licensed entitlement and metered use is allocated to the Portland Coast basin and not shared on a proportional basis with the Glenelg basin, in which the Portland GMA has 27% of its surface area. Only non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages. The Gerangamete GMA is known to have all its groundwater resources used for Geelong's urban supply in the Barwon basin, therefore 100% of the entitlement limit, licensed entitlement and metered use for Gerangamete GMA is allocated to the Barwon basin. It is not shared on a proportional basis with the Corangamite basin, in which Gerangamete GMA has 14% of its surface area.

It should be noted that when displayed in the report, percentages are rounded to the nearest percent, however the underlying calculation multiplies by the actual percent. In the above example, the Cardigan GMA in the Corangamite basin would show that it has 19% of its surface area within the basin, however all volumes are multiplied by 19.5%.

This method does not perfectly reflect where the entitlement and use is actually located. In the example above, it is likely that groundwater bores are not evenly distributed across the Cardigan GMA and therefore more or less than 19.5% of bores will be located within the Corangamite basin. Further, some bores are licensed to extract more water than others, which will also result in inaccuracies in the volumes reported. However, the revised methodology is likely to result in a more meaningful representation of groundwater entitlements and use in each of the basins.

As in prior years, a GMU will not be reported at all in a basin if it does not have at least 5% of its surface area within the basin. For example, in the Broken basin chapter, Table 9-8 includes the Katunga WSPA, because all of these groundwater management units have more than 5% of their area within the Broken basin. The Shepparton WSPA, with 1.1% of its area within the Goulburn basin, has not been included in Table 9-8, because it is lower than the 5% threshold. In this instance, the 1.1% that is located within the Broken basin is added to the basin that holds the largest proportion of the WSPA's surface area, in this case, the Goulburn basin.

The Minister for Water declares by order published in the government gazette the total volume of groundwater that may be taken from a GMU, which is the permissible consumptive volume (PCV). The entitlement limit included in the groundwater compliance table is set at the PCV of the management unit or, where there is no gazetted PCV, it equates to the sum of all licensed entitlements for the area. This volume is also used as a proxy for the total groundwater resource in Table x-2 in each basin. The total groundwater use in Table x-2 includes both licensed usage and usage from domestic and stock bores.

As groundwater resources in UAs are largely undeveloped, resource information is not currently readily available in these areas and is not reported in each basin. A limitation of this approach is where urban groundwater use is sourced from a UA. For instance, in the Avoca basin, Avoca and Redbank are both supplied by groundwater from a UA, although there is no groundwater compliance table within the Avoca basin because there are no WSPAs or GMAs. In this instance, it was also necessary to amend Table 13-2 to show that there is groundwater available and used in the basin, although there is no groundwater compliance table.

Monitoring and measurement of groundwater resources are constantly improving. These improved measurements (e.g. better metering) have sometimes resulted in variances between the numbers of bores and entitlement/usage volumes in previous reports.

The numbers of domestic and stock bores recorded for each GMU include all bores registered in the Groundwater Management System that are less than 30 years old, as this is the expected average life of a bore. Bore identification numbers were cross-checked with the Victorian Water Register to ensure domestic and stock bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. This is a change to the method applied in previous reports and provides a more consistent, statewide approach to determining domestic and stock bores. The numbers reported are based on the surface area percentage within the basin. As indicated above, those GMAs/WSPAs with less than 5% surface area within the basin are not reported within that specific basin. The number of domestic and stock bores in Victoria has decreased in 2008/09.

The level of metering of groundwater resources is increasing. Generally, metering within WSPAs is approaching 100% of all significant users (all new licences since 2004 have been metered and all historical licences greater than 20 ML are metered), enabling more accurate reporting.

In non-metered areas, an estimate of use based on estimates from the relevant rural water business is provided for the 2008/09 water accounts.

Rounding applied to groundwater resource and total use (Tables X-2 in basin chapters) are to the nearest 10 ML for volumes less than 1,000 ML and nearest 100 ML for volumes greater than 1,000 ML.

5.4.3 Recycled water

Recycled water from towns with wastewater treatment plants has been assigned to river basins according to the point of discharge from the plant to the receiving waters. If all water from a treatment plant is reused and none is discharged to rivers or lakes, the volume is reported within its river basin.

Recycled water data was collected from each water business by the Essential Services Commission (ESC), separated into categories including:

- volume of wastewater produced, excluding evaporation
- volume recycled for urban and industrial uses
- volume recycled for agricultural uses
- volume recycled for beneficial allocations (e.g. environmental flows)
- volume recycled within process
- volume discharged to the environment (ocean outfalls or inland water discharges).

The reuse information collected by the ESC is prepared by each of the relevant water businesses in accordance with the ESC's Performance Reporting Framework (which includes an audit component). Although the ESC has high level

definitions of the end use categories that water businesses must report on, in some cases it is possible that certain recycling activities may be classified by different businesses under different end-use categories.

In the three editions of the State Water Report, the volume of water recycled 'within process' was included in the total volume recycled and the percentage recycled. In the 2006/07, 2007/08 and 2008/09 Victorian Water Accounts, the volume recycled within process has still been included in the volume recycled, but has been excluded from the percentage recycled. This methodology has been applied to be consistent with the percentages reported in the ESC's Annual Performance Report.

5.5 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions on water use due to water scarcity or poor water quality are reported in the basin accounts according to the basin in which the restriction occurs.

For urban water authorities and metropolitan retailers, restrictions target outdoor water use. Each of these urban water businesses has developed restriction policies which are applied in accordance with the drought response plans developed for each supply system. When water restrictions are not in force, all water consumers must still abide by permanent water saving measures. Information on restrictions is generally obtained from annual reports prepared by the relevant water corporations, supported by information collected during the data collection process.

The amount of water made available to irrigators each year is determined by seasonal water allocations. The seasonal allocation differs from urban restrictions in that every year each irrigator is allocated a share of the available resource, which will vary from year to year. This seasonal allocation can be used at any time throughout the irrigation season. Water use can be further restricted via the qualification of rights. While seasonal allocations largely apply to surface water, they are being progressively introduced into groundwater management planning.

Seasonal allocations are expressed as a percentage of entitlement (water share, water right or licensed volume). They are made early in the irrigation season based on the current volume of water in storage, estimated inflows during the season and the amount of water required to provide for subsequent years. Allocations are reviewed by rural water businesses throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water authorities do not know until late spring how much water will be available for use. Seasonal allocations are reported for each basin with an irrigation supply system.

Restrictions on licensed diversions from unregulated streams are typically as follows:

- rostering (also referred to as Stage 1 restrictions): restricts the time or day on which water can be diverted from rivers
- Stage 2, 3 and 4 restrictions: 25%, 50% and 75% reduction respectively in diversion rate
- irrigation ban: no water can be diverted.

5.6 Surface water balance

A number of assumptions were made in preparing the surface water balance for each river basin:

- Only on-stream storages greater than 1,000 ML were included in the water balance. Off-stream storages are not reported because this would otherwise double count the water that has already been diverted from rivers or extracted from groundwater. While storages that are less than 1,000 ML are important locally, they are generally insignificant relative to total storage at a river basin and statewide level. Figure x-1 in each basin includes all major storages over 1,000 ML in the basin – both on-stream and off-stream.
- The unknown item in each water balance is generally the catchment inflows. Inflows have been back-calculated as the sum of basin outflows plus diversions.
- The method of calculating in-stream 'losses', i.e. infiltration from streams to groundwater, flows to floodplains and evaporation, is based on the loss functions used in models such as REALM.
- Unless otherwise reported by water businesses, domestic and stock water users were assumed to divert their full entitlement volume.
- The water accounts exclude diversions from rivers under domestic and stock rights, which do not require a licence. The volume associated with these rights is relatively small.

Inflows to the Kiewa basin, which are shared between New South Wales and Victoria, were reported as a consolidated volume and the outflows were split between New South Wales and Victorian shares.

In the Murray basin, inflows to Lake Victoria were not recorded as inflows to the Murray basin since those flows are actually transfers from elsewhere within the basin. Since the volume held in the Menindee Lakes was lower than the defined threshold under which control reverts to New South Wales, Victoria had no share of inflows to the Menindee Lakes and therefore these have not been included in the Murray basin inflows. A release to the Murray via the Snowy hydroelectric scheme was included as an inflow or transfer to the basin because it is consistent with the water balance protocols established in the methodology.

5.7 Small catchment dams

Small catchment dams include dams used for domestic and stock purposes, which are not required to be licensed. They also include dams used for commercial and irrigation purposes, which are now required to be registered (under the *Water Act 1989*) but for which registration has not yet been completed. When registration is complete, registered dams will be included as part of the unregulated licences category in future water accounts. Small catchment dams filled by domestic and stock channel runs, such as in the Wimmera region, have been excluded.

As in 2007/08, small catchment dam information was sourced from the Department of Sustainability and Environment's Flow Stress Ranking project. During 2006/07 flows were well below average across the state and were the lowest on record in many areas. Because small catchment dams are only able to harvest flows from their upstream catchments, the dams must harvest less water when low flow conditions are prevalent. As a result, usage and the impact on inflows were adjusted to reflect the low inflows. While flows were still below average during 2008/09, flows were generally higher than in 2006/07. As a result, the usage and impact of small catchment dams on inflows were assumed to be similar to that estimated for the 2007/08 year. The 2006/07 methodology of adjusting usage and inflows was applied in the Campaspe, Loddon, Maribyrnong, Werribee, Moorabool, Corangamite, Hopkins and Glenelg basins due to the extreme dry conditions experienced during 2008/09.

Small catchment dam information is presented in terms of average annual data. While the number of dams, their sizes and their uses are generally known, the volume of water that they actually use over the year is not readily available. It is therefore assumed to be similar to the estimated average annual usage.

5.8 Water entitlement transfers

The Victorian Water Register is a register of water entitlements and transactions. It was launched on 1 July 2007 and initially included entitlements in the regulated northern Victorian water systems. On 1 July 2008, the Water Register was extended to include entitlements in the regulated systems of Thomson/Macalister and Werribee in southern Victoria. This register was used to obtain information on water trade in Victoria during 2008/09. The data presented is for all transfers of allocation and water shares which were finalised in 2008/09.

The 'Transfers and variations of water shares in the (catchment) basin' table represents a summary of the movement of water shares into and out of the basin delivery systems during 2008/09. The Murray basin is the only basin in Victoria that trades in interstate entitlements.

The 'Allocation trade in the (catchment) basin' represents an aggregate of the volume of allocation trade (seasonal allocation made against water shares). These tables provide a quantification Victorian water entitlement transfers in the basins.

The 'Transfer of surface water bundled entitlements in the (catchment) basin' summarises the movement of bundled entitlements in the basin during 2008/09. These tables are applicable to basins with bundled entitlements (i.e. entitlements where the right to take and use water are not separated).

5.9 Volume diverted

Water businesses have an obligation to report on water use against their entitlements in their annual reports. These annual reports can be found on each water business's website. The Victorian Water Accounts present:

- the volume of surface water diverted from rivers relative to the volume in each bulk entitlement conversion order. Licensed diversions on regulated streams are reported as part of bulk entitlements. Licensed diversions on unregulated streams are reported as a separate line item in each basin. Volumes diverted under bulk entitlements are provided by the water businesses and have not been audited to ensure compliance was actually achieved.
- the volume of groundwater extracted relative to licensed volume for a GMA or WSPA. This is reported according to the proportion of the aquifer that lies within a basin and not at the individual licence holder level, which is assessed separately by water businesses.

Where a bulk entitlement was not finalised prior to 1 July 2009, compliance against that entitlement has not been assessed in the 2008/09 water accounts and will be presented in future water accounts.

5.10 Drought contingency measures

The drought contingency measures included in the basin chapters were obtained from the questionnaires distributed to water businesses and the Department of Sustainability and Environment's Office of Water. The drought contingency measures reported are intended to highlight the most important short to medium term measures taken and do not represent an exhaustive list.

5.11 Water for the environment

Information set out in this report on water for the environment was obtained from a number of sources. These include:

- annual reports prepared by catchment management authorities and Melbourne Water
- discussion with representatives of catchment management authorities
- responses to questionnaires sent to water businesses with responsibilities for meeting passing flow requirements under their bulk entitlements and section 51 licences

- streamflow management plan annual reports prepared by Melbourne Water
- information held by the Department of Sustainability and Environment's Sustainable Water Environment and Innovation division.

5.12 Comparison of the water accounts with other data sources

The 2008/09 water accounts have been prepared using readily available information. Water accounts for parts of Victoria are also published in the Murray-Darling Basin Authority Independent Audit Group's report on extraction cap compliance and other reports. Some of these documents may not have been finalised at the time of preparation of the water accounts and consequently the values presented in the water accounts may be subject to revision within those documents. The method of reporting may also be different: small catchment dams, for example, are reported in the water accounts but not included in diversion figures for extraction cap reporting.

Water businesses present information individually in each of their annual reports. It is important to note when comparing the water accounts with these annual reports that the water business only reports on its area of jurisdiction. For example, Goulburn-Murray Water and Lower Murray Water only report on water trading that they have each processed, and it is only by presenting the sum of trade processed by these two businesses that an accurate picture of volumes traded can be obtained for the Murray basin.

While all efforts have been taken to ensure the accuracy and completeness of data presented, the Department of Sustainability and Environment is not responsible for the results of any actions taken on the basis of information in this report, nor for any errors or omissions.

6 Murray basin (Victoria)

This chapter sets out the accounts for the Murray basin. For detailed information about how they have been compiled, refer to Chapter 5.

6.1 Murray basin summary

Record low reserves in the Murray system required water resource managers to focus on securing essential domestic and stock water supplies at the beginning of the year.

Seasonal allocations relied heavily on good inflows, which again failed to eventuate. For the third successive year, inflows to Victoria's share of the Murray basin were less than 30% of the long term average.

Allocations in the regulated Murray system began the year at 0% and increased to 35%, which is a record low. For the second year in a row, Goulburn-Murray Water shortened the irrigation season and announced its final seasonal allocation on 1 April 2008. All water resource improvements after this date were directed to building up supplies for the 2009/10 season.

Since both urban and individual entitlements are linked to seasonal allocations on the regulated Murray system, it was necessary to qualify rights to ensure essential supplies could be maintained until allocations reached 20% of high reliability water shares, at which stage an active water market was functioning. Under the qualifications, all towns and private domestic and stock users were given access to water for essential needs.

Urban water corporations were in a better position in 2008/09 to manage the impact of the extreme low allocations by carrying over water and purchasing allocation on the market. No towns supplied by the regulated Murray system were subject to water restrictions more severe than Stage 3 throughout the year.

The water market was again very active in 2008/09 in response to the water shortage. While there was a net export of water shares from the basin, there was a net import of 169,554 ML of allocation. This is an 80% increase compared to 2007/08.

For the third consecutive year, rural diverters on unregulated streams were placed on severe restrictions or banned for much of the year.

Groundwater users in the Katunga WSPA were restricted in 2008/09, however total groundwater use in the basin reduced in comparison with 2007/08, predominantly due to a reduction in extractions from the Shepparton WSPA.

6.2 Responsibilities for management of water resources

In December 2008 the Murray-Darling Basin Authority (MDBA) assumed responsibility for all of the functions of the Murray-Darling Basin Commission. The MDBA is responsible for managing the water resources of the Murray basin on behalf of Victoria, New South Wales, Queensland, the Australian Capital Territory and South Australia under the Murray-Darling Basin Agreement. Under the agreement, Victoria shares the volume of water stored in the basin's storages with New South Wales and holds a share of the total reservoir capacity to store and release its share of inflows. The Murray-Darling Basin Agreement also specifies the minimum volume that both states must pass along the River Murray to South Australia.

Goulburn-Murray Water is responsible for allocating water to bulk entitlement holders from Victoria's share of the water supply storages in the Murray basin.

Table 6-1 shows the responsibilities of various authorities within the Victorian-controlled parts of the Murray basin in 2008/09. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 6-1 Responsibilities for water resources management within the Murray basin (Victoria), 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Murray-Darling Basin Authority(1)				Jointly coordinates waterway management along the River Murray
River Murray Water				Operates the River Murray supply system
Department of Sustainability and Environment				Coordinates Victoria's input to resource management associated with the River Murray
State Water New South Wales				Operates Lake Hume, Euston Weir and the Menindee Lakes on behalf of River Murray Water
South Australian Water Corporation				Operates Lake Victoria and several locks on behalf of River Murray Water
Goulburn-Murray Water	Supplies Murray Valley, Torrumbarry, Woorinen, Tresco and Nyah irrigation areas	Manages private groundwater and surface water diversions on the Victorian side of the River Murray basin upstream of Nyah		Operates Lake Dartmouth, Yarrawonga Weir (Lake Mulwala), Torrumbarry Weir and Mildura Weir on behalf of River Murray Water
Lower Murray Water(2)	Supplies Red Cliffs, Robinvale, Merbein and First Mildura Irrigation Trust irrigation areas	Manages private groundwater and surface water diversions in Sunraysia region	Supplies towns along the River Murray from Swan Hill to the South Australian border including Robinvale and Mildura	
North East Water			Supplies towns upstream of Lake Mulwala, including Wodonga and Yarrawonga	Obliged to meet passing flow requirements
Goulburn Valley Water			Supplies towns in the Murray Valley Irrigation Area including Cobram	
Coliban Water			Supplies towns in the Torrumbarry Irrigation Area	
East Gippsland Water			Supplies Omeo and Dinner Plain	
GWMWater			Supplies towns and farms for domestic and stock water in the Northern Mallee area	
North East Catchment Management Authority				Manages waterways within the North East CMA area
Mallee Catchment Management Authority				Manages waterways within the Mallee CMA area

Notes:

(1) In December 2008, the Murray-Darling Basin Authority assumed responsibility for all of the functions of the former Murray-Darling Basin Commission.

(2) In August 2008, Lower Murray Water was appointed to take over the whole of the functions, powers and duties of First Mildura Irrigation Trust.

6.3 Rainfall, flows and storage in 2008/09

In 2008/09, rainfall in the Murray basin was generally between 60% and 100% of the long term average. Catchment inflows were again low at 26% of the long term average (of 7,618,000 ML[4]). This was third successive year inflows to Victoria's share of the Murray basin were less than 30% of the long term average.

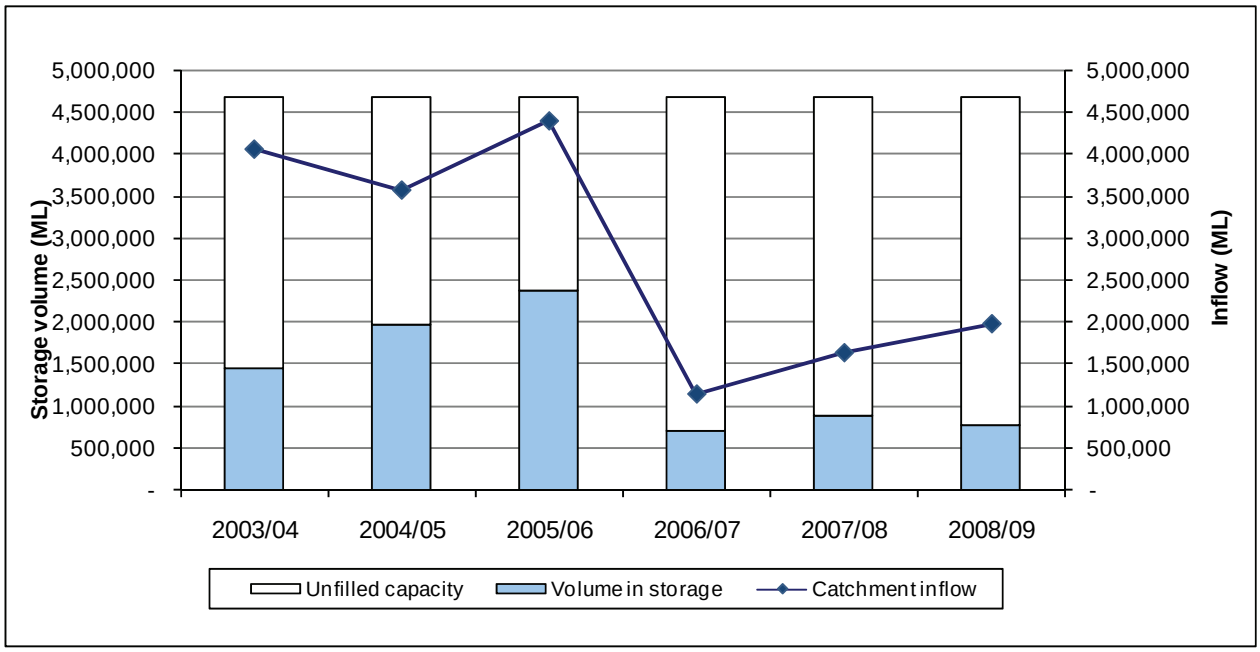
[4] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

The Victorian component of water flowing from the Murray basin to South Australia was 510,500 ML in 2008/09. This represented 26% of the total inflows into the basin, compared with 25% in 2007/08.

Storage volumes for all major storages (greater than 1,000 ML capacity) in the Murray basin decreased from 892,600 ML at the start of the year to 773,700 ML, or 16% of the total storage capacity of 4,684,100 ML. In the Murray basin this includes Victoria's share of Lake Hume, Lake Dartmouth, Kings Billabong, Lake Cullulleraine, Lake Victoria and the Menindee Lakes, however Victoria was unable to access any storage from the Menindee as storage levels were insufficient during 2008/09. This was also the case in 2006/07 and 2007/08.

Only volumes for major on-stream storages have been included in the water balance, and as such, Kings Billabong has not been included.

Figure 6-1 All major storages and catchment inflows in the Murray basin (Victoria)



6.4 Total water resources in the basin

Victoria's share of the total volumes of water available and supplied from water resources in the Murray basin is shown in Table 6-2. The total surface water resource includes Victoria's share of inflows to Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes, Victoria's share of inflows from the Kiewa River, as well as outflows from other Victorian rivers (Ovens, Broken, Goulburn, Campaspe, and Loddon) into the River Murray.

Table 6-2 Summary of total water resources and water use in the Murray basin (Victoria), 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	1,990,700	913,700
Groundwater[2]	124,300	46,000
Recycled water	7,460	3,390

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 6-9 and the estimated domestic and stock use as presented in Table 6-10.

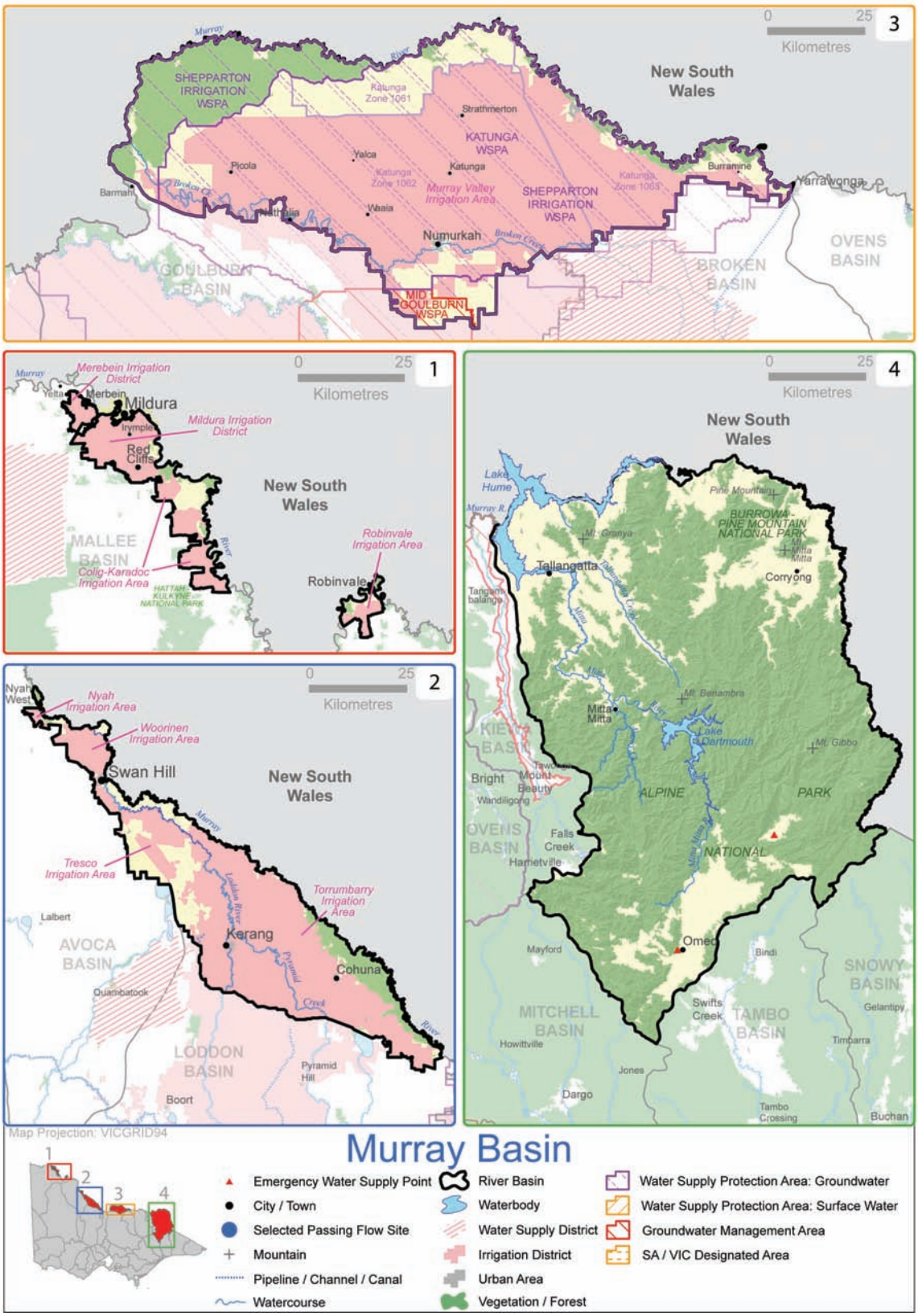
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

6.4.1 Infrastructure projects to improve water availability

During 2008/09 Lower Murray Water began constructing the Robinvale high pressure system upgrade, which involves replacing the current open channel irrigation infrastructure in the Robinvale Irrigation System with a high pressure pipeline. The project will provide an estimated 1,500 ML of water savings per annum and will be complete for the 2009/10 irrigation season.

6.5 Location of water resources

Figure 6-2 Map of the Murray basin (Victoria)



6.6 Surface water resources

6.6.1 Water balance

A surface water balance for the Murray basin (Victoria) is shown in Table 6-3.

Table 6-3 Balance of surface water in the Murray basin (Victoria)

Water account component	2008/09 (ML)[1]	2007/08 (ML)[1]
Major on-stream storage		
Volume in storage at start of year	892,600	715,200
Volume in storage at end of year	772,000	892,600
Change in storage	**-120,600**	**177,400**
Inflows		
Catchment inflow[2]	1,977,900	1,632,800
Spills from NSW share of storage	0	0
Return flow from irrigation	10,000	44,200
Treated wastewater discharged back to river	2,810	3,110
Sub-total	**1,990,700**	**1,680,100**
Usage		
Urban diversions	30,980	27,090
Irrigation district diversions	592,400	543,200
Licensed diversions from regulated streams	269,300	235,400
Licensed diversions from unregulated streams	4,200	14,600
Environmental water diversions	10,300	10,400
Small catchment dams	6,500	6,500
Sub-total	**913,700**	**837,200**
Losses		
Net evaporation losses from major storages	150,900	129,400
Evaporation from small catchment dams[3]	1,100	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation[4][5]	431,900	35,200
Sub-total	**583,900**	**165,700**
Water passed at outlet of basin		
River Murray flow to South Australia from Victoria's allocation	510,500	404,500
Spills to NSW share of storages	0	0
Ceding to NSW storages per Murray-Darling Basin Agreement	103,200	95,300

Notes:

(1) The volumes in this table may not be consistent with the Murray-Darling Basin Authority's final accounts, as different methods of reporting have been used.

(2) Inflows calculated based on estimates of inflows to major storages, plus inflows from tributaries.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from total water harvested.

(4) Value estimated via back-calculation based on the difference between Victoria's share of inflows and outflows. Includes environmental diversions under surplus flow conditions.

(5) The 'in-stream losses' component is a balancing item which is affected by errors in all other components, however the numbers are based on the best possible information at the time of finalising the *Victorian Water Accounts 2008-2009*. The 2007/08 loss estimate was an anomaly and the 2008/09 loss estimate is similar to values presented in previous years.

6.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 6-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 6-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	7,200	3,600	n/a
Registered commercial and irrigation	3,400	2,900	n/a
Total	**10,600**	**6,500**	**7,600**

n/a: Information not available.

6.6.3 Water entitlement transfers

Surface water was moved into, out of and within the Murray basin during 2008/09 through water share transfers and variations, allocation trade and temporary transfer of bundled entitlement. Water share and allocation transactions make up the bulk of this movement, with 183 ML of Murray basin bundled entitlement being transferred on a temporary basis during the year.

Table 6-5 summarises the movement of water shares into and out of the Murray basin delivery systems during 2008/09. The water share market in the Murray was one of the most active Victorian basins, due in part to the large volume of water shares located in the basin. There was a net transfer of both high and low reliability water shares due to the large number of water shares being disassociated with land and therefore no longer being associated with any delivery system.

Table 6-5 Transfers and variations of water shares in the Murray (Vic.) basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
First Mildura Irrigation District	9,646	10,188	-542	0	0	0
River Murray	58,152	50,651	7,501	5,594	7,000	-1,406
Murray Valley Irrigation Area	26,502	38,193	-11,691	13,055	17,931	-4,876
Nyah, Tresco and Woorinen	2,336	2,630	-294	512	571	-59
Robinvale, Red Cliffs and Merbein	9,587	13,353	-3,766	148	0	148
Torrumbarry Irrigation Area	29,561	45,149	-15,588	16,628	23,657	-7,030
1062 Katunga Groundwater[(3)]	68	108	-40	0	0	0
Total	**135,853**	**160,272**	**-24,419**	**35,937**	**49,159**	**-13,222**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Murray basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

(3) Whilst no water shares exist in the Katunga groundwater area, two water shares have been incorrectly processed in the Victorian Water Register, causing the delivery system to be displayed incorrectly. Measures have been undertaken during 2009/10 to correct the fields on thee water shares.

Table 6-6 summarises the trade of allocation in Victoria's share of the Murray basin during 2008/09. A total of 337,857 ML of allocation was traded into the Murray basin, which included 128,046 ML traded within the basin, and a net import to the basin of 169,554 ML. Most of the water imported to the basin was sourced from New South Wales basins due in part to the much higher seasonal allocations in New South Wales compared with the Victorian Murray.

Table 6-6 Allocation trade in the Murray (Vic.) basin, 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Murray (Vic.) basin	128,046
Trade from other Victorian basins	40,069
Trade to other Victorian basins	25,277
Interstate trade - inbound	169,742
Interstate trade - outbound	14,980
Total trade into the Murray (Vic.) basin	**337,857**
Net trade into the Murray (Vic.) basin	**169,554**

Notes:

(1) This table summarises allocation trades approved into, out of and within the Victorian Murray basin trading zones (Zone 6 Murray – Dartmouth to Barmah, Zone 7 Murray – Barmah to SA and Zone 6B Lower Broken Creek) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

In 2008/09, 183 ML of bundled entitlement in the Murray basin was transferred on a temporary basis. Table 6-7 summarises the movement of bundled entitlements in the Murray basin during the year. There was no surface water movement reported in 2007/08.

Table 6-7 Transfer of surface water bundled entitlements in the Murray basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Barmah to Nyah unregulated	0	0	0	0	0	0
Upper Murray Main Stem unregulated	0	0	0	0	0	0
Upper Murray unregulated	0	0	0	183	183	0
Total 2008/09	**0**	**0**	**0**	**183**	**183**	**0**
Total 2007/08[(1)]	n/a	n/a	n/a	n/a	n/a	n/a

Note:

(1) No data available for 2007/08.

6.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 6-8.

The total volume diverted in 2008/09 increased by 11% compared with 2007/08. This increase is largely as a result of increased demands by Goulburn Murray Water and Sunraysia Water.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water. Compliance with individual bulk entitlement volumes is deemed to occur in Table 6-8 if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Table 6-8 Volume of water diverted under surface water entitlements in the Murray basin (Victoria)

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(1)
East Gippsland Water					
Omeo	1	77	0	57	Yes
Coliban Water					
River Murray	1	6,285	1,995	3,455	Yes
Goulburn Valley Water					
River Murray	1	5,593	0	4,324	Yes
North East Water					
Bundalong	1	51	0	13	Yes
Corryong	1	680	0	260	Yes
Cudgewa	1	29	0	0	Yes
Dartmouth	1	60	0	23	Yes
Walwa	1	61	0	31	Yes
River Murray	1	12,794	4,245	7,643	Yes
GWMWater					
River Murray	1	3,492	973	2,996	Yes
Goulburn-Murray Water					
River Murray	1	1,485,212	0	472,416	Yes
Lower Murray Water					
River Murray – (former) Lower Murray Water	1	31,958	0	15,167	Yes
River Murray – (former) Sunraysia Water	1	438,105	0	342,842	Yes
River Murray – (former) FMIT	1	76,085	0	36,834	Yes
Environment Minister					
River Murray – Flora and Fauna	1	27,600	0	10,259	Yes
River Murray – Snowy Environmental Reserve	1	6,988		6,639	n/a
Total annual volume of bulk entitlements 2008/09		**2,095,070**	**7,212**	**902,962**	
Total annual volume of bulk entitlements 2007/08		**2,151,105**	**3,124**	**816,088**	
Licensed diversions from unregulated streams 2008/09		*29,086*		*4,200*	
Licensed diversions from unregulated streams 2007/08		*29,086*		*14,600*	

Notes:

(1) Compliance with River Murray bulk entitlements is also assessed against the Murray-Darling basin annual cap target for the Murray, Kiewa and Ovens basins. Details of this are contained in the Murray-Darling Basin Authority's Water Audit Monitoring Report 2008/09.

n/a: Not applicable.

6.7 Groundwater resources

Licensed groundwater entitlements and use within the Murray basin is presented for 2008/09 in Table 6-9. Murray basin groundwater includes a proportion of the Katunga WSPA and the Shepparton WSPA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Groundwater usage in the Murray basin reduced slightly in 2008/09 compared with 2007/08, predominantly due to reduced extractions from the Shepparton WSPA. Initially groundwater extraction in the Shepparton WSPA was to control salinity resulting from rising water levels, a historical legacy of vegetation removal. As the aquifer is shallow, further declines in groundwater levels during 2008/09 resulted in many licensed groundwater users not having access to as much water. Some groundwater from the Shepparton WSPA requires shandying with surface water to improve the water quality.

Extractions from Katunga WSPA were restricted to 70% allocation during 2008/09.

Groundwater levels in the Katunga WSPA are generally stable, while Shepparton WSPA levels are declining.

Table 6-9 Licensed groundwater volumes, Murray basin (Victoria) 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Katunga WSPA (80%)	>25	48,092	47,898	26,427	0	26,427	24,014
Shepparton WSPA (31%)	≤25	74,536	74,536	17,674	0	17,674	26,533
Total[5]		**122,628**	**122,434**	**44,101**	**0**	**44,101**	**50,547**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established (e.g. Shepparton WSPA), in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 6-10.

Table 6-10 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Katunga WSPA (80%)	374	748
Shepparton WSPA (31%)	577	1,154
Total	**951**	**1,902**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6-9.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is used to provide urban water supply to a number of towns in the Murray basin. The licensed entitlements and metered use for these supplies is presented in Table 6-11. Groundwater use for the towns of Dinner Plain and Katunga in 2008/09 was similar to that in 2007/08.

Table 6-11 Urban groundwater usage

Town supplied[1]	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Dinner Plain	120	53	48
Katunga	110	53	60
Strathmerton	730	2	0
Total	**960**	**108**	**108**

Note:

(1) Up to 2006/07 Barnawartha groundwater use was reported within the Murray basin in Victorian Water Accounts. A review of the basin boundaries indicated that the extractions for Barnawartha are located in the Ovens basin.

6.8 Drought contingency measures

A range of drought contingency measures were implemented in the Murray basin in 2008/09, including:

- restricting urban and rural water use (discussed in section 6.9)
- ending the irrigation season early to build reserves for 2009/10
- utilising carryover
- the continuation of a temporary qualification of rights as detailed in Table 6-12.

For the second year in a row, Goulburn-Murray Water shortened the irrigation season and announced its final seasonal allocation on 1 April 2008. All water resource improvements after this date were directed to building up supplies for the 2009/10 season.

Table 6-12 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Murray Water System July 2007 Amendment to Temporary Qualification of Rights in the Murray Water System June 2008	1 July 2008 to 30 June 2008 (continuing from 1 July 2007)	Differential access by priority entitlements	Rights qualified to enable domestic and stock users to take the volume of water necessary for essential needs (such as household purposes, fire fighting) when the Murray system seasonal allocation was less than 20%. Commercial and industrial users' rights qualified to enable them to take water for limited purposes when the Murray system seasonal allocation was less than 20%
		Differential access by priority entitlements	Rights held by Lower Murray Water, GWMWater, Coliban Water, Goulburn Valley Water and North East Water under the River Murray bulk entitlements qualified to enable the supply of essential needs of urban water users when the Murray system seasonal allocation was less than 20%
		Volume carried over	Granted the right to carry over water that remained unused at 30 June 2007 and at 30 June 2008 up to 30% of entitlement minus 5% for losses

6.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 6-13.

Urban water corporations were in a better position in 2008/09 to manage the impact of the extreme low allocations by carrying over water and purchasing allocation on the market. No towns supplied by the regulated Murray system were subject to water restrictions more severe than Stage 3 throughout the year.

The regulated Murray system began the year with record low reserves and a 0% allocation. The final seasonal allocation of 35% against high reliability water shares was a record low.

For the third consecutive year, rural diverters on unregulated streams were placed on severe restrictions or banned for much of the year.

Table 6-13 Seasonal allocations and restrictions on water use in Murray basin (Victoria), 2008/09

Type of restriction	Area	Nature of restriction
Urban	Cohuna, Gunbower and Leitchville	Stage 3 restrictions from July to December 2008, and Stage 2 from January to June 2009
	Picola, Nathalia and Numurkah	Stage 1 restrictions from July 2008 to June 2009
	Katunga	Stage 1 restrictions from July 2008 to June 2009
	Barmah, Cobram and Strathmerton	Stage 1 restrictions from July 2008 to June 2009
	GWMWater customers serviced by the Northern Mallee Pipeline (including Ouyen, Patchewollock, and Walpeup)	Stage 4 restrictions from July 2008 to January 2009, Stage 3 restrictions from February to June 2009.
	Lower Murray Water customers (including Kerang, Mildura and Swan Hill)	Stage 3 restrictions from July 2008 to June 2009
	Cudgewa and Corryong	Stage 1 restrictions from November 2008 to June 2009
	Bellbridge, Ebden and Tallangatta	Stage 2 from July 2008 to June 2009
Licensed diversions from unregulated streams	Little Scrubby Creek	Irrigation ban in July 2008, from January to June 2009
	Little Snowy Creek	Stage 4 restrictions in July 2008, from January to June 2009
	Back Creek	Stage 4 restrictions from January 2009 to April 2009, irrigation ban from May to June 2009
	Lockharts Creek	Irrigation ban in July 2008, from November 2008 to June 2009
	Livingstone Creek	Irrigation ban from July 2008 to June 2009
	Mitta Mitta tributaries	Irrigation ban from July to August 2008
	Sheepwash Creek (tributary of Ulupna Creek)	Stage 3 restrictions from July 2008 to June 2009
	Murray (below Hume) tributaries, Upper Murray (above Hume) tributaries, Indigo Creek, Black Dog Creek (upper)	Irrigation ban from July 2008 to June 2009
	Tallangatta Creek	Irrigation ban from January to June 2009
	Scrubby Creek	Irrigation ban from July 2008 to June 2009
	Cudgewa Creek (Upper Murray)	Stage 2 restrictions from January to June 2009
	Waterfall Creek	Irrigation ban in July 2008, from January to June 2009
	Indi River (upper Murray)	Stage 2 restrictions from March to June 2009
	Nariel Creek	Irrigation ban from February to April 2009, Stage 4 restrictions from May to June 2009
Irrigation	Murray system (gravity and pumped)	Allocation began the year at 0% of high reliability water shares and increased to 35% by April 2009
Groundwater	Katunga WSPA	Seasonal allocations applied, with use from Katunga WSPA restricted to 70% allocation

6.10 Recycled water

Around 45% of the volume of wastewater passing through treatment plants in the basin was recycled for consumptive use (Table 6-14), mostly for agricultural purposes. This is similar to the proportion recycled in 2007/08, however lower water consumption reduced total quantities of wastewater produced and recycled.

Table 6-14 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bellbridge	29	29	100%	0	29	0	0	0	0
Bundalong	0	0	0%	0	0	0	0	0	0
Cobram	198	198	100%	0	198	0	0	0	0
Cohuna	0	0	0%	0	0	0	0	0	0
Corryong	91	91	100%	0	91	0	0	0	0
Dartmouth	0	0	0%	0	0	0	0	0	0
Gunbower/ Leitchville	0	0	0%	0	0	0	0	0	0
Koondrook	0	0	0%	0	0	0	0	0	0
Koorlong	1,073	1,073	100%	0	1,073	0	0	0	0
Lake Boga	23	0	0%	0	0	0	0	0	23
Merbein	0	0	0%	0	0	0	0	0	0
Mildura	1,251	1,251	100%	0	1,251	0	0	0	0
Nathalia	67	67	100%	0	67	0	0	0	0
Numurkah	82	82	100%	0	82	0	0	0	0
Nyah/Nyah West	32	0	0%	0	0	0	0	0	32
Omeo	16	16	100%	0	16	0	0	0	0
Red Cliffs	88	88	100%	88	0	0	0	0	0
Robinvale	176	176	100%	0	176	0	0	0	0
Strathmerton	0	0	0%	0	0	0	0	0	0
Swan Hill	1,209	0	0%	0	0	0	0	0	1,209
Tallangatta	78	78	100%	0	78	0	0	0	0
Wodonga	3,006	200	7%	200	0	0	0	2,806	0
Yarrawonga	37	37	100%	0	37	0	0	0	0
Total 2008/09	**7,456**	**3,386**	**45%**	**288**	**3,098**	**0**	**0**	**2,806**	**1,264**
Total 2007/08	**8,182**	**3,776**	**46%**	**326**	**3,450**	**0**	**0**	**3,115**	**1,291**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. to maintain biological processes. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

6.11 Water for the environment

6.11.1 Environmental Water Reserve (EWR)

Important environmental assets depend on the EWR in the Murray basin. The Barmah-Millewa Forest, Gunbower Forest, Hattah Lakes and Kerang Wetlands are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention and Living Murray icon sites. Lindsay-Walpolla and Mulcra Islands, all Living Murray icon sites, are also dependent on the EWR in the Murray basin. These sites rely on the freshwater inputs from the River Murray to function ecologically.

In 2008/09 the Murray basin (Victoria) EWR comprised the following components:

- the Bulk Entitlement (River Murray - Flora and Fauna) Order 1999 comprising 27,600 ML high reliability entitlements held by the Environment Minister
- the Bulk Entitlement (River Murray - Flora and Fauna) Order 1999 comprising 100,412 ML low reliability entitlements held by the Environment Minister on behalf of Murray-Darling Basin Authority
- the Barmah-Millewa Forest Environmental Water Allocation (EWA) – a significant operational rule embedded in consumptive entitlements
- water set aside for the environment through the operation of passing flows released by River Murray Water as a condition of the Murray-Darling Basin Agreement
- water set aside for the environment through flow-sharing arrangements set out in North East Water's bulk entitlements from unregulated rivers
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

6.11.2 Entitlements for the environment

The formal entitlements for the environment in the Murray basin in 2008/09 comprised the Bulk Entitlement (River Murray - Flora and Fauna) Order 1999, which includes 27,600 ML of high reliability and 100,412 ML of low reliability entitlements held by the Environment Minister. In 2008/09, some 18,166 ML was released under this bulk entitlement, which was more than the 10,432 ML released in 2007/08.

6.11.3 Passing flow compliance

North East Water reported that it met all passing flow requirements under its bulk entitlements in 2008/09.

Table 6-15 shows selected passing flow compliance for the River Murray Flora and Fauna bulk entitlement.

Table 6-15 Selected passing flow compliance in the Murray basin

River	Passing flow	
River Murray	Instrument where passing flows are specified	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999
	Responsible authority	Environment Minister
	Compliance point	Not applicable
	Passing flow compliance	• Lindsay River dilution water: less than 91.3 GL/year • Barmah-Millewa Forest Water: high security entitlement 50 GL/year; lower security entitlement 25 GL/year

7 Kiewa basin

This chapter sets out the accounts for the Kiewa basin. For detailed information about how they have been compiled, refer to Chapter 5.

7.1 Kiewa basin summary

Estimated inflows in the Kiewa basin in 2008/09 were less than half of the long term average for the third consecutive year.

Although inflows were again low, North East Water was able to maintain low to medium levels of water restrictions for its towns located within the basin. This was due to good rainfall in December, efforts by its customers to save water, and being able to purchase allocation from the regulated Murray system.

Licensed diverters on tributaries of the Kiewa River were severely restricted or banned due to low river flows. As a result, the total volumes of surface water extracted under licences declined by more than 75% compared to 2007/08. The volume diverted in 2007/08 was an anomaly and the volume diverted in 2008/09 was similar to values presented in previous years.

7.2 Responsibilities for management of water resources

Table 7-1 shows the responsibilities of various authorities within the Kiewa basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 7-1 Responsibilities for water resources management within the Kiewa basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water		Manages groundwater and surface water private diversions		
North East Water			Supplies towns across the whole basin, including Wodonga and Mount Beauty	Obliged to meet passing flow requirements
AGL Hydro				Operates reservoirs in the upper parts of the Kiewa basin for hydropower operations Obliged to meet passing flow requirements
North-East Catchment Management Authority				Manages waterways for the whole of the Kiewa basin

7.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Kiewa basin ranged between 60% and 80% of the long term average. Catchment inflows were 44% of the long term average (of 689,000 ML[5]). This is the third consecutive year inflows were less than half the long term average and are well below the inflows recorded in 2003/04, 2004/05 and 2005/06. Figure 7-1 illustrates the decline in inflows to the basin over recent years.

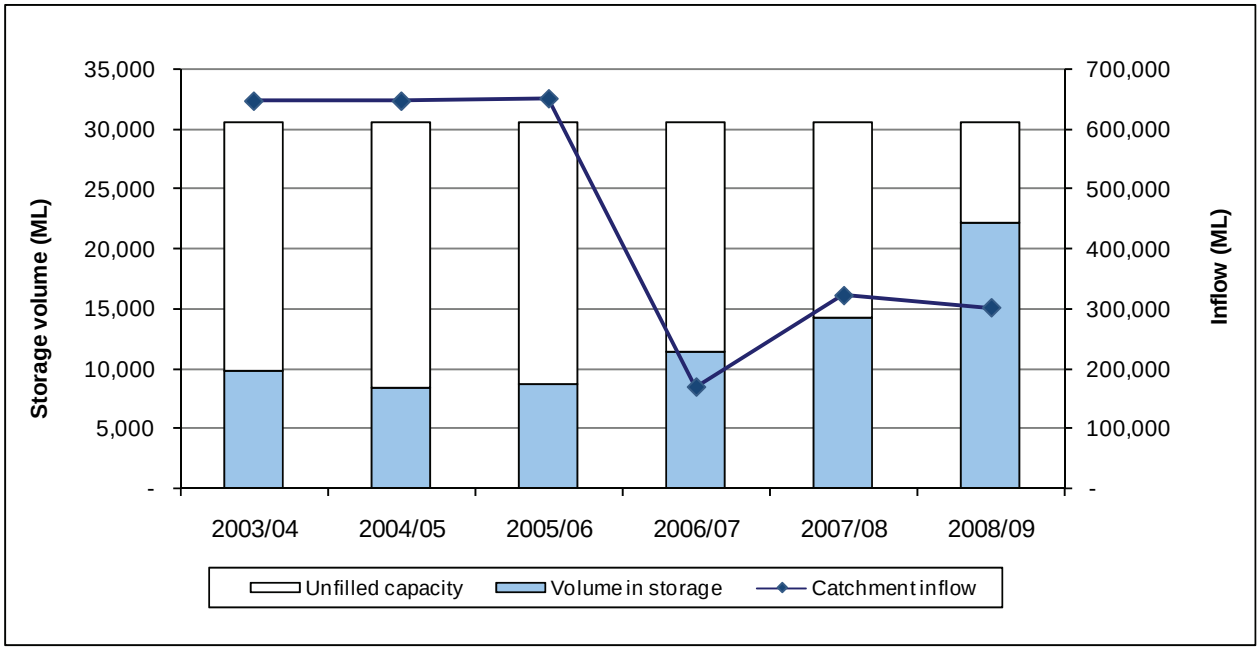
The volume of water flowing from the Kiewa basin into the River Murray reduced to 279,200 ML in 2008/09 (including the New South Wales share of Kiewa River flows under the Murray-Darling Basin Agreement). This volume was slightly lower than the 2007/08 outflow volume of 292,800 ML. The volume of water flowing from the Kiewa basin into the River Murray in 2008/09 represented 92% of the total inflows into the basin, compared with 91% in 2007/08.

Although inflows were low, the volume of water in the two major on-stream storages in the basin, Rocky Valley and Lake Guy, increased from 13,500 ML at the start of July 2008 to 21,500 ML by June 2009. Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 14,200 ML in July 2008 to 22,100 ML by June 2009, or 73% of the total storage capacity of 30,470 ML.

Only volumes for major on-stream storages have been included in the water balance and, as such, major storages such as Pretty Valley basin and Clover Pondage have not been included.

[5] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 7-1 All major storages and catchment inflows in the Kiewa basin



7.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Kiewa basin are shown in Table 7-2. Only a small proportion of the surface water resources in the Kiewa basin (3%) was extracted for consumptive use.

An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

Table 7-2 Summary of total water resources and water use in the Kiewa basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	302,400	8,600
Groundwater[2]	1,600	700
Recycled water	210	120

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 7-7 and the estimated domestic and stock use as presented in Table 7-8.

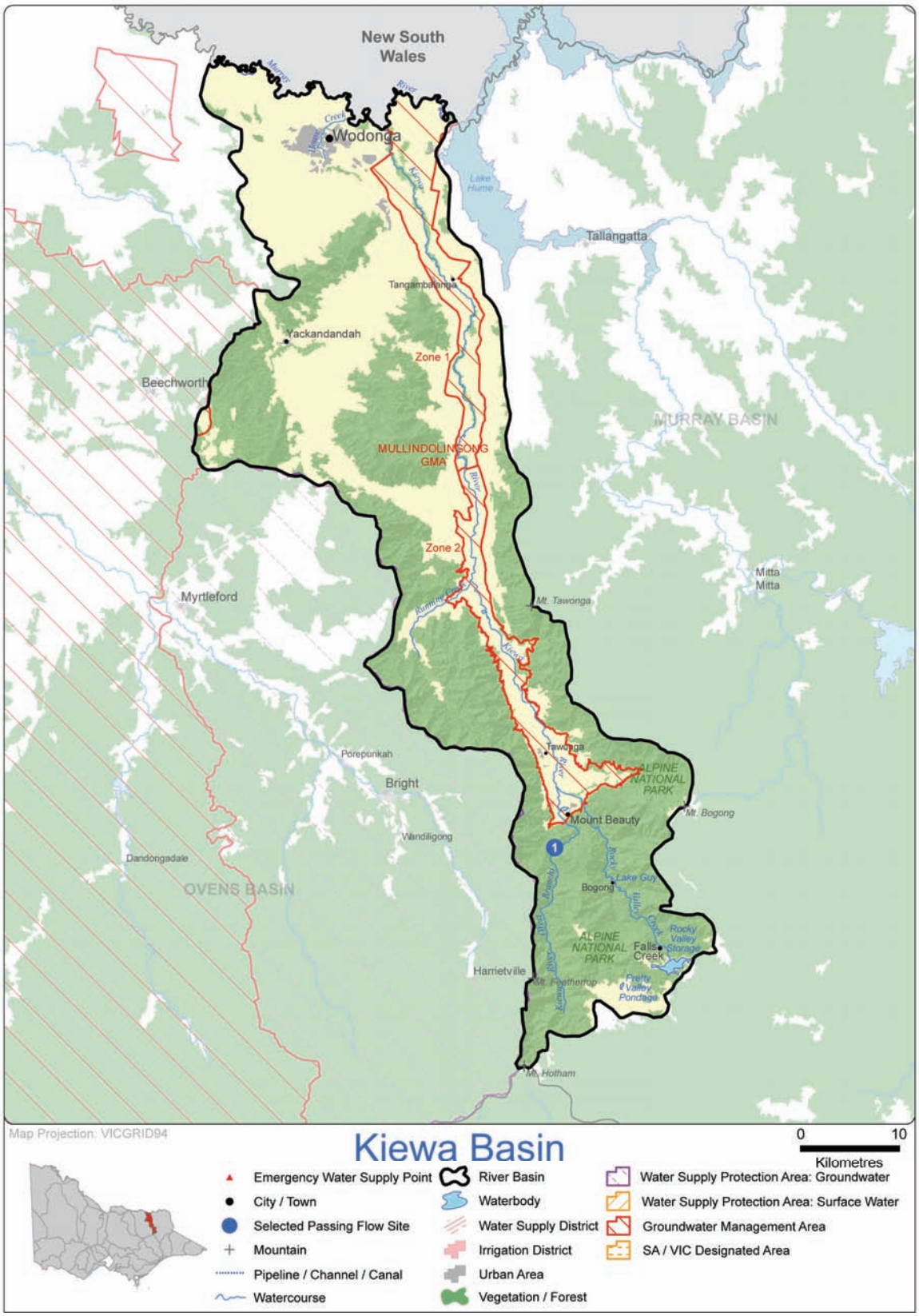
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

7.4.1 Infrastructure projects to improve water availability

North East Water started the upgrade of Wodonga Water treatment plant from a direct filtration plant to dissolved air flotation water treatment plant. North East Water also commissioned works to provide alternative supply to Wodonga industry. The installation of pumps and pipework to connect industry to fit-for-purpose water supplied from the wastewater treatment plant was 70% complete by the end of 2008/09.

7.5 Location of water resources

Figure 7-2 Map of the Kiewa basin



7.6 Surface water resources

7.6.1 Water balance

A surface water balance for the Kiewa basin is shown in Table 7-3. Note that only on-stream storages greater than 1,000 ML capacity have been included in the water balance.

Outflows from the Kiewa basin are shared on a 50/50 basis between Victoria and New South Wales in the Murray system.

Table 7-3 Balance of surface water in the Kiewa basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	13,500	10,800
Volume in storage at end of year	21,500	13,500
Change in storage	**8,000**	**2,700**
Inflows		
Catchment inflow(1)	302,300	325,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river(2)	110	300
Sub-total	**302,400**	**325,400**
Usage		
Urban diversions	500	540
Licensed diversions from unregulated streams(3)	4,200	17,000
Small catchment dams	3,900	3,900
Sub-total	**8,600**	**21,400**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(4)	1,100	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	5,500	7,400
Sub-total	**6,600**	**8,500**
Water passed at outlet of basin		
Kiewa basin outflow to River Murray – Victoria share	139,600	146,400
Kiewa basin outflow to River Murray – NSW share	139,600	146,400

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Includes water returned from the alpine resorts.

(3) The volume diverted in 2007/08 was an anomaly and the volume diverted in 2008/09 was similar to values presented in previous years.

(4) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(5) Losses estimated using loss functions from the Kiewa River REALM model.

7.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 7-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 7-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,000	2,000	n/a
Registered commercial and irrigation	2,300	1,900	n/a
Total	**6,300**	**3,900**	**5,000**

n/a: Information not available.

7.6.3 Water entitlement transfers

Surface water movement in the Kiewa basin was limited to transfers of bundled entitlement within the basin. In 2008/09, some 111 ML of bundled entitlements in the Kiewa basin were transferred on a permanent basis and 881 ML on a temporary basis.

Table 7-5 summarises the movement of bundled entitlements in the Kiewa basin during 2008/09.

Table 7-5 Transfer of surface water bundled entitlements in the Kiewa basin

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin[1]	Bought (ML)	Sold (ML)	Net transfer to basin
Kiewa Main Stem unregulated	89	111	-22	881	881	0
Total 2008/09	**89**	**111**	**-22**	**881**	**881**	**0**
Total 2007/08 [2]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:
(1) Net loss covers the additional losses incurred in extracting the water further downstream. This volume is effectively returned to the environment.
(2) No data available for 2007/08.

7.6.4 Volume diverted

The volume of water diverted under North East Water and AGL Hydro Limited's bulk water entitlements is shown in Table 7-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 7-6 Volume of water diverted under surface water entitlements in the Kiewa basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[1]
North East Water					
Kiewa – Tangambalanga	1	179	0	0	Yes
Mount Beauty – Tawonga	1	719	0	321	Yes
Yackandandah	1	209	0	153	Yes
AGL Hydro Ltd					
Bogong Village	1	50	0	25	Yes
Kiewa – Southern Hydro Ltd[2]	1	0	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**1,157**	**0**	**499**	
Total annual volume of bulk entitlements 2007/08		**1,157**	**0**	**536**	
Licensed diversions from unregulated streams 2008/09[3]		*18,594*		*4,200*	
Licensed diversions from unregulated streams 2007/08		*18,594*		*17,000*	

Notes:
(1) Compliance with River Murray bulk entitlements is also assessed against the Murray-Darling basin annual cap target for the Murray, Kiewa and Ovens basins. Details of this are contained in the Murray-Darling Basin Authority's Water Audit Monitoring Report 2008/09.
(2) The Kiewa – Southern Hydro Ltd bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes and therefore the volume has not been included. Any water diverted under this entitlement is returned to the watercourse.
(3) Volume diverted in 2007/08 was an anomaly and 2008/09 is similar to values presented in previous years.

7.7 Groundwater resources

Licensed groundwater entitlements and use for the Mullindolingong GMA in the Kiewa basin, excluding domestic and stock use, are shown in Table 7-7. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Groundwater extractions from the Mullindolingong GMA were estimated as 40% of the licensed entitlement volume, a decrease from the 60% estimated use in 2007/08. Groundwater levels in the Mullindolingong GMA remained stable thorugh 2008/09.

Table 7-7 Licensed groundwater volumes, Kiewa basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Mullindolingong GMA (100%)	All depths	6,980	1,532	0	613	613	907
Total		**6,980**	**1,532**	**0**	**613**	**613**	**907**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV).

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use based on 40% of the licensed entitlement volume.

An estimate of domestic and stock groundwater use is provided in Table 7-8. Groundwater is not used as an additional source to supply urban customers.

Table 7-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Mullindolingong GMA (100%)	56	112
Total	**56**	**112**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 7-7.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

7.8 Drought contingency measures

The main drought contingency measures undertaken in the Kiewa basin in 2008/09 were the continuation of restrictions on urban water use and diversions on unregulated streams, discussed in more detail in section 7.9.

North East Water's rights to supply Tangambalanga, Kiewa and Wodonga were qualified as part of the River Murray qualification of rights (refer to Table 6-12).

7.9 Seasonal allocations and restrictions on water use, diversions and extractions

Water restrictions applying to urban customers and licensed diversions in the Kiewa basin during 2008/09 are shown in Table 7-9. Although inflows were again low, North East Water was able to maintain low to medium levels of water restrictions for its towns located within the basin. This was due to good rainfall in December, efforts by its customers to save water, and being able to purchase allocation from the regulated Murray system.

Licensed diverters on tributaries of the Kiewa River were severely restricted or banned due to low river flows. While the 2007/08 diversions appeared high, the 2008/09 diversions were similar to those in previous years.

Table 7-9 Seasonal allocations and restrictions on water use in Kiewa basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Tangambalanga, Kiewa and Wodonga	Stage 2 restrictions from July 2008 to June 2009
	Yackandandah	Stage 1 from February 2008 to June 2009
Licensed diversions on unregulated streams	Basin Creek, Nine Mile Creek (Yackandanda tributary), Back Creek (Nine Mile Creek), Back Creek (Yackandandah Creek), Sheep Creek, Cherry Tree Creek, Bay Creek, Glen Creek, Hellhole Creek, Deep Creek, Kiewa River tributary, Sheepwash Creek (tributary of Hellhole Creek), House Creek (Kiewa Creek), Middle Creek (Kiewa Creek), Morgans Creek, Kinchington Creek, Plain Creek, Junction Creek	Irrigation ban from July 2008 to June 2009
	Running Creek (Kiewa Creek)	Irrigation ban from April to June 2009
	Yackandandah Creek and tributaries	Irrigation ban from January to June 2009
	Simmonds Creek	Irrigation ban from December 2008 to June 2009

7.10 Recycled water

Four wastewater treatment plants are in the Kiewa basin, with three operated by North East Water and the Dinner Plain treatment plant operated by East Gippsland Water. Although the volume of wastewater produced during 2008/09 reduced compared with 2007/08, the proportion of wastewater recycled increased from 36% in 2007/08 to 58% in 2008/09. The increase was largely due to urban and industrial reuse from the Mount Beauty plant.

Table 7-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Baranduda	0	0	0%	0	0	0	0	0	0
Dinner Plain	25	25	100%	0	25	0	0	0	0
Mount Beauty	149	58	39%	58	0	0	0	0	90
Yackandandah	40	40	100%	0	40	0	0	0	0
Total 2008/09[4]	**214**	**123**	**58%**	**58**	**65**	**0**	**0**	**0**	**90**
Total 2007/08	256	91	36%	0	91	0	0	165	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site effluent storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) Recycled water returned in Table 7-3 includes returns from alpine resorts.

7.11 Water for the environment

7.11.1 Environmental Water Reserve (EWR)

Important environment assets, such as threatened remnant vegetation and the Murray Cod, are dependent on water from the EWR in the Kiewa basin. Water from the Kiewa basin also feeds into the River Murray, helping to protect environmental assets within that basin.

In 2008/09 the Environmental Water Reserve in the Kiewa basin comprised the following components:

- water set aside for the environment through flow-sharing arrangements set out in North East Water's bulk entitlements
- water set aside for the environment through the operation of passing flows released as a condition of bulk entitlements held by North East Water and AGL Hydro Limited
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

7.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at points in a waterway. Others detail flow-sharing arrangements, which restrict the volume of water an authority can take depending on streamflows.

North East Water and AGL Hydro both reported they met all passing flow and flow-sharing requirements under their bulk entitlements in 2008/09.

Table 7-11 shows passing flow compliance in the Kiewa basin for the bulk entitlement compliance point in AGL Hydro's Kiewa bulk entitlement. The location of this compliance point can be seen in Figure 7-2.

Table 7-11 Selected passing flow compliance in the Kiewa basin

River	Passing flow	
East and West Kiewa Rivers and tributaries, Bundara River and tributaries	Instrument where passing flows are specified	Bulk Entitlement (Kiewa – Southern Hydro Ltd) Conversion Transfer Order 1998
	Responsible authority	AGL Hydro Ltd
	Compliance point	Mount Beauty Regulating Pondage (shown as 1 in Figure 7-2)
	Passing flow compliance	The lesser of 100 ML/day or the daily average of the natural inflow to the waterway recorded over the previous seven days was passed at the Mount Beauty Regulating Pondage

8 Ovens basin

This chapter sets out the accounts for the Ovens basin. For detailed information about how they have been compiled, refer to Chapter 5.

8.1 Ovens basin summary

The historically reliable Ovens basin recorded its third successive year of well below average inflows in 2008/09.

Towns located within the basin were subject to various levels of restriction throughout the year depending on their location and volume of storage available to get them through the dry summer and autumn. While most experienced low to medium restriction levels, North East Water was required to place a number of its small towns on severe Stage 4 restrictions for some periods during the year.

Water held in storage enabled the regulated rural diverters to maintain their use at levels similar to 2007/08. However, the volume of licensed extractions on unregulated streams almost halved compared to 2007/08 because of low streamflows that led to restrictions and bans being placed on a number of tributaries within the basin throughout the year.

Licensed groundwater use in the basin also declined compared to 2007/08 as extractions from the Lower Ovens GMA fell.

8.2 Responsibilities for management of water resources

Table 8-1 shows the responsibilities of various authorities within the Ovens basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 8-1 Responsibilities for water resources management within the Ovens basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water	Supplies primary entitlements on the regulated Ovens and King system	Manages groundwater and surface water licensed diversions		Operates Lake Buffalo and Lake William Hovell Obliged to meet passing flow requirements
North East Water			Supplies towns including Wangaratta, Bright, Myrtleford, Beechworth and Chiltern	Obliged to meet passing flow requirements
North-East Catchment Management Authority				Manages waterways for the whole of the Ovens basin

8.3 Rainfall, flows and storages in 2008/09

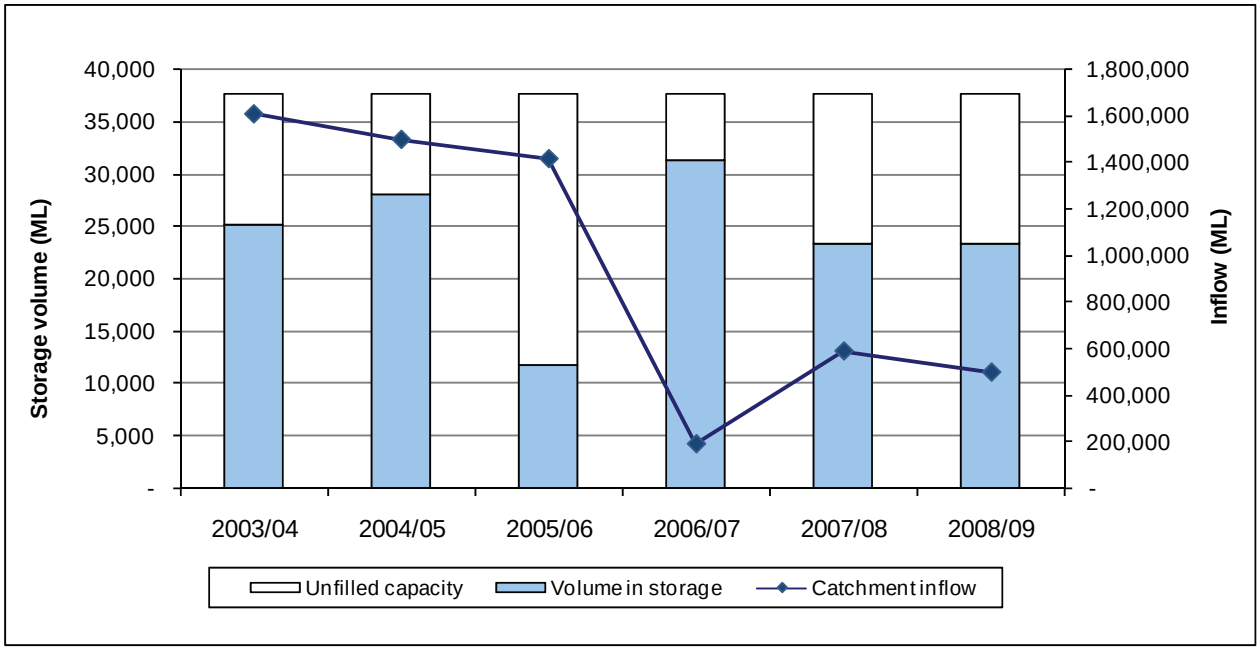
In 2008/09, rainfall across the Ovens basin ranged between 60% and 80% of the long term average. Inflows in 2008/09 were 28% of the long term annual average (1,758,000 ML[6]), compared with 34% in 2007/08. This was the third successive year the Ovens basin recorded well below average inflows.

The volume of water flowing from the Ovens basin into the River Murray was 430,500 ML in 2008/09. This represented 86% of the total inflows into the basin, compared with 89% in 2007/08.

The total volume of water held in major storages in the Ovens basin at the end of the year was 23,300 ML, or 62% of capacity. The major storages also began the year with this volume in store. Major on-stream storages include Lake Buffalo and Lake William Hovell.

[6] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 8-1 All major storages and catchment inflows in the Ovens basin



8.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Ovens basin are shown in Table 8-2. The volume of surface water resources in 2008/09 reduced to 499,600 ML, compared with 590,800 ML in 2007/08. Overall, water use decreased by some 8% compared with 2007/08.

Table 8-2 Summary of total water resources and water use in the Ovens basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	499,600	45,100
Groundwater[2]	25,800	13,200
Recycled water	1,790	820

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 8-9 and the estimated domestic and stock use as presented in Table 8-10.

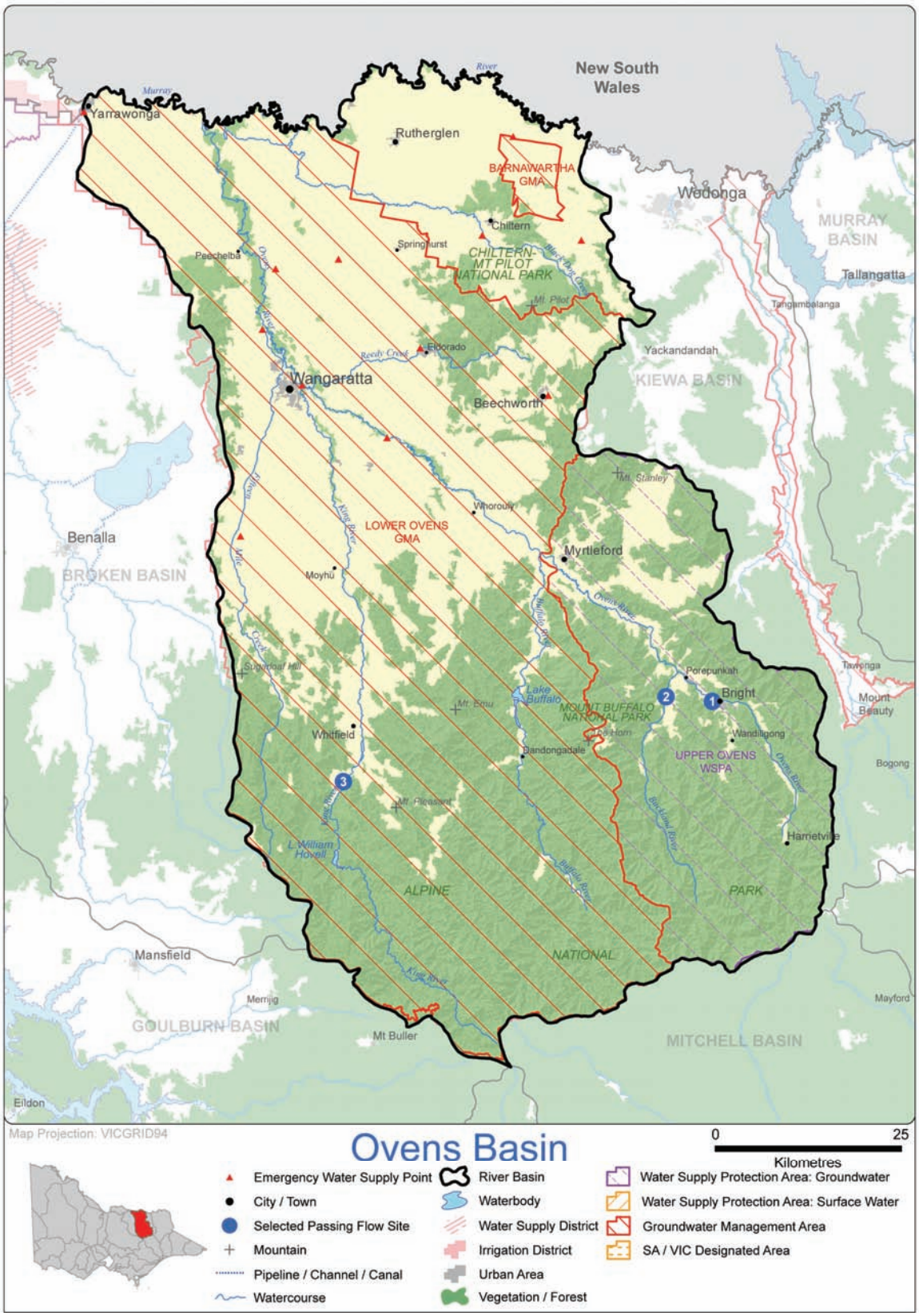
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

8.4.1 Infrastructure projects to improve water availability

In March 2009, North East Water completed a 16 kilometre pipeline from Wodonga to Chiltern to secure water supplies for the towns of Barnawartha and Chiltern.

8.5 Location of water resources

Figure 8-2 Map of the Ovens basin



8.6 Surface water resources

8.6.1 Water balance

A surface water balance for the Ovens basin is shown in Table 8-3. Only those storages greater than 1,000 ML capacity have been included in the water balance.

Table 8-3 Balance of surface water in the Ovens basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	23,300	31,200
Volume in storage at end of year	23,300	23,300
Change in storage	**0**	**-7,900**
Inflows		
Catchment inflow(1)	498,600	589,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	970	1,120
Sub-total	**499,600**	**590,800**
Usage		
Urban diversions	5,710	5,980
Licensed diversions from regulated streams	15,900	13,200
Licensed diversions from unregulated streams	7,600	14,000
Small catchment dams	15,900	15,900
Sub-total	**45,100**	**49,100**
Losses		
Net evaporation losses from major storages	200	-30
Evaporation from small catchment dams(2)	4,500	4,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	19,300	19,200
Sub-total	**24,000**	**23,700**
Water passed at outlet of basin		
Ovens basin outflow to River Murray	430,500	525,900

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.
(3) Loss estimate is based on the average annual losses from the Ovens River REALM model.

8.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 8-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 8-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	14,700	7,400	n/a
Registered commercial and irrigation	10,100	8,500	n/a
Total	**24,800**	**15,900**	**20,400**

n/a: Information not available.

8.6.3 Water entitlement transfers

Surface water was moved into, out of and within the Ovens basin during 2008/09 through water share transfers and variations, allocation trade and permanent and temporary transfer of bundled entitlement.

Table 8-5 summarises the movement of water shares into and out of the Ovens basin delivery systems during the year. There was a net export of both high and low reliability water shares out of the basin in 2008/09. The only low reliability water traded in the basin during this year was the Ovens River spill shares.

Table 8-5 Transfers and variations of water shares in the Ovens basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Ovens River	633	737	-104	0	0	0
Ovens River – spill[(3)]	n/a	n/a	n/a	211	230	-19
Total	**633**	**737**	**-104**	**211**	**230**	**-19**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Ovens basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

(3) Spill water is low reliability and is therefore not available for trade in the high reliability category.

Table 8-6 summarises the trade of allocation in Victoria's share of the Ovens basin during 2008/09. A total of 1,405 ML of allocation was traded within the Ovens basin. No water was traded with other Victorian or interstate basins. As all the water was traded within the basin in 2008/09, no net movement of water into or out of the basin occurred.

Table 8-6 Allocation trade in the Ovens basin, 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Ovens basin	1,405
Trade from other Victorian basins	0
Trade to other Victorian basins	0
Interstate trade - inbound	0
Interstate trade - outbound	0
Total trade into the Ovens basin	**1,405**
Net trade into the Ovens basin	**0**

Notes:

(1) This table summarisies allocation trades approved into, out of and within the Ovens basin trading zones (Zone 9 Ovens River) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

Table 8-7 summarises the movement of bundled entitlements in the Ovens basin in 2008/09. There was no net movement of water in to or out of the basin in this year.

Table 8-7 Transfers of surface water bundled entitlements in the Ovens basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)[(1)]	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Ovens and King unregulated	61	76	-15	480	480	0
Total 2008/09	**61**	**76**	**-15**	**480**	**480**	**0**
Total 2007/08[(2)]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:

(1) Net loss covers the additional losses incurred in extracting the water further downstream. This volume is effectively returned to the environment.

(2) No data available for 2007/08.

8.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 8-8. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. The volume diverted by North East Water for the town of Glenrowan includes 39 ML of drought reserve water in accordance with the bulk entitlement conditions.

The Ovens River system bulk entitlement held by Goulburn-Murray Water is a climatically varying cap, which varies annually depending on the prevailing conditions as outlined in the conversion order.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 8-8 Volume of water diverted under surface water entitlements in the Ovens basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[2][3]
North East Water					
Beechworth	1	1,100	0	540	Yes
Bright	1	704	0	647	Yes
Chiltern[4]	1	180	0	3	Yes
Glenrowan	1	90	0	70	Yes
Harrietville	1	91	0	58	Yes
Myrtleford	1	1,212	0	577	Yes
Ovens (Wangaratta, Oxley, Moyhu)	1	7,932	0	3,759	Yes
Porepunkah	1	166	0	13	Yes
Springhurst	1	36	0	18	Yes
Whitfield	1	34	0	22	Yes
Goulburn-Murray Water					
Ovens River System	1	46,868	0	15,941	Yes
Total annual volume of bulk entitlements 2008/09		**58,413**		**21,648**	
Total annual volume of bulk entitlements 2007/08		**58,515**	**0**	**19,148**	
Licensed diversions from unregulated streams 2008/09		*24,505*		*7,600*	
Licensed diversions from unregulated streams 2007/08		*24,505*		*14,000*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Compliance with River Murray bulk entitlements is also assessed against the Murray-Darling basin annual cap target for the Murray, Kiewa and Ovens basins. Details of this are contained in the Murray-Darling Basin Authority's Water Audit Monitoring Report 2008/09.

(4) The annual bulk entitlement volume for Chiltern includes up to 25 ML of groundwater extractions.

8.7 Groundwater resources

Licensed groundwater entitlements and use for the groundwater management units in the Ovens basin, excluding domestic and stock use, are shown in Table 8-9.

The Ovens basin contains the whole Barnawartha GMA, Upper Ovens WSPA and Lower Ovens GMA. In 2007/08 Murmungee GMA was replaced with the Upper Ovens WSPA and Lower Ovens GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

The licensed groundwater use reduced by about 25% from around 60% in 2007/08 to 40% of the licensed entitlement in 2008/09. Groundwater levels in the area are generally stable.

Table 8-9 Licensed groundwater volumes, Ovens basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Barnawartha GMA (100%)	All depths	2,100	635	0	381	381	291
Upper Ovens WSPA (100%)	All depths	4,010	3,658	0	1,463	1,463	1,985
Lower Ovens GMA (100%)	All depths	25,200	17,062	0	6,825	6,825	9,420
Total[6]		**31,310**	**21,355**	**0**	**8,669**	**8,669**	**11,696**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Entitlement volume includes domestic and stock usage in those cases where it is part of an existing licence.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use based on 40% of the licensed entitlement volume for the Barnawartha GMA and 40% for the Upper and Lower Ovens WSPA. The estimated use decreased from 60% in 2007/08 due to wetter conditions.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 8-10.

Table 8-10 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Barnawartha GMA (100%)	32	64
Upper Ovens GMA (100%)	318	636
Lower Ovens GMA (100%)	1,897	3,794
Total	**2,247**	**4,494**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 8-9.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is used within the Ovens basin for urban water supply for Barnawartha and as a back-up urban water supply for the townships of Chiltern, Moyhu, Myrtleford and Springhurst and the city of Wangaratta. The volume of licensed entitlements and metered use for these groundwater supplies are provided in Table 8-11.

In 2008/09 no groundwater was supplied to the towns of Moyhu and Myrtleford. Continued low streamflows near Chiltern, however, resulted in North East Water transferring 150 ML of groundwater associated with its Barnawartha licence to Chiltern.

Table 8-11 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Barnawartha	293	88	85
Moyhu	15	0	0
Myrtleford	75	0	0
Springhurst	20	5	1
Wangaratta(1)	200	13	73
Chiltern(2)	25	107	166
Total	**628**	**213**	**325**

Note:
(1) The licensed volume for Wangaratta comprises two licences of 150 ML and 50 ML respectively.
(2) Chiltern metered use was greater than the licensed volume as 150 ML was traded from the Barnawatha urban supply.

8.8 Drought contingency measures

A range of drought contingency measures was implemented in the Ovens basin in 2008/09. These included restricting urban and rural water at times (discussed below) and water carting.

North East Water carted water from Wangaratta to Springhurst during March to June 2009 due to supply and quality issues in Diddah Diddah Reservoir. It also carted water to Bundalong from Yarrawonga between July and August 2008 and May to June 2009 to maintain supplies while Lake Mulwala was drawn down to low levels to improve water availability for the Murray system.

Due to a qualification of rights in place in the Murray system, some 4,245 ML was purchased to supply the North East Water River Murray towns.

8.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 8-12.

Towns located within the basin were subject to various levels of restriction throughout the year depending on their location and availability of storage to get them through the dry summer and autumn. While most experienced low to medium restriction levels, North East Water was required to place a number of its small towns on severe Stage 4 restrictions for some periods during the year.

Rural diverters from a number of tributaries within the basin were placed on restrictions and bans throughout the year.

Table 8-12 Seasonal allocations and restrictions on water use in Ovens basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Barnawartha	Stage 1 restrictions in June 2009
	Bundalong	Stage 2 restrictions from July 2008 to April 2009, Stage 4 from May to June 2009
	Springhurst	Stage 1 from November 2008 to January 2009, Stage 2 in February 2009, and Stage 4 from March to June 2009
	Rutherglen, Wahgunyah and Yarrawonga	Stage 2 restrictions from July 2008 to June 2009
	Beechworth	Stage 2 restrictions for July 2008, Stage 1 from November 2008 to March 2009, Stage 2 from April to June 2009
	Bright, Harrietville, Porepunkah and Wandiligong	Stage 1 restrictions for July 2009, then for February 2009, Stage 2 from March to June 2009
	Chiltern	Stage 2 restrictions from July to October 2008, Stage 3 from November 2008 to January 2009, Stage 4 for February 2009 and Stage 2 from March to June 2009
	Glenrowan	Stage 1 restrictions from November 2008 to March 2009, Stage 2 from April to May 2009, and Stage 3 in June 2009
	Whitfield	Stage 1 restrictions from November 2008 to February 2009, Stage 2 for March 2009, then Stage 4 from April to June 2009
	Myrtleford	Stage 1 restrictions from November 2008 to June 2009
Unregulated diversions	Roberts Creek	Irrigation ban from July to August 2008
	Ovens River Upper	Stage 4 restrictions from February to May 2009
	Barwidgee Creek, Myrtle Creek	Irrigation ban July to August 2008 and January 2009
	Hodgsons Creek	Stage 4 restrictions in July to August 2008 and January 2009
	15 Mile Creek including tributaries and Middle Creek	Irrigation ban from February to May 2009
	Reedy Creek (above Yellow Creek confluence)	Irrigation ban from December 2008 to June 2009
	2 Mile Creek (tributary of Buckland River), Buckland River, Eurobin Creek	Stage 4 restrictions from February to May 2009
	Morses Creek	Irrigation ban from February 2009
	Happy Valley Creek, Havilah Creek, Jackson Creek, Roberts Creek	Irrigation ban from March to June 2009
	Buffalo Creek, Snowy Creek	Stage 4 restrictions from February to June 2009

8.10 Recycled water

North East Water operates all wastewater treatment plants in the Ovens basin. Approximately 46% of the wastewater passing through treatment plants in the basin in 2008/09 was recycled, higher than the estimated 37% in 2007/08.

Table 8-13 below shows the volumes of water recycled in the Ovens basin during 2008/09.

Table 8-13 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Barnawartha	19	19	100%	0	19	0	0	0	0
Beechworth	166	56	34%	0	56	0	0	110	0
Bright / Porepunkah	199	31	16%	31	0	0	0	168	0
Chiltern	12	12	100%	0	12	0	0	0	0
Myrtleford	41	0	0%	0	0	0	0	41	0
Rutherglen / Wahgunyah	196	196	100%	171	26	0	0	0	0
Wangaratta	1,155	500	43%	8	492	0	0	655	0
Total 2008/09	**1,788**	**814**	**46%**	**210**	**605**	**0**	**0**	**974**	**0**
Total 2007/08	1,771	651	37%	59	592	0	0	1,121	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site effluent storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

8.11 Water for the environment

8.11.1 Environmental Water Reserve (EWR)

The Lower Ovens floodplain, a heritage river, is one important environmental asset that depends on the EWR in the Ovens basin. Water from the Ovens basin also feeds into the Murray basin, helping to maintain environmental assets within that basin. In 2008/09 the Ovens basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Goulburn-Murray Water on the regulated rivers
- water set aside for the environment through flow-sharing arrangements set out in North East Water's bulk entitlements on the unregulated rivers
- water set aside for the environment through the operation of licensed diversions with passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

8.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at points in a waterway. Others detail flow-sharing arrangements, which restrict the volume of water an authority can take depending on streamflows.

North East Water reported they met all passing flow requirements under their bulk entitlements in 2008/09.

Goulburn Murray Water reported short term non-compliances on the Ovens River at Wangaratta (one day), and Peechelba (three days), and also on the Buffalo River downstream of Lake Buffalo (two days). These non-compliances were due to higher than expected demand when operating close to minimum compliance flow.

Table 8-14 shows passing flow compliance in the Ovens basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The locations of these compliance points are presented in Figure 8-2.

Table 8-14 Selected passing flow compliance in the Ovens basin

River	Passing flow	
Ovens River	Instrument where flow-sharing rules are specified	Bulk Entitlement (Bright) Conversion Order 2000
	Responsible authority	North East Water
	Compliance point	Bright diversion weir (shown as 1 in Figure 8-2)
	Passing flow compliance	• All flows were passed for flows less than 2 ML/day • A minimum flow of 2 ML/day was passed for flows between 2 and 3.6 ML/day • A minimum flow of 2 ML/day plus 20% of the total of flow less 3.6 ML/day was passed for flows between 3.6 and 39.5 ML/day • 9.5 ML/day was passed for flows of 39.5 ML/day or greater
Buckland River	Instrument where flow-sharing rules are specified	Bulk Entitlement (Porepunkah) Conversion Order 1999
	Responsible authority	North East Water
	Compliance point	Porepunkah pump station (shown as 2 in Figure 8-2)
	Passing flow compliance	• Half the flow was passed for flows less than 2.6 ML/day • The entire flow, less 1.3 ML/day was passed for flows of 2.6 ML/day or greater
Buffalo River, King River, confluence to River Murray	Instrument where passing flows are specified	Bulk Entitlement (Ovens System – Goulburn-Murray Water) Conversion Order 2004
	Responsible authority	Goulburn-Murray Water
	Compliance point	Catchment upstream of Cheshunt (King River between Cheshunt and Lake William Hovell) (shown as 3 in Figure 8-2)
	Passing flow compliance	• The lesser of 20 ML/day or natural flow was passed from November to May inclusive • The lesser of 30 ML/day or natural flow was passed from June to October inclusive

8.11.3 Management plan

In 2008/09 a joint groundwater and surface water WSPA was declared for the Upper Ovens River as a precursor to the establishment of an integrated surface water/groundwater management plan. In May 2009, a consultative committee was appointed and commenced the development of the plan.

9 Broken basin

This chapter sets out the accounts for the Broken basin. For detailed information about how they have been compiled, refer to Chapter 5.

9.1 Broken basin summary

The Broken system began 2008/09 with record low reserves and a need for good inflows to provide an allocation to irrigators. This didn't eventuate as inflows were extremely low at 17% of the long term average.

Due to the severe water shortage, Goulburn-Murray Water was unable to announce a seasonal allocation during a shortened irrigation season. As a result, water resource managers again directed attention towards securing essential domestic and stock needs through a qualification of rights and supplying carryover through contingency operations. All water improvements were directed to building up supplies for the 2009/10 season.

Carryover was an important tool for water users to individually manage through the dry conditions. A total of 6,900 ML of allocation was carried over from 2007/08 in the Broken system, a volume equivalent to a 26% allocation of high reliability water shares.

Most towns in the Broken basin are supplied from the Murray or the Goulburn system. These larger systems provided urban water corporations with more options to source water and enabled them to keep restrictions at medium to low levels. The local supply for Benalla, from a tributary of the Broken River, was adequate for residents and remained largely unrestricted throughout the year.

Private diverters on the unregulated tributaries were again severely restricted or banned for a large part of the year. The total volume of licensed diversions equalled 200 ML. This represents 2% of licensed entitlements on unregulated streams in the basin.

9.2 Responsibilities for management of water resources

Table 9-1 shows the responsibilities of various authorities within the Broken basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 9-1 Responsibilities for water resources management within the Broken basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water	Supplies the Tungamah domestic and stock supply system	Manages groundwater and surface water licensed diversions	Provides bulk water supplies to Goulburn Valley Water(1)	Operates Lake Mokoan and Lake Nillahcootie Obliged to meet passing flow requirements
North East Water			Supplies towns across most of the Broken basin, including Benalla	Obliged to meet passing flow requirements
Goulburn Valley Water			Supplies towns in the west of the basin, including Dookie(1)	
Goulburn Broken Catchment Management Authority				Manages waterways for the whole of the Broken basin

Note:

(1) Urban water systems managed by Goulburn Valley Water in the Broken basin are supplied from the Goulburn and Murray systems.

9.3 Rainfall, flows and storages in 2008/09

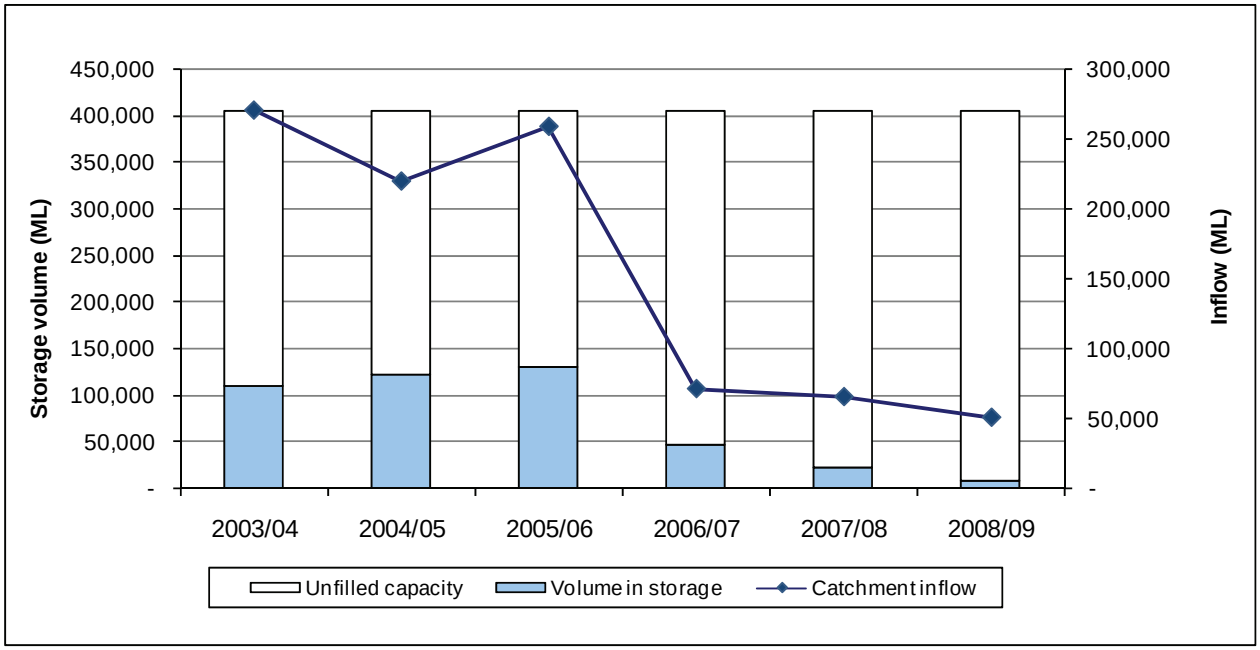
In 2008/09 rainfall across the Broken basin ranged between 60% and 80% of the long term average. Dry catchment conditions resulted in total inflows of 17% of the long term average (of 308,000 ML[7]) making it the third consecutive year where inflows were less than 30%. The 2008/09 inflows were also lower than the 2006/07 inflows.

The amount of water flowing from the Broken basin into the River Murray reduced to 12,900 ML in 2008/09. This represented 25% of the total inflows into the basin, a decline from 33% in 2007/08.

The volume of water held in major storages (greater than 1,000 ML capacity) in the Broken basin fell by 15,252 ML during 2008/09 to 9,200 ML, or 2% of the total storage capacity. This includes Lake Mokoan, Lake Nillahcootie and Loombah-McCall Say Reservoir. The low storage levels were the result of three consecutive years of low inflows, high levels of evaporation and releases for irrigation.

[7] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 9-1 All major storages and catchment inflows in the Broken basin



9.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Broken basin are shown in Table 9-2.

Table 9-2 Summary of total water resources and water use in the Broken basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	51,200	25,800
Groundwater[2]	5,100	2,800
Recycled water	290	290

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 9-8 and the estimated domestic and stock use as presented in Table 9-9.

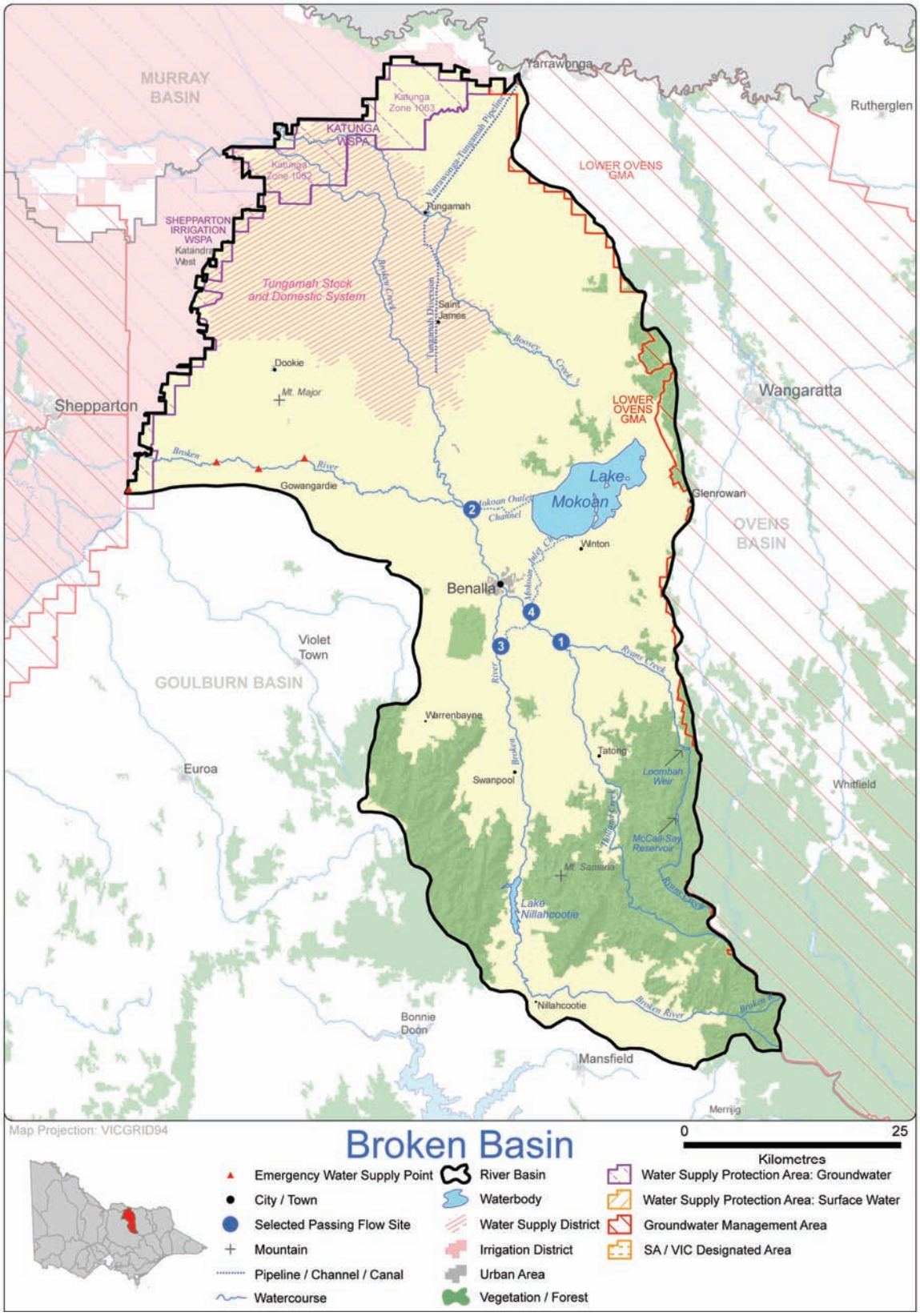
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

9.4.1 Infrastructure projects to improve water availability

Lake Mokoan was decommissioned as an active storage in February 2009. Broken system supplies were maintained from Lake Nillahcootie.

9.5 Location of water resources

Figure 9-2 Map of the Broken basin



9.6 Surface water resources

9.6.1 Water balance

A surface water balance for the Broken basin is shown in Table 9-3. Note that only those storages greater than 1,000 ML capacity have been included in the water balance.

Table 9-3 Balance of surface water in the Broken basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	24,500	48,600
Volume in storage at end of year	9,200	24,500
Change in storage	-15,300	**-24,100**
Inflows		
Catchment inflow(1)	51,200	66,000
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	60
Sub-total	**51,200**	**66,100**
Usage		
Urban diversions	1,570	1,460
Licensed diversions from regulated streams(2)	8,200	9,560
Licensed diversions from unregulated streams(3)	200	1,900
Environmental water diversions	0	0
Small catchment dams(4)	15,800	15,800
Sub-total	**25,800**	**28,700**
Losses		
Net evaporation losses from major storages	15,500	26,300
Evaporation from small catchment dams(4)	7,200	7,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	5,100	6,200
Sub-total	**27,800**	**39,700**
Water passed at outlet of basin		
Broken River at Gowangardie to Goulburn basin	12,400	19,700
Boosey Creek at Tungamah to Murray basin	200	1,000
Broken Creek at Katamatite to Murray basin	300	1,100

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Includes Tungamah domestic and stock system.

(3) Licensed diversions from unregulated streams are derived from an estimate based on the total licensed volume of diversions.

(4) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(5) 2008/09 loss data derived from the Goulburn Simulation Model.

9.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 9-4 are based on the estimates provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 9-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,400	7,700	n/a
Registered commercial and irrigation	9,600	8,100	n/a
Total	**25,000**	**15,800**	**23,000**

n/a: Information not available.

9.6.3 Water entitlement transfers

Surface water was moved in to, out from, and within the Broken basin in 2008/09 through water share transfers and variations, and allocation trade. There was no trade of permanent or temporary bundled entitlements in 2008/09.

Table 9-5 summarises the movement of water shares into and out of the Broken basin delivery systems during 2008/09. There was a net export of both high and low reliability water shares out of the basin in 2008/09, with 32 ML of high reliability and 6 ML of low reliability water traded out of the basin in this water year.

Table 9-5 Transfers and variations of water shares in the Broken basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Broken unregulated	774	806	-32	150	156	-6
Total	**774**	**806**	**-32**	**150**	**156**	**-6**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Broken basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

Table 9-6 summarises the trade of allocation within the Broken basin in 2008/09. A total of 1,565 ML of allocation was traded within the Broken basin. No water was traded with other Victorian or interstate basins. As all the water was traded within the basin in 2008/09, there was no net movement of water into or out of the basin.

Table 9-6 Allocation trade in the Broken basin 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Broken basin	1,565
Trade from other Victorian basins	0
Trade to other Victorian basins	0
Interstate trade - inbound	0
Interstate trade - outbound	0
Total trade into the Broken basin	1,565
Net trade into the Broken basin	0

Notes:

(1) This table summarises allocation trades approved into, out of and within the Broken basin trading zones (Zone 2A Broken – Nhill to Caseys) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

9.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 9-7.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

The Broken River system bulk entitlement volume held by Goulburn-Murray Water is a climatically varying annual cap in which compliance is determined under the Murray-Darling Basin Commission cap compliance process.

Table 9-7 Volume of water diverted under surface water entitlements in the Broken basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(1)
North East Water					
Loombah-McCall Say	1	2,324	0	1,565	Yes
Tungamah, Devenish and St James	1	135	0	0	Yes
Goulburn-Murray Water					
Broken River System	1	38,000	0	7,892	Yes
Broken River System – Tungamah domestic and stock, urban supplies	1	6,150	0	311	Yes
Environment Minister					
Broken System – Snowy Environmental Reserve(2)	1	990	0	703	Yes
Total annual volume of bulk entitlements 2008/09		**47,599**		**10,471**	
Total annual volume of bulk entitlements 2007/08		**48,587**	**0**	**11,720**	
Licensed diversions from unregulated streams 2008/09		*9,802*		*200*	
Licensed diversions from unregulated streams 2007/08		*9,802*		*1,900*	

Notes:

(1) Compliance with River Murray bulk entitlements is also assessed against the Murray-Darling basin annual cap target for the Goulburn, Loddon and Broken basins. Details of this are contained in the Murray-Darling Basin Authority's Water Audit Monitoring Report 2008/09.

(2) The volume diverted under this bulk entitlement is passed to the Murray as a substitute for Snowy River water formerly released to the Murray.

9.7 Groundwater resources

Licensed groundwater entitlements and use for the groundwater management units in the Broken basin, excluding domestic and stock use, are shown in Table 9-8. The Broken basin contains 8% of the Katunga WSPA by surface area. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Groundwater extractions from the Katunga WSPA were restricted during 2008/09. The volume extracted from the Katunga WSPA during 2008/09 was similar to that extracted in 2007/08.

Table 9-8 Licensed groundwater volumes, Broken basin 2008/09

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Katunga WSPA (8%)	>25	5,042	5,021	2,770	0	2,770	2,518
Total(5)		**5,042**	**5,021**	**2,770**	**0**	**2,770**	**2,518**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water in this table represents the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 9-9.

Table 9-9 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Katunga WSPA (8%)	39	78
Total	**39**	**78**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 9-8.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is available as an urban water supply for the Goorambat in the Broken basin. The licensed entitlements and metered use for this supply are provided in Table 9-10.

Table 9-10 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Goorambat	24	16	19
Total	**24**	**16**	**19**

9.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Broken basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- utilising carryover
- ending the irrigation season early to build reserves for 2009/10
- providing emergency environmental flows
- the continuation of a temporary qualification of rights, as detailed in Table 9-11.

Carryover was an important tool for water users to individually manage through the dry conditions. A total of 6,900 ML of allocation was carried over from 2007/08 in the Broken system, a volume equivalent to a 26% allocation of high reliability water shares.

As with all northern Victorian systems, Goulburn-Murray Water ended the irrigation season early to build reserves for supplies in 2009/10.

Nearly 2,000 ML of the Goulburn system water quality reserve was delivered down Broken Creek to improve the health of the drought affected river.

Table 9-11 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Broken Water System July 2007 Amendment to Temporary Qualification of Rights in the Broken Water System June 2008	1 July 2008 to 30 June 2009 (continuing from 1 July 2007)	Differential access by priority entitlements	Rights qualified to enable domestic and stock users to take the volume of water necessary for essential needs (such as household purposes, fire fighting) when the Broken system seasonal allocation was less than 20%. Commercial and industrial users' rights qualified to enable them to take water for limited purposes when the Broken system seasonal allocation was less than 20%
		Differential access by priority entitlements	Reduced the volume of water entitlement to Goulburn-Murray Water under Bulk Entitlement (Broken System – Tungamah Domestic and Stock, Urban Supplies – Goulburn Murray Water) Conversion Order 2004 and to North East Water under Bulk Entitlement (Broken System – Tungamah, Devenish and St James – North East Water) Conversion Order 2004 when the Broken System seasonal allocation was less than 20%
		Volume carried over	Granted the right to carry over water that remained unused at 30 June 2008 up to 30% of entitlement minus 5% for losses
		Reduced passing flow requirements	Removed obligation of Goulburn-Murray Water to release water for passing flows on Broken River and Holland Creek while allocations were 0%

9.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 9-12.

Most towns in the Broken basin are supplied from the Murray or the Goulburn system. These larger systems provided urban water corporations with more options to source water and enabled them to keep restrictions at medium to low levels. The local supply for Benalla was adequate for its residents and remained largely unrestricted throughout the year.

Due to the severe water shortage, Goulburn-Murray Water was unable to announce a seasonal allocation during a shortened irrigation season.

Private diverters on the unregulated tributaries were again severely restricted or banned for a large part of the year.

Table 9-12 Seasonal allocations and restrictions on water use in Broken basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Benalla	Stage 1 restrictions in May and June 2009
	Katamatite	Stage 1 restrictions from July 2008 to June 2009
	Devenish, St James, Dookie and Tungamah	Stage 2 restrictions from July 2008 to June 2009
	Dookie	Stage 1 restrictions from July 2008 to June 2009
Regulated diversions	Broken System	0% allocation in 2008/09
Unregulated diversions	Boosey Creek	Irrigation ban July 2008 to June 2009
	Hollands Creek	Irrigation ban July 2008 to June 2009
	Ryans Creek	Irrigation ban July 2008 to June 2009
	Lima East Creek	Irrigation ban July 2008 to June 2009
	Lima Creek	Irrigation ban July 2008 to June 2009
Groundwater	Katunga WSPA	Restrictions in place during 2008/09

9.10 Recycled water

North East Water operates the sole wastewater treatment plant in the Broken basin at Benalla. The volume of wastewater produced from the Benalla treatment plant reduced from 394 ML in 2007/08 to 292 ML in 2008/09, however the proportion recycled increased from 84% in 2007/08 to 100% in 2008/09. Table 9-13 details the recycling undertaken at Benalla during 2008/09.

Table 9-13 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Benalla	292	292	100%	0	292	0	0	0	0
Total 2008/09	**292**	**292**	**100%**	**0**	**292**	**0**	**0**	**0**	**0**
Total 2007/08	394	331	84%	0	331	0	0	63	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site effluent storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

9.11 Water for the environment

9.11.1 Environmental Water Reserve (EWR)

Important environmental assets such as the Murray Cod and Trout Cod and significant areas of intact riparian and floodplain vegetation depend on the Broken basin EWR. Water from the Broken basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets within that basin.

In 2008/09 the Broken basin EWR comprised the following components:

- the Bulk Entitlement (Broken System – Snowy Environmental Reserve) Conversion Order 2006 of 990 ML, held by the Environment Minister
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by North East Water and Goulburn-Murray Water
- 2,817 ML of the Goulburn system water quality reserve made available to improve the health of Broken Creek
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

9.11.2 Entitlements for the environment

The Environment Minister holds a 990 ML environmental bulk entitlement. This is used in accordance with Victoria's Snowy River obligations (i.e. as a substitute for Snowy water formerly released to the Murray).

9.11.3 Passing flow compliance

Some bulk entitlements require passing flow requirements to be met at a number of points in the basin.

North East Water and Goulburn-Murray Water reported that they met all passing flow requirements in the Broken basin under their bulk entitlements in 2008/09. However, the Minister for Water qualified rights in the Broken River in 2008/09. This qualification included the removal of obligations to meet some passing flow requirements at various points within the system.

Table 9-14 shows passing flow compliance in the Broken basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The locations of these compliance points are presented in Figure 9-2.

Table 9-14 Selected passing flow compliance in the Broken basin

River	Passing flow	
Ryan's Creek	Instrument where passing flows are specified	Bulk Entitlement (Loombah – McCall Say) Conversion Order 2001
	Responsible authority	North East Water
	Compliance point	Loombah Reservoir (shown as 1 in Figure 9-2)
	Passing flow compliance	• The lesser of 2.75 ML/day or natural flow was passed • 3.5 KL/day was passed from February to May when the combined storage volume was greater than a specified amount at the beginning of the month
Broken River, Holland Creek	Instrument where passing flows are specified	Bulk Entitlement (Broken System – Goulburn-Murray Water) Conversion Order 2004
	Responsible authority	Goulburn-Murray Water
	Compliance point	Catchment upstream of Moorngag (Broken River upstream of Casey Weir) (shown as 2 in Figure 9-2)
	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements: • June to November inclusive, the lesser of 30 ML/day or natural flow
	Compliance point	Broken River between Broken Weir and Casey Weir (shown as 3 in Figure 9-2)
	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements: • December to May inclusive, the lesser of 22 ML/day or natural flow
	Compliance point	Holland Creek downstream of Holland Weir (shown as 4 in Figure 9-2)
	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements: • When water is diverted from Broken River and/or Holland Creek to Lake Mokoan, passing flow is the lesser of 22 ML/day or natural flow • The prevailing flow was deemed as meeting environmental flows when water was not being diverted from Broken River and/or Holland Creek to Lake Mokoan

10 Goulburn basin

This chapter sets out the accounts for the Goulburn basin. For detailed information about how they have been compiled, refer to Chapter 5.

10.1 Goulburn basin summary

Goulburn basin inflows were again very low in 2008/09 at 28% of the long term average.

As with all northern Victorian systems, the season began with record low reserves and a 0% allocation, and ended early to build reserves for supplies in 2009/10. The final seasonal allocation of 33% against high reliability water shares was a record low.

The Minister for Water qualified rights on the Goulburn system to retain a portion of environmental water in storage and to ensure enough water could be supplied for essential domestic and stock needs while allocations were extremely low. The qualification also provided Coliban Water and Central Highlands Water access to the Goulburn Water Quality Reserve to supplement their local supplies so they could meet the critical water shortages facing Bendigo and Ballarat.

Water availability in the regulated system was again boosted by pumping Waranga basin. The $1.6 million exercise was funded by irrigators and allowed an additional 86,000 ML to be allocated. This increased seasonal allocations by 7%.

Carryover was also important in supplementing supplies. Nearly 93,000 ML of allocation was carried over by water users in 2008/09, a volume equivalent to a 9% allocation of high reliability water shares.

The water market was also an important tool for water users to manage through the record low allocation. A net total of nearly 40,000 ML of allocation was transferred into the basin in 2008/09.

Goulburn Valley Water used both carryover and the water market to ensure it was able to keep water restrictions at low levels for the majority of its towns in 2008/09. Only towns supplied by the Sunday Creek, Sevens Creek and Nine Mile Creek systems were subject to severe restrictions. However, by the end of the year, these had also been eased to medium or low levels.

The easing of restrictions was made possible in the Sunday Creek system due to the completion of the Broadford pipeline in December 2008. The pipeline connects Broadford to the Goulburn River near Tallarook and provides Goulburn Valley Water with an alternative source from which to supply this system.

The February 2009 bushfires severely damaged water infrastructure in a number of towns in the Goulburn basin including Kilmore, Broadford, Wandong, Heathcote Junction, Buxton and Marysville. Goulburn Valley Water responded to the emergency situation as a matter of urgency and managed to continue supplies with little interruption to its towns. It also reinstated supplies for Buxton and Marysville by the time residents returned to these communities. Rural water supplies were largely unimpacted by the bushfires.

Licensed diverters on many streams were again placed on severe restrictions throughout 2008/09, particularly in the latter half of the year. The total volume of licensed diversions from unregulated streams subsequently declined by nearly 70%.

10.2 Responsibilities for management of water resources

Table 10-1 shows the responsibilities of various authorities within the Goulburn basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 10-1 Responsibilities for water resources management within the Goulburn basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water	Supplies Central Goulburn irrigation district, Rochester Irrigation Area, Shepparton Irrigation Area	Manages private groundwater pumping and surface water diversions	Delivers bulk supplies to many of Goulburn Valley Water's towns, and some of Coliban Water's towns	Operates Lakes Eildon and Nagambie, and the Waranga basin Obliged to meet passing flow requirements
Goulburn Valley Water			Supplies towns located in the Goulburn basin, including Shepparton, Alexandra and Seymour	Obliged to meet passing flow requirements for towns with supply from unregulated streams
Coliban Water			Supplies towns located in the Loddon and Campaspe basins from the Goulburn basin including Bendigo	
Melbourne Water			Operates the Silver-Wallaby diversion system to Melbourne	Obliged to meet passing flow requirements
Environment Minister				Manages release of Snowy Environmental Reserve to the Murray for irrigation use as part of arrangements to supply Snowy environmental flows, also Living Murray environmental entitlement
Goulburn Broken Catchment Management Authority				Manages waterways for the whole of the Goulburn basin

10.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall across the Goulburn basin ranged between 60% and 80% of the long term average. Inflows were again very low at 28% of the long term average (of 3,363,000 ML[8]). This is lower than in 2007/08.

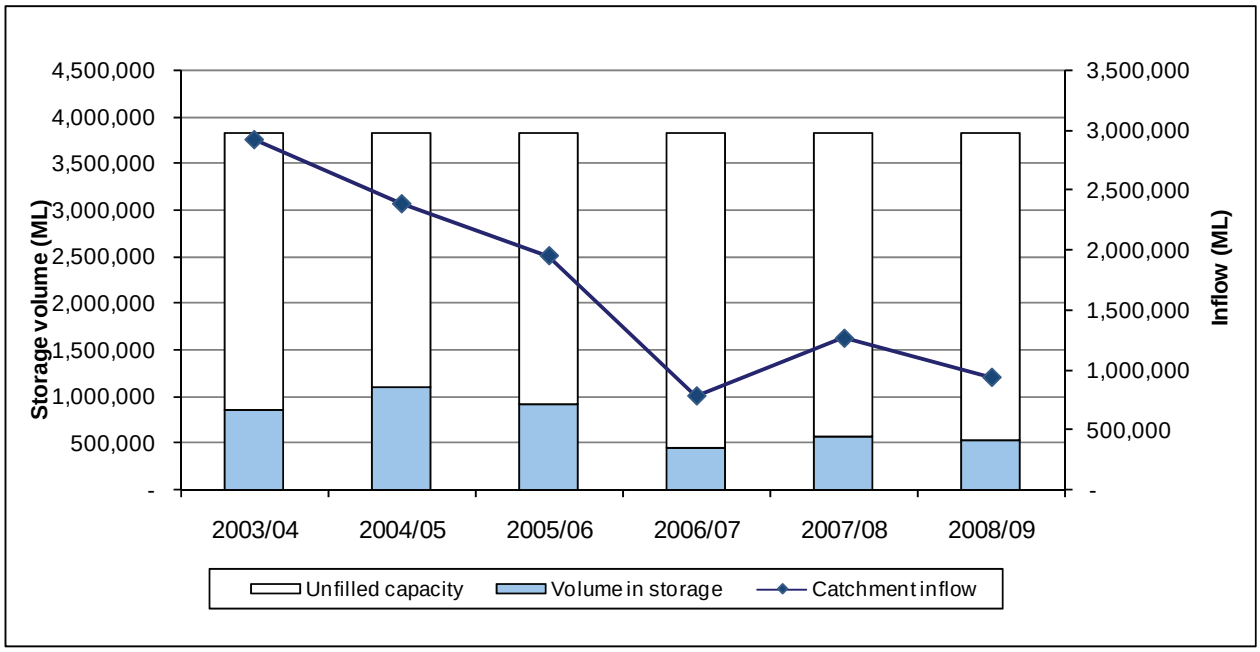
The volume of water flowing from the Goulburn basin into the River Murray reduced to 145,900 ML in 2008/09. This is 63% of the 230,200 ML that left the basin in 2007/08 and lower than the outflows in 2006/07 of 165,500 ML. In 2008/09 outflows from the Goulburn basin were 16% of catchment inflows, compared with 19% in the previous year.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin decreased from 574,000 ML in July 2008 to 546,600 ML by June 2009, or 14% of the total storage capacity.

Only volumes for major on-stream storages have been included in the water balance and, as such, major storages such as Waranga basin and Greens' Lake have not been included. The volume of water in the three major on-stream storages in the basin – Lake Eildon, Lake Nagambie (Goulburn Weir) and Sunday Creek Reservoir – decreased by 40,300 ML in 2008/09 to 458,500 ML by June 2009.

[8] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 10-1 All major storages and catchment inflows in the Goulburn basin



10.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Goulburn basin are shown in Table 10-2. Total use in 2008/09 reduced by 5.6% compared with 2007/08.

Table 10-2 Summary of total water resources and water use in the Goulburn basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	933,700	735,100
Groundwater[2][3]	167,500	48,600
Recycled water	6,840	6,640

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 10-9 and the estimated domestic and stock use as presented in Table 10-10.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

(3) Groundwater entitlements in Shepparton are generally high as traditionally groundwater has been pumped for salinity control. The total licence entitlements may therefore not reflect the total water resource.

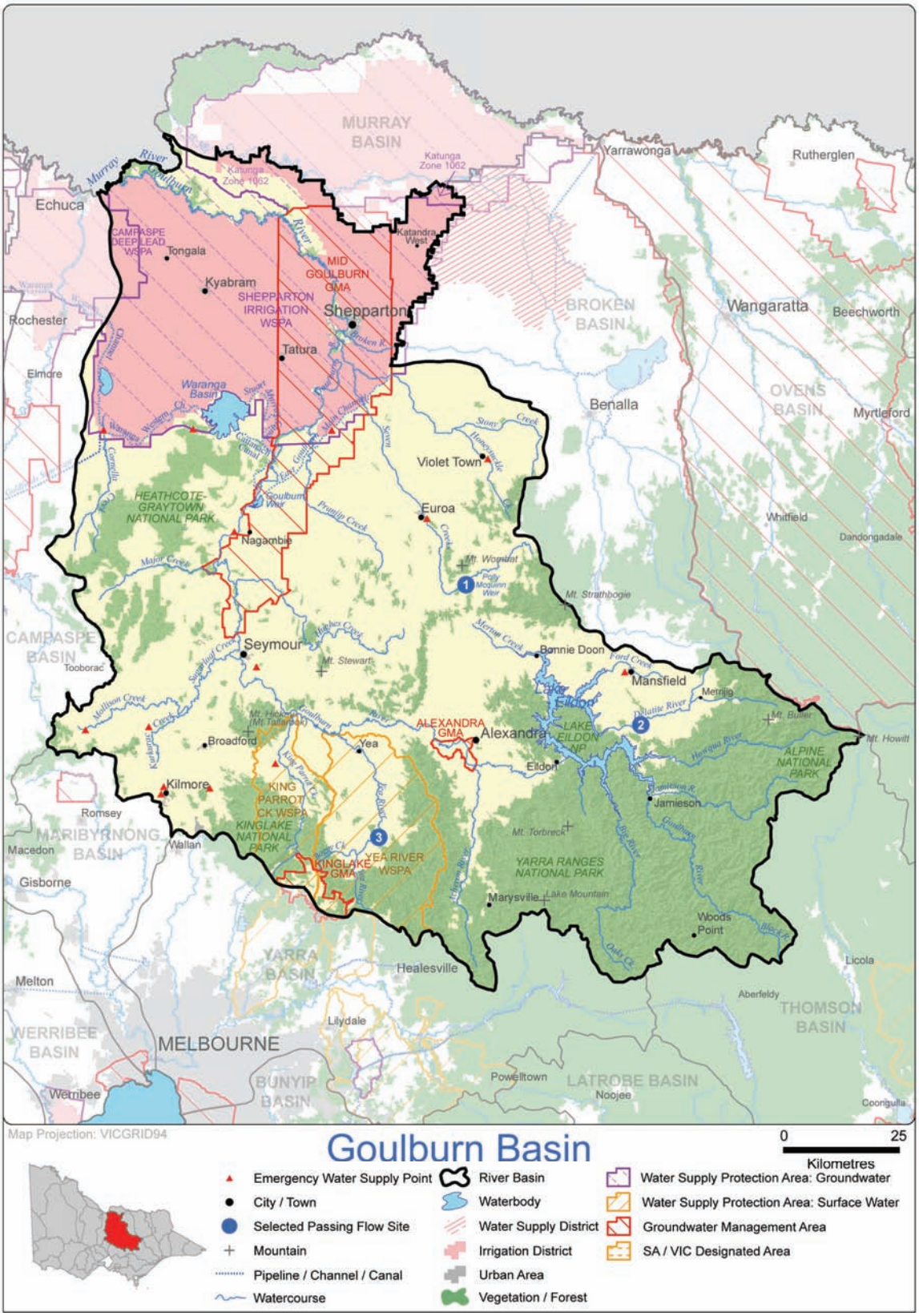
10.4.1 Infrastructure projects to improve water availability

Ongoing major infrastructure projects in the Goulburn basin include Stage 2 of the northern Victorian Irrigation Renewal Project, which commenced in March 2008 and is expected to be complete in 2010. Works involve replacing the existing irrigation infrastructure to improve operation efficiency include works to reduce channel outfalls, leakage and seepage, and rationalising the distribution system.

In December 2008, Goulburn Valley Water completed the Broadford pipeline, which connects Broadford to the Goulburn River near Tallarook. The pipeline provides Goulburn Valley Water with an alternative source from which to supply this system. It also began constructing the the Upper Goulburn Water Supply Project, which will transfer treated water from Alexandra to Thornton and Eildon.

10.5 Location of water resources

Figure 10-2 Map of the Goulburn basin



10.6 Surface water resources

10.6.1 Water balance

A surface water balance for the Goulburn basin is shown in Table 10-3. Note that only on-stream storages with capacity greater than 1,000 ML have been included in the water balance.

Table 10-3 Balance of surface water in the Goulburn basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	498,800	377,800
Volume in storage at end of year	458,500	498,800
Change in storage	**-40,300**	**121,000**
Inflows		
Catchment inflow(1)	921,000	1,241,100
Inflow from Broken River at Gowangardie	12,400	19,700
Return flow from irrigation	0	0
Treated effluent discharged back to river(2)	320	670
Sub-total	**933,700**	**1,261,500**
Usage		
Urban diversions	25,530	23,970
Irrigation district diversions	647,000	679,400
Licensed diversions from regulated streams	8,800	10,400
Licensed diversions from unregulated streams	5,200	16,500
Silver and Wallaby Creeks to Yarra basin	1,200	1,100
Environmental water diversions	0	0
Small catchment dams(3)	47,500	47,500
Sub-total	**735,100**	**778,900**
Losses		
Net evaporation losses from major storages	17,900	19,900
Losses from small catchment dams(3)	10,100	10,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	62,200	99,000
Sub-total	**90,200**	**129,000**
Water passed at outlet of basin		
Goulburn River to Campaspe River via Waranga Western Channel	2,800	2,400
Goulburn River outflow to River Murray	133,400	204,900
Goulburn River outflow to River Murray via Broken Creek	12,500	25,300

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Includes 129 ML of water returned to rivers within the basin from Mount Buller and Lake Mountain alpine resorts in 2008/09.

(3) Evaporation losses are calculated by subtracting estimated usage from total water harvested.

(4) Losses estimated using loss functions from the Goulburn Simulation Model (REALM).

10.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 10-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 10-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	35,900	17,900	n/a
Registered commercial and irrigation	35,200	29,600	n/a
Total	**71,100**	**47,500**	**57,600**

n/a: Information not available.

10.6.3 Water entitlement transfers

Surface water movement in the Goulburn basin in 2008/09 occurred through water share transfers and variations, allocation trade and temporary transfer of bundled entitlement. In 2008/09 trade in unregulated systems was far greater than trade within the bundled systems.

Table 10-5 summarises transfers and variations in high reliability and low reliability water shares in 2008/09. During the year there was a net export of water from the basin, with 33,915 ML of high reliability, and 12,581 ML of low reliability water shares being traded out of the basin.

Table 10-5 Transfers and variations of water shares in the Goulburn basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Central Goulburn Irrigation Area	24,536	39,487	-14,951	13,806	19,957	-6,151
Rochester Irrigation Area	10,019	17,218	-7,199	4,485	7,832	-3,347
Shepparton Irrigation Area	13,804	20,535	-6,731	8,465	10,194	-1,730
Goulburn River	2,517	7,551	-5,035	1,226	2,580	-1,354
Total	**50,876**	**84,791**	**-33,915**	**27,982**	**40,563**	**-12,581**

Notes:
(1) This table summarises all recorded water share transfers and variations in the Goulburn basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.
(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

Table 10-6 summarises trades in allocation within the Goulburn basin, and with other Victorian and interstate basins. A total of 211,263 ML of water allocations were traded in 2008/09, with approximately half of the volume traded within the basin. There was also a net import of water from interstate basins, with 76,193 ML of water entering the basin from interstate, predominantly from New South Wales, compared to 14,817 ML of water being sold to interstate users, predominantly in South Australia. In total there was a net import of 44, 683 ML of water allocation into the basin in 2008/09.

Table 10-6 Allocation trade in the Goulburn basin[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Goulburn basin	109,378
Trade from other Victorian basins	25,693
Trade to other Victorian basins	42,385
Interstate trade - inbound	76,193
Interstate trade - outbound	14,817
Total trade into the Goulburn basin	**211,263**
Net trade into the Goulburn basin	**44,683**

Notes:
(1) This table summarises allocation trades approved into, out of and within the Goulburn basin trading zones (Zone 1A Greater Goulburn, and Zone 3 Lower Goulburn) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.
(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

Table 10-7 summarises the movement of bundled entitlements in the Goulburn basin during 2008/09. Permanent trade in bundled water rights only occurred within the Goulburn unregulated system in 2008/09. The temporary trade took place within both the Goulburn unregulated and Lower Goulburn unregalated systems in 2008/09. There was no net movement of bundled water rights into the Goulburn basin in the year.

Table 10-7 Transfers of surface water bundled entitlements in the Goulburn basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Goulburn unregulated	2	2	0	20	20	0
King Parrot Creek unregulated	0	0	0	0	0	0
Lower Goulburn unregulated	0	0	0	20	20	0
Yea River unregulated	0	0	0	0	0	0
Total 2008/09	**2**	**2**	**0**	**40**	**40**	**0**
Total 2007/08[(1)]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

10.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 10-8. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that an authority will still comply even though the volume diverted in any given year exceeds the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 10-8 Volume of water diverted under surface water entitlements in the Goulburn basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[(1)]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[(2)(3)]
Coliban Water					
Boort	1	425	3	163	Yes
Dingee	1	50	0	8	Yes
Lockington	1	130	0	79	Yes
Macorna	1	40	0	7	Yes
Mitiamo	1	60	0	19	Yes
Mysia	1	15	0	1	Yes
Pyramid Hill	1	300	0	138	Yes
Rochester	1	1,400	0	978	Yes
Goulburn Valley Water					
Alexandra	1	916	-528	376	Yes
Bonnie Doon	1	112	-55	45	Yes
Buxton	1	110	0	0	Yes
Colbinabbin	1	89	-56	25	Yes
Corop	1	44	-30	10	Yes
Dookie	1	160	-70	110	Yes
Eildon	1	471	-337	123	Yes
Euroa System	1	1,990	0	818	Yes
Gigarre	1	100	-50	50	Yes
Katandra West	1	64	0	46	Yes
Kyabram	1	2,000	-780	1,222	Yes
Longwood	1	120	0	50	Yes
Mansfield	2	1,300	-2	839	Yes
Marysville	1	462	0	271	Yes
Mooroopna	1	300	-210	160	Yes
Murchison	1	350	-104	196	Yes
Nagambie	1	825	-250	605	Yes
Pyalong	1	75	0	39	Yes
Rushworth	1	530	-219	314	Yes

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[2][3]
Seymour	1	5,340	-4,493	2,200	Yes
Shepparton	1	17,970	-690	11,566	Yes
Stanhope	1	200	-115	85	Yes
Sunday Creek	10	2,238	0	620	Yes
Tatura	1	2,600	-591	2,108	Yes
Thornton	1	120	0	45	Yes
Tongala	1	1,404	-570	746	Yes
Upper Delatite	1	235	0	71	Yes
Violet Town	1	20	0	0	Yes
Woods Point[4]	1	30	0	34	No
Yea	1	438	0	259	Yes
GWMWater					
Quambatook[5]	1	100	0	107	Yes
Melbourne metropolitan retailers					
Silver and Wallaby Creek	3	22,000	0	1,100	Yes
Environment Minister					
Goulburn System – Snowy Environmental Reserve [6]	1	14,812	0	7,702	Yes
Goulburn System – Living Murray[7]	1	141,046	0	0	Yes
Goulburn-Murray Water					
Eildon – Goulburn Weir	10	1,919,000	0	655,656	Yes
AGL Hydro Ltd					
Rubicon – Southern Hydro Ltd[8]	1	0	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**2,139,991**	**-9,147**	**688,991**	
Total annual volume of bulk entitlements 2007/08		**2,140,241**	**-13,023**	**713,782**	
Licensed diversions from unregulated streams 2008/09		*40,259*		*5,200*	
Licensed diversions from unregulated streams 2007/08		*40,259*		*16,500*	

Note:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) Compliance is also assessed against the Murray-Darling basin annual cap target for the Goulburn, Loddon and Broken basins. Details of this are contained in the Murray-Darling Basin Authority's Water Audit Monitoring Report 2008/09.

(3) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(4) The volume of water taken at Woods Point exceeded the bulk entitlement limit by 4 ML. This was caused by a non-return valve on an emergency pump failing, which allowed water to siphon from the supply tank into the Goulburn River.

(5) GWMWater used carryover to supplement its annual average entitlement volume and therefore complied with its bulk entitlement.

(6) The volume diverted under this bulk entitlement is passed to the Murray as a substitute for Snowy River water formerly released to the Murray.

(7) Added in 2007/08.

(8) The Rubicon – Southern Hydro Ltd bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes and therefore the volume has not been included. Any water diverted under this entitlement is returned to the watercourse.

10.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Goulburn basin, excluding domestic and stock use, is presented in Table 10-9.

The Goulburn basin contains the whole Alexandra GMA and Mid Goulburn GMA as well as parts of the Campaspe Deep Lead WSPA, Shepparton WSPA, Katunga WSPA and Kinglake GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Initially groundwater extraction was to control salinity resulting from rising water levels, a historical legacy of vegetation removal. Reported groundwater usage in the Goulburn basin reduced in 2008/09 compared with 2007/08, largely due to a decrease in the Shepparton WSPA extractions.

The recent years' increase in groundwater consumption is linked to reduced availability of surface water resources. Low rainfall in 2006/07 increased the scarcity of surface water and led to higher groundwater extraction volumes. Slightly higher summer rainfalls in 2007/08 increased availability of surface water compared with 2006/07 and subsequently reduced demand for groundwater. In the Shepparton WSPA, licensed groundwater users access the shallow groundwater system and, as groundwater levels dropped during 2008/09, many users could not access as much water.

Extractions from the Campaspe Deep Lead WSPA and the Katunga WSPA were restricted to a 65% and 70% allocation respectively during 2008/09.

Table 10-9 Licensed groundwater volumes, Goulburn basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Alexandra GMA (100%)	All depths	1,937	1,714	182	1,028	1,210	1,028
Mid Goulburn GMA (100%)	Zone 1070 - >25 Zone 1071 all depths	14,900	12,330	4,566	0	4,566	4,202
Kinglake GMA (81%)	All depths	1,636	1,513	213	908	1,121	906
Campaspe Deep Lead WSPA (10%)	>25	4,675	4,560	2,385	0	2,385	2,814
Katunga WSPA (11%)	>25	6,647	6,620	3,652	0	3,652	3,319
Shepparton WSPA (57%)	≤25	137,699	137,699	32,651	0	32,651	49,017
Total[6]		**167,494**	**164,436**	**43,649**	**1,936**	**45,585**	**61,286**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established (e.g. Shepparton WSPA), in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use based on 60% of the licensed entitlement volume for Alexandra GMA,and Kinglake GMA.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 10-10. Groundwater does not supplement the urban water supply in the Goulburn basin.

Table 10-10 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Alexandra GMA	4	8
Kinglake GMA	235	471
Campaspe Deep Lead WSPA	23	45
Katunga WSPA	52	103
Mid Goulburn GMA	152	304
Shepparton WSPA	1,065	2,131
Total	**1,531**	**3,062**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 10-9.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

10.8 Drought contingency measures

A range of drought contingency measures was implemented in the Goulburn basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- purchasing and supplying water from an alternative location
- pumping Waranga basin
- ending the irrigation season early to build reserves for 2009/10
- utilising carryover
- water carting
- the continuation of a qualification of rights as detailed in Table 10-11.

Goulburn Valley Water purchased 16.2 ML of water from Yarra Valley Water to supplement supplies in the Sunday Creek system. The water was transferred to Kilmore via temporary connection to Yarra Valley Water's system at Wallan until 30 December 2008. Goulburn Valley Water also carted 53 ML of water from Seymour to Broadford between July and August to supplement the Sunday Creek system's supplies.

These measures were reinstated temporarily after the Kilmore water treatment plant suffered fire damage during the bushfires in February 2009. To supplement supplies in the aftermath of this event, Goulburn Valley Water transferred 4.2 ML of water to Kilmore from Yarra Valley Water's supply system and carted approximately 1 ML to Broadford and Kilmore from Seymour.

Goulburn-Murray Water again increased water availability in the regulated Goulburn system by pumping water from below the normal operating level in Waranga basin. The $1.6 million exercise was funded by irrigators and allowed an additional 86,000 ML to be allocated. This increased seasonal allocations by 7%.

Carryover was also important in supplementing supplies in the regulated system. Nearly 93,000 ML of allocation was carried over by water users in 2008/09, a volume equivalent to a 9% allocation of high reliability water shares.

As with all northern Victorian systems, Goulburn-Murray Water ended the irrigation season early to build reserves for supplies in 2009/10.

Table 10-11 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Goulburn Water System July 2007 Amendment to Temporary Qualification of Rights in the Goulburn Water System January 2008 Further Amendment to Temporary Qualification of Rights in the Goulburn Water System June 2008	1 July 2008 to 30 June 2009 (continuing from 1 July 2007)	Differential access by priority entitlements	Rights qualified to enable domestic and stock users to take the volume of water necessary for essential needs (such as household purposes, fire fighting) when the Goulburn system seasonal allocation was less than 20%. Commercial and industrial users' rights qualified to enable them to take water for limited purposes when the Goulburn system seasonal allocation was less than 20%
		Differential access by priority entitlements	Rights of Coliban Water qualified under the Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995 by allocating 1,800 ML in total for its Goulburn entitlements and removing the restriction rules, to enable the supply of its townships when the Goulburn system allocation was less than 20%
		Differential access by priority entitlements	Rights of GWMWater qualified under the Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Conversion Order 2006 by allocating 50 ML and removing the restriction rules, to enable the supply of Quambatook while the Goulburn system allocation was less than 20%
		Differential access by priority entitlements	Qualified Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995 so that 10,000 ML of water set aside for water quality releases in the Goulburn River and lower Broken Creek was made available to Coliban Water and Central Highlands Water for supplying Bendigo, Ballarat and satellite towns via the Goldfields Superpipe
		Differential access by priority entitlements	Rights of primary entitlements set out in Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995 qualified so that: • supplies were reduced to 600 ML in the West Loddon Waterworks district • supplies were reduced to 314 ML for the Normanville Waterworks district • GWMWater was supplied with up to 2,000 ML during April and May • when the Goulburn system allocation was less than 20%
		Reduced passing flow requirements	Goulburn-Murray Water's passing flow requirements for Goulburn River at McCoys Bridge gauging station reduced
		Volume carried over	Granted right to carry over water that remained unused at 30 June 2007 and 30 June 2008, up to 30% of entitlement volume less 5% losses

10.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 10-12.

Goulburn Valley Water utilised both carryover and the water market to ensure it was able to keep water restrictions at low levels for the majority of its towns in 2008/09. Only towns supplied by the Sunday Creek, Sevens Creek and Nine Mile Creek systems were subject to severe restrictions. However, by the end of the year these had also been eased to medium or low levels.

The Goulburn system irrigation season began with record low reserves and a 0% allocation. The final seasonal allocation of 33% against high reliability water shares was a record low.

Licensed diverters on many streams throughout the basin were again placed on severe restrictions throughout 2008/09, particularly in the latter half of the year.

Table 10-12 Seasonal allocations and restrictions on water use in Goulburn basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Kyabram, Tatura and Tongala	Stage 1 restrictions between July 2008 to June 2009
	Woods Point	Stage 1 restrictions from July 2008 to June 2009
	Kilmore, Wandong and Heathcote Junction	Stage 4 restrictions from July to December 2008, Stage 2 from January to February 2009, and Stage 1 from March to June 2009
	Broadford and Clonbinane	Stage 4 restrictions from July to November 2008, Stage 1 from December 2008 to June 2009.
	Euroa, Violet Town	Stage 1 restrictions from July 2008 to March 2009, Stage 2 from April to June 2009
	Sawmill Settlement, Merrijig	Stage 1 restrictions from July 2008 to June 2009
	Mansfield	Stage 1 restrictions from July 2008 to June 2009
	Longwood	Stage 1 restrictions from July 2008 to June 2009
	Bonnie Doon	Stage 1 restrictions from July 2008 to June 2009
	Alexandra, Eildon, Murchison, Nagambie, Rushworth, Seymour/Mangalore, Shepparton, Mooroopna, Toolamba, Corop, Girgarre, Katandra West and Stanhope	Stage 1 restrictions from July 2008 to June 2009
	Pyalong	Stage 1 restrictions from July 2008 to June 2009
	Marysville	Stage 1 restrictions from July 2008 to June 2009
	Thornton	Stage 1 restrictions from July 2008 to June 2009
	Yea	Stage 1 restrictions from July 2008 to June 2009
	Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill, Rochester	Stage 3 restrictions from July to December 2008, Stage 2 restrictions from January to June 2009
Irrigation and regulated diversions	Goulburn system	Allocation began the year at 0% of entitlement, increasing to 33% in April 2009
Unregulated diversions	Yea River and tributaries	Irrigation ban November 2008 to January 2009, Stage 3 restrictions from February to June 2009
	Sevens Creek	Irrigation ban October 2008 to June 2009
	Sunday Creek	Irrigation ban July 2008, October 2008 to June 2009
	Faithfulls Creek	Irrigation ban July to August 2008, October 2008 to June 2009
	Hughes Creek	Irrigation ban November 2008 to June 2009
	Stony Creek	Irrigation ban from February to June 2009
	King Parrot Creek, Archeron River, Stevenson River and Little Stevenson River	Irrigation ban from February 2009 to June 2009
	Cummins Creek, Strath Creek, Chyser Creek, Johnstons Creek, Wallaby Creek, Pheasant Creek	Irrigation ban February to June 2009
Groundwater	Katunga WSPA	Restrictions in place in 2008/09
	Campaspe Deep Lead WSPA	Restrictions in place in 2008/09

10.10 Recycled water

Goulburn Valley Water operates all wastewater treatment plants in the Goulburn basin. Approximately 97% of the volume of wastewater passing through treatment plants in the basin was recycled (Table 10-13), an increase of 5% compared with 2007/08. For most treatment plants, 100% of wastewater was recycled.

Table 10-13 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Alexandra	176	66	37%	0	66	0	0	110	0
Avenel	17	17	100%	0	17	0	0	0	0
Bonnie Doon	8	8	100%	0	8	0	0	0	0
Broadford	136	136	100%	0	136	0	0	0	0
Eildon	84	0	0%	0	0	0	0	84	0
Euroa	177	177	100%	92	85	0	0	0	0
Girgarre	0	0	0%	0	0	0	0	0	0
Kilmore	170	170	100%	0	170	0	0	0	0
Kyabram / Merrigum	194	194	100%	0	194	0	0	0	0
Mansfield	198	198	100%	76	122	0	0	0	0
Marysville	42	42	100%	26	16	0	0	0	0
Mooroopna	672	672	100%	0	672	0	0	0	0
Murchison	0	0	0%	0	0	0	0	0	0
Nagambie	117	117	100%	0	117	0	0	0	0
Seymour	430	430	100%	0	430	0	0	0	0
Shepparton	3,165	3,165	100%	0	3,165	0	0	0	0
Stanhope / Rushworth	0	0	0%	0	0	0	0	0	0
Tatura	829	829	100%	0	829	0	0	0	0
Tongala	286	286	100%	0	286	0	0	0	0
Upper Delatite	23	23	100%	0	23	0	0	0	0
Violet Town	21	21	100%	0	21	0	0	0	0
Yea	95	95	100%	41	54	0	0	0	0
Total 2008/09	**6,840**	**6,646**	**97%**	**235**	**6,411**	**0**	**0**	**194**	**0**
Total 2007/08	6,469	5,965	92%	271	5,694	0	0	505	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site effluent storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

10.11 Water for the environment

10.11.1 Environmental Water Reserve (EWR)

Important environmental assets, such as wetlands of state significance, significant areas of intact riparian and floodplains vegetation and endangered flora and fauna species including Trout Cod and Murray Cod, depend on the EWR in the Goulburn basin. Water from the Goulburn basin also feeds into the Murray basin helping to maintain internationally significant environmental assets such as Gunbower Forest and the Kerang Wetlands.

In 2008/09 the Goulburn basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements (regulated and unregulated systems) held by Goulburn Valley Water and Goulburn Murray Water
- the Goulburn Living Murray environmental entitlement
- water set aside for the environment to maintain water quality in the Goulburn basin
- Goulburn system Snowy environmental reserve bulk entitlement
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- the Goulburn River – Living Murray environmental entitlement of 141,046 ML held by the Environment Minister
- the Goulburn system – Snowy environmental reserve entitlement of 14,812 ML held by the Environment Minister
- all other water in the basin not allocated for consumptive use, ie water above cap.

10.11.2 Entitlements for the environment

The formal entitlement for the environment in the Goulburn basin in 2007/08 was the Goulburn River – Living Murray environmental entitlement of 141,046 ML held by the Environment Minister. Due to the ongoing drought and low storage levels, no allocation was received for this entitlement during 2008/09 and therefore releases were not made.

10.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Goulburn-Murray Water reported that it complied with all passing flow requirements in the Goulburn basin during 2008/09.

The Goulburn system water quality provision was also qualified, reducing it by 5,000 ML. This volume of water was made available for Bendigo and Ballarat to secure urban water supplies.

Table 10-14 shows passing flow compliance in the Goulburn basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 10-2.

Table 10-14 Selected passing flow compliance in the Goulburn basin

River	Passing flows	
Seven Creeks	Instrument where passing flows are specified	Bulk Entitlement (Euroa System) Conversion Order 2001
	Responsible authority	Goulburn Valley Water
	Compliance point	Polly McQuinns Reservoir (shown as 1 in Figure 10-2)
	Passing flow compliance	The lesser of 10 ML/day or observed flow was passed
Delatite River	Instrument where flow-sharing rules are specified	Bulk Entitlement (Mansfield) Conversion Order 1995
	Responsible authority	Goulburn Valley Water
	Compliance point	Upstream of Tonga Bridge Gauging Station (shown as 2 in Figure 10-2)
	Passing flow compliance	• All flows were passed for flows less than 18 ML/day • 18 ML/day was passed for flows between 18 and 20.2 ML/day • The entire flow less 2.2 ML/day was passed for flows between 20.2 and 30 ML/day • 27.8 ML/day was passed for flows between 30 and 32.2 ML/day • The entire flow less 4.4 ML/day was passed for flows greater than 32.2 ML/day
Yea River	Instrument where flow-sharing rules are specified	Bulk Entitlement (Yea) Conversion Order 1997
	Responsible authority	Goulburn Valley Water
	Compliance point	Upstream of the Yea urban offtake (shown as 3 in Figure 10-2)
	Passing flow compliance	• Half the flow was passed for flows less than 7.2 ML/day • The entire flow less 3.6 ML/day was passed for flows greater than 7.2 ML/day

11 Campaspe basin

This chapter sets out the accounts for the Campaspe basin. For detailed information about how they have been compiled, refer to Chapter 5.

11.1 Campaspe basin summary

Inflows in the Campaspe basin were 13% of the long term average, which was again one of the most drought-affected basins in Victoria.

The severe water shortage prevented seasonal allocations being announced on both the regulated Campaspe and Coliban rural systems. For the second time in three years water users on the Campaspe system did not receive an allocation.

The zero allocations forced water resource managers to focus on securing essential domestic and stock needs and emergency rural supplies through qualification of rights and contingency operations. Carryover was also important in supplementing supplies in the Campaspe system, as was use of the water market. A net total of 2,177 ML of allocation was transferred to the Campaspe basin in 2008/09.

As in all major northern Victorian systems, the irrigation season closed in April 2009 and all water resource improvements after this date were directed towards building supplies for the 2009/10 season.

Environmental passing flows were qualified on the Campaspe River and Coliban Rivers to retain water in Lake Eppalock and Upper Coliban storages for emergency consumptive supplies.

Most of the major towns located within the Campaspe basin, including Kyneton and Heathcote, were subject to severe water restrictions over the entire year due to the continuing water shortage. However, Coliban Water was able to reduce restrictions to Stage 2 for towns such as Echuca and Rochester as seasonal allocations gradually increased in the Murray and Goulburn systems and water became increasingly available on the market.

Severe restrictions were also placed on licensed diverters on a number of unregulated streams throughout the basin.

Groundwater continued to play an important role in rural supplies in the basin even though users in the Campaspe Deep Lead WSPA were restricted. Nearly 30,000 ML of groundwater was extracted by licensed users in 2008/09.

11.2 Responsibilities for management of water resources

Table 11-1 shows the responsibilities of various authorities within the Campaspe basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 11-1 Responsibilities for water resources management within the Campaspe basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water	Supplies Rochester irrigation district and Campaspe irrigation district	Manages groundwater and surface water licensed diversions	Provides bulk water supply to Coliban Water	Operates Lake Eppalock Obliged to meet passing flow requirements
Coliban Water	Provides irrigation and domestic and stock supplies off the Coliban Main Channel		Supplies urban water for the majority of the Campaspe basin, including Echuca, Rochester and Kyneton	Operates Upper Coliban, Lauriston and Malmsbury Reservoirs in the upper reaches of the Campaspe basin Obliged to meet passing flow requirements
Western Water			Supplies urban water for Woodend at the southern end of the basin	Obliged to meet passing flow requirements
North Central Catchment Management Authority				Manages waterways in the whole of the Campaspe basin

11.3 Rainfall, flows and storages in 2008/09

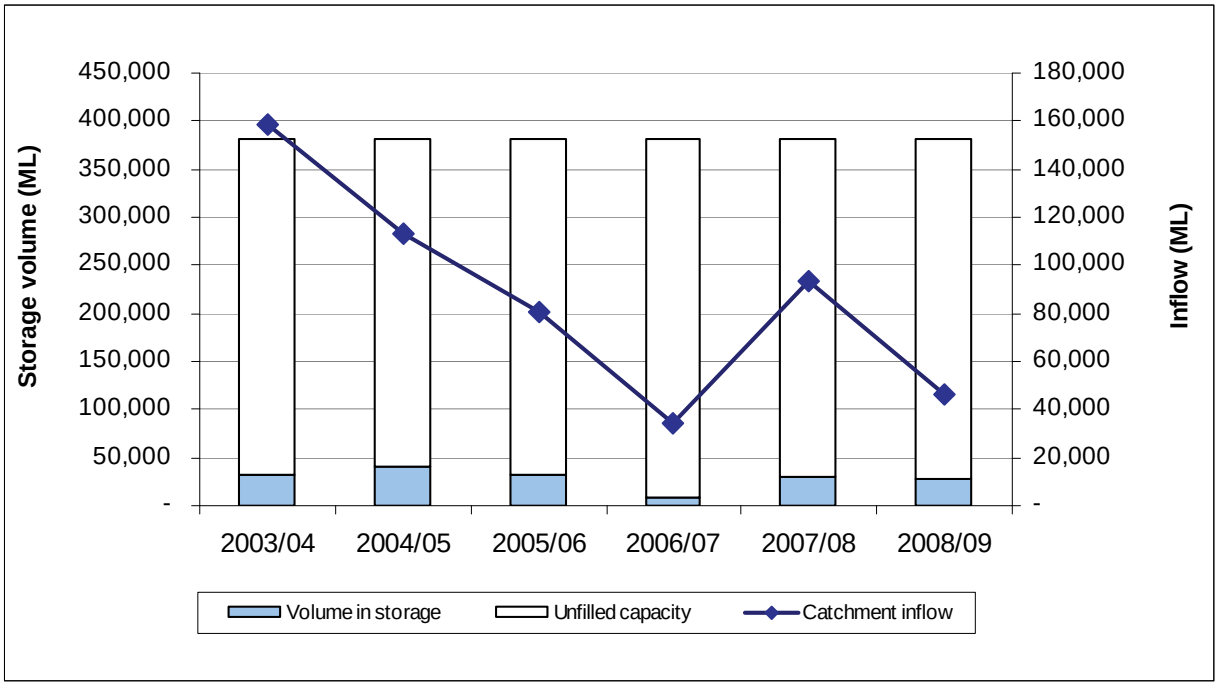
In 2008/09, rainfall across the Campaspe basin ranged from 60% to 80% of the long term average. Catchment inflow for the year of 46,100 ML was 13% of the long term average (of 352,000 ML[9]), less than half the 2007/08 inflows of 93,400 ML (27%).

[9] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

The amount of water flowing from the Campaspe basin into the River Murray was 3,500 ML in 2008/09. This represents 8% of the total inflows into the basin, which is less than the 13% for 2007/08.

Storage levels for all major storages (greater than 1,000 ML) in the basin decreased from 28,100 ML in July 2008 to 24,900 ML by the end of June 2009, or 7% of the total storage capacity of 382,300 ML. In the Campaspe basin, storages greater than 1,000 ML capacity include the Upper Coliban, Lauriston and Malmsbury Reservoirs, and Lake Eppalock, all of which are on-stream storages.

Figure 11-1 All major storages and catchment inflows in the Campaspe basin



11.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Campaspe basin are shown in Table 11-2. The volume of available surface water in 2008/09 was lower than in 2007/08 (64,600 ML compared with 107,200 ML). Demand also decreased from 2007/08 levels, with no allocations in the Campaspe and Coliban rural systems. Total groundwater usage in the Campaspe basin reduced in 2008/09 compared with 2007/08, however groundwater use in the Southern Campaspe Plains CMA increased.

Table 11-2 Summary of total water resources and water use in the Campaspe basin, 2008/09

Water source	Total water resource (ML)[1][2]	Total use (ML)
Surface water	64,600	45,600
Groundwater[3]	72,000	29,500
Recycled water	1,310	1,150

Note:

(1) For surface water, the total water resource includes the basin inflows and any treated water returned to the basin waterways. It does not include basin transfers via the Waranga Western Channel since these are made available from the Goulburn basin resource.

(2) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 11-8 and the estimated domestic and stock use as presented in Table 11-9.

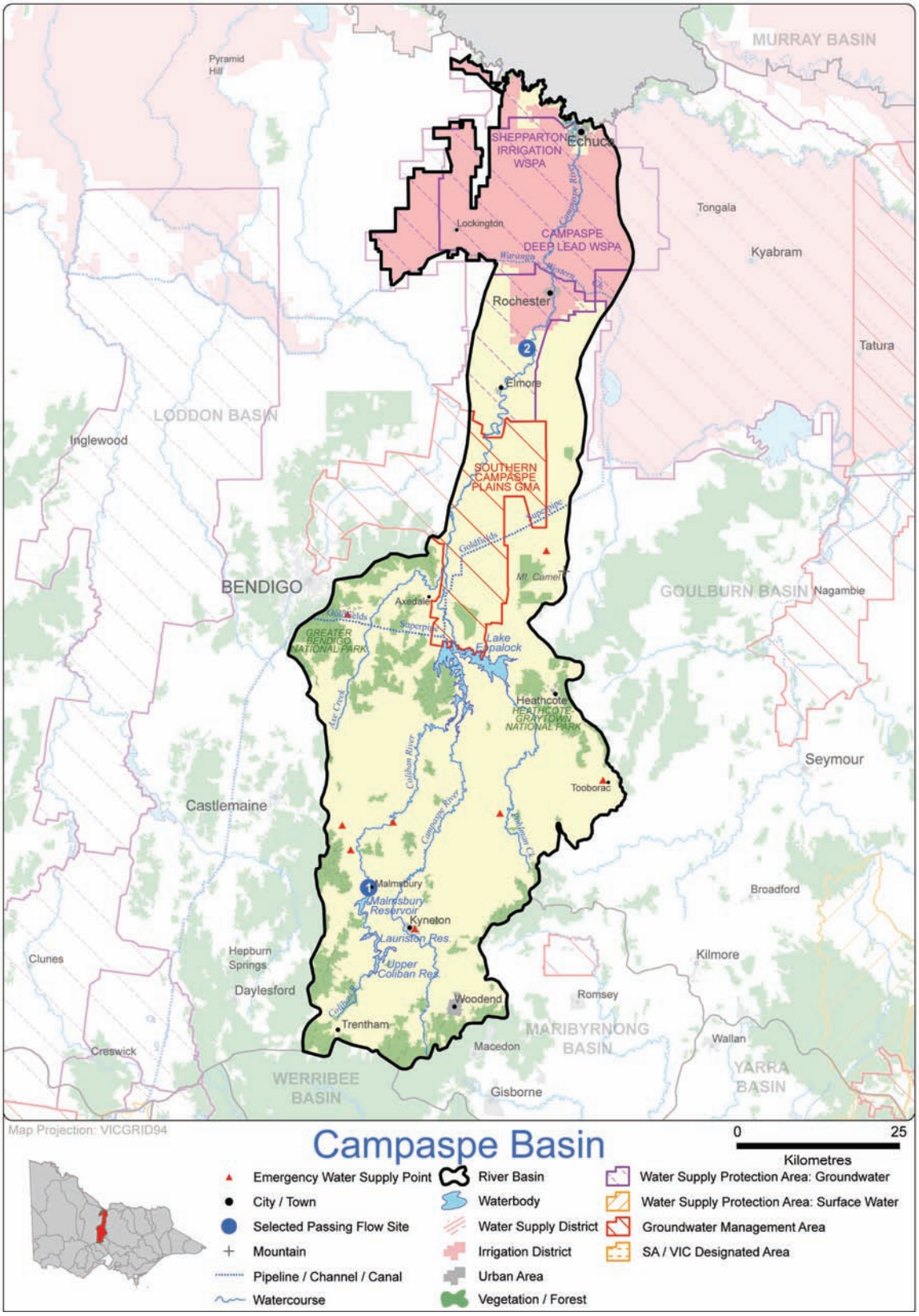
(3) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

11.4.1 Infrastructure projects to improve water availability

Coliban Water completed the construction of a pipeline and upgrade of the chlorination facility to connect the township of Axedale to the Bendigo water supply system. This pipeline was fully complete and operational by June 2009.

11.5 Location of water resources

Figure 11-2 Map of the Campaspe basin



11.6 Surface water resources

11.6.1 Water balance

A surface water balance for the Campaspe basin is shown in Table 11-3. Note that only on-stream storages with capacity greater than 1,000 ML have been included in the water balance.

Table 11-3 Balance of surface water in the Campaspe basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	28,100	7,300
Volume in storage at end of year	24,900	28,100
Change in storage	**-3,200**	**20,800**
Inflows		
Catchment inflow(1)	46,100	93,400
Return flow from irrigation	0	0
Waranga Western Channel to River Murray via Campaspe River	2,780	2,410
Waranga Western Channel to Goldfields Superpipe	15,600	11,100
Treated wastewater discharged back to river	150	150
Sub-total	**64,600**	**107,100**
Usage		
Urban diversions	11300	11,600
Coliban Channel rural diversions	1,600	8,100
Campaspe Irrigation District diversions	1,600	4,900
Licensed diversions from regulated streams	500	1,100
Licensed diversions from unregulated streams	100	1,300
Small catchment dams(2)	19,100	28,800
Campaspe River to Waranga Western Channel(3)	11,420	0
Sub-total	**45,600**	**55,800**
Losses		
Net evaporation losses from major storages	4,000	2,000
Losses from small catchment dams(2)	14,200	14,800
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	500	2,000
Sub-total	**18,700**	**18,800**
Water passed at outlet of basin		
Campaspe River outflow to River Murray	3,500	11,700

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from total water harvested.
(3) Reflected as a transfer into the Barwon basin.
(4) Losses estimated using loss functions from the Goulburn Simulation Model (REALM).
n/a: Information not applicable.

11.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values provided in Table 11-4 are based on estimates provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 11-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,000	5,000	n/a
Registered commercial and irrigation	25,300	14,100	n/a
Total	**40,300**	**19,100**	**33,300**

n/a: Information not available.

11.6.3 Water entitlement transfers

Surface water was moved into, out of and within the Campaspe basin during 2008/09 through water share transfers and variations and allocation trade. There were no trades of temporary or permanent bundled entitlements in this water year.

In addition to the Campaspe basin transfers summarised in Table 11-5 and Table 11-6, Coliban Water also purchased 13,015 ML of water shares and 10,193 ML of water allocations from Goulburn system irrigators to augment its Campaspe system bulk entitlement. Following the purchase, this water was assigned to the non-water user category within the Water Register and therefore does not appear as a trade in the Campaspe trading zones in Table 11-5.

Table 11-5 summarises the movement of water shares into and out of the Campaspe basin delivery systems during 2008/09. There was a net movement of water shares out of the basin in 2008/09, with 1,198 ML of high reliability and 165 ML of low reliability water leaving the basin.

Table 11-5 Transfers and variations of water shares in the Campaspe basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Campaspe Irrigation District	747	1,645	-898	479	632	-153
Campaspe River	771	1,071	-300	397	410	-12
Total	**1,518**	**2,716**	**-1,198**	**876**	**1,041**	**-165**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Campaspe basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

Table 11-6 summarises the trade of allocation in Victoria's share of the Campaspe basin during 2008/09. A total of 3,322 ML of water was traded, with a majority of that being trade with other Victorian basins. In total, 2,177 ML of water allocation moved into the Campaspe basin in 2008/09.

Table 11-6 Allocation trade in the Campaspe basin, 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Campaspe basin	548
Trade from other Victorian basins	2,469
Trade to other Victorian basins	596
Interstate trade - inbound	305
Interstate trade - outbound	0
Total trade into the Campaspe basin	3,322
Net trade into the Campaspe basin	2,177

Notes:

(1) This table summarises allocation trades approved into, out of and within the Campaspe basin trading zones (Zone 4C Lower Campaspe, Zone 4A Campaspe – Eppalock to WWC) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

11.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 11-7.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 11-7 Volume of water diverted under surface water entitlements in the Campaspe basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(2)(3)
Coliban Water					
Axedale and Goornong(4)	1	215	0	60	Yes
Part Rochester(4)	10	134	0	0	Yes
Coliban System	3	50,260	10,193	3,699	Yes
Western Water					
Woodend	1	802	0	43	Yes
Goulburn-Murray Water					
Campaspe System	10	83,590	0	2,131	Yes
Environment Minister					
Campaspe River – Living Murray	1	5,085	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**140,086**	**10,193**	**5,933**	
Total annual volume of bulk entitlements 2007/08		**140,086**	**4,874**	**15,481**	
Licensed diversions from unregulated streams 2008/09		*9,238*		*100*	
Licensed diversions from unregulated streams 2007/08		*9,238*		*1,300*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) Compliance is also assessed against the Murray-Darling basin annual cap target for the Campaspe basin. Details of this are contained in the MDBC's Water Audit Monitoring Report 2008/09.

(3) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(4) Axedale, Goornong and part of Rochester bulk supplies are provided under the same bulk entitlement. Rochester is also supplied under Coliban Water's bulk entitlement from the Goulburn system. Coliban Water didn't supply Rochester from the Campaspe basin in 2008/09 due to a qualification of rights.

11.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Campaspe basin, excluding domestic and stock use, is presented in Table 11-8.

The Campaspe basin contains part of the Campaspe Deep Lead WSPA, the Shepparton WSPA and the Southern Campaspe Plains GMA. The Southern Campaspe Plains GMA is a new management unit created in 2007/08. Groundwater entitlements and use within unincorporated areas are detailed in Appendix A.

Extractions from the Campaspe Deep Lead WSPA were restricted during 2008/09. Groundwater levels are declining in all GMUs in this area.

Table 11-8 Licensed groundwater volumes, Campaspe basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Campaspe Deep Lead WSPA (82%)	>25	38,633	37,688	19,710	0	19,710	23,254
Shepparton WSPA (12%)	≤25	28,798	28,798	6,829	0	6,829	10,251
Southern Campaspe Plains GMA (55%)	All depths	4,897	4,596	1,942	0	1,942	1,622
Total[6]		**72,328**	**71,082**	**28,481**	**0**	**28,481**	**35,128**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established (e.g. Shepparton WSPA), in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 11-9.

Table 11-9 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Southern Campaspe Plains GMA (55%)[4]	56	167
Campaspe Deep Lead WSPA (82%)	186	372
Shepparton WSPA (12%)	223	446
Total	**465**	**985**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 11-8.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

(4) Estimated domestic and stock use of 167 ML in the Southern Campaspe Plains GMA includes 55% of 100 ML entitlement for Goulburn Murray Water.

In the Campaspe basin, groundwater is used as an urban water supply for the townships of Elmore and Trentham. The licensed entitlements and metered use for these groundwater supplies is provided in Table 11-10.

Table 11-10 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Elmore	284	179	281
Trentham	48	32	36
Total	**332**	**211**	**317**

11.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Campaspe basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- water carting
- entering the water market to supplement urban water supplies
- utilising carryover
- ending the irrigation season early to build reserves for 2009/10
- the continuation of a temporary qualification of rights as detailed in Table 11-11.

The severe water shortage forced water resource managers to focus on securing essential domestic and stock needs and emergency rural supplies through qualification of rights and contingency operations. Carryover was also important in supplementing supplies in the Campaspe system, as was use of the water market.

For all of 2008/09 Coliban Water was required to cart between 0.04 ML and 0.08 ML of water per day from Bendigo to Axedale to supplement this town's supplies.

Coliban Water also purchased 10,193 ML of water allocation and 13,015 ML of water shares in the Goulburn, Campaspe and Loddon irrigation areas to supplement water supplies, including Bendigo's, sourced from the Campaspe system.

As in all major northern Victorian systems, the irrigation season closed in April 2009 and all water resource improvements after this date were directed towards building supplies for the 2009/10 season.

Table 11-11 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Campaspe Water System July 2007 Amendment to Temporary Qualification of Rights in the Campaspe Water System 2007 Further Amendment to Temporary Qualification of Rights in the Campaspe System 2008 Second Further Amendment to Temporary Qualification of Rights in the Campaspe System 2008	1 July 2008 to 30 June 2009 (continuing from 1 July 2007)	Differential access by priority entitlements	Until Campaspe allocation is 50% or higher: • right to take the volume of water necessary for household, pet, stock, firefighting purposes. • right to take either the water allocation or the volume necessary only for essential domestic and stock, commercial and industrial uses, whichever is greatest. • remove obligation to supply Rochester during May, June, July, August and September
		Reduced passing flow requirements	Until Campaspe allocation reaches 100%: • remove obligation to provide minimum passing flow requirements below Lake Eppalock for emergency supplies, if needed. Returned to environment when qualification revoked or for emergency environmental release
		Reduced passing flow requirements	Until Stage 4 restrictions are lifted for the townships of Kyneton and Castlemaine: • remove Coliban Water's obligation to provide minimum passing flow requirements below Malmsbury Reservoir, for emergency supplies, if needed • returned to environment when qualification revoked or for emergency environmental release
		Differential access by priority entitlements	While general allocation is 0% on the Coliban Rural system, provision of emergency supplies of up to 30% of licensed volume to licence holders who meet specific conditions
		Volume carried over	Water that is allocated to a water share or the environmental manager and that is unused at the end of 2007/08 can be carried over for use in the following year, up to a maximum of 30% of entitlement and minus 5% for losses
Temporary Qualification of Rights in the Campaspe Deep Lead Water Supply Protection Area April 2009	9 April 2009 to 30 June 2009	Differential access by priority entitlements	Allocations increased from 50% to 65% to support irrigators through continuing dry period

11.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to towns and licensed diversions on unregulated streams are shown in Table 11-12.

Most of the major towns located within the Campaspe basin, including Kyneton and Heathcote, were subject to severe water restrictions over the entire year due to the continuing water shortage. However, Coliban Water was able to reduce restrictions to Stage 2 for towns such as Echuca and Rochester as seasonal allocations gradually increased in the Murray and Goulburn systems and water became increasingly available on the market.

The severe water shortage prevented seasonal allocations being announced on both the regulated Campaspe and Coliban rural systems in 2008/09. For the second time in three years water users on the Campaspe system did not receive an allocation.

Severe restrictions were also placed on licensed diverters on a number of unregulated streams throughout the basin.

Table 11-12 Seasonal allocations and restrictions on water use in Campaspe basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Axedale	Stage 4 restrictions from July 2008 into June 2009, moving to Stage 3 during June 2009.
	Echuca	Stage 3 restrictions from July to December 2008, Stage 2 from January to June 2009
	Rochester	Stage 3 restrictions from July to December 2008, Stage 2 from January to June 2009
	Elmore	Stage 1 restrictions from July 2008 to June 2009
	Woodend	Stage 3a restrictions from July 2008 to June 2009
	Kyneton	Stage 4 restrictions from July 2008 to June 2009
Irrigation and regulated diversions	Campaspe Irrigation District	0% allocation in the Campaspe Irrigation District.
	Coliban rural supply system	0% allocation in the Coliban rural supply system, however some emergency supplies were provided
Licensed diversions on unregulated streams	Wanalta Creek	Irrigation ban July to November 2008, January to June 2009
	Campaspe River, Axe Creek, Jones Creek, Little Coliban River, Smith Creek, Stony Creek	Irrigation ban October 2008 to June 2009
	Coliban River unregulated	Irrigation ban November 2008 to June 2009
Groundwater	Campaspe Deep Lead WSPA	Restrictions in place from December 2008 to March 2009

11.10 Recycled water

Coliban Water operates all wastewater treatment plants in the Campaspe basin except the Woodend treatment plant, which is operated by Western Water. Around 88% of the wastewater discharged from treatment plants in the basin was recycled, mostly for agricultural use (Table 11-13). This includes recycled water from the Echuca treatment plant, which was previously reported in the Murray basin.

Table 11-13 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Axedale	5	0	0%	0	0	0	0	0	5
Echuca[4]	572	572	100%	0	572	0	0	0	0
Elmore	0	0	0%	0	0	0	0	0	0
Heathcote	112	112	100%	112	0	0	0	0	0
Kyneton	401	262	65%	78	184	0	0	139	0
Lockington[5]	0	0	0%	0	0	0	0	0	0
Rochester	68	68	100%	0	68	0	0	0	0
Woodend	150	135	90%	68	67	0	0	15	0
Total 2008/09	**1,308**	**1,149**	**88%**	**258**	**891**	**0**	**0**	**154**	**5**
Total 2007/08	1,594	1,443	91%	249	1,194	0	0	151	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) Recycling volumes for the Echuca treatment plant were previously reported under the Murray basin.

(5) All effluent at this treatment plant is evaporated on site.

11.11 Water for the environment

11.11.1 Environmental Water Reserve (EWR)

Important environmental assets, such as threatened riparian vegetation communities and endangered flora and fauna species including Murray Cod and Painted Snipe, depend on the EWR in the Campaspe basin. Water from the Campaspe basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets such as Gunbower Forest and Kerang Wetlands.

In 2008/09 the Campaspe basin EWR comprised the following components:

- the Environmental Entitlement (Campaspe River – Living Murray Inititiave) 2007
- water set aside for the environment under the temporary qualification of rights described in Table 11-11
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Coliban Water, Western Water and Goulburn-Murray Water (where qualifications did not apply)
- water set aside for the environment through the operation of licensed diversions with passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

11.11.2 Passing flow compliance

Bulk entitlements require passing flows to be met at a number of points in the basin.

As noted in Table 11-11, the passing flow requirements on the Coliban River downstream of Malmsbury Reservoir were waived during 2008/09 through a qualification. Thirty per cent of the water saved by this action was held in Malmsbury Reservoir for later release to target environmental objectives.

A qualification also removed Goulburn-Murray Water's obligation to provide passing flow requirements on the Campaspe River. A proportion of water saved from this action was held in Lake Eppalock for later release to help mitigate environmental risks.

Table 11-14 shows passing flow compliance in the Campaspe basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

Table 11-14 Selected passing flow compliance in the Campaspe basin

River	Passing flows	
Coliban River and its tributaries to confluence with Campaspe River	Instrument where passing flows are specified	Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999
	Responsible authority	Coliban Water
	Compliance point	Malmsbury Reservoir (shown as 1 in Figure 11-2))
	Passing flow compliance	The requirement to pass the lesser of 8 ML/day or natural inflow was waived in 2008/09 under a qualification
Campaspe River	Instrument where passing flows are specified	Bulk Entitlement (Campaspe System – Goulburn Murray Water) Conversion Order
	Responsible authority	Goulburn-Murray Water
	Compliance point	Between Lake Eppalock and Campaspe Weir pool (shown as 2 in Figure 11-2)

	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements.
		1 July to 30 November inclusive:
		• if Lake Eppalock volume is less than 150,000 ML, the lesser of 10 ML/day or natural inflow
		• if Lake Eppalock volume is between 150,001 ML and 200,000 ML, the lesser of 50 ML/day or natural inflow
		• if Lake Eppalock volume is between 200,001 ML and 250,000 ML, the lesser of 80 ML/day or natural inflow
		• if Lake Eppalock volume is greater than 250,001 ML:
		  • in January, March, May, June and December, the lesser of 90 ML/day or natural inflow
		  • in February and April, the lesser of 80 ML/day or natural inflow
		  • in July and November, the lesser of 150 ML/day or natural inflow
		  • in August, September and October, the lesser of 200 ML/day or natural inflow

11.11.3 Environmental entitlements

The environment's formal entitlements in the Campaspe basin in 2008/09 comprised the Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007.

12 Loddon basin

This chapter sets out the accounts for the Loddon basin. For detailed information about how they have been compiled, refer to Chapter 5.

12.1 Loddon basin summary

The Loddon basin was one of the most drought affected basins in Victoria in 2008/09: the year began with record low reserves and inflows failed to reach 8% of the long term average. This was the third consecutive year inflows in the Loddon have been extremely low.

The severe water shortage prevented seasonal allocations from being announced on both the regulated Loddon and Bullarook systems. They also forced the Minister for Water to qualify rights to ensure the essential needs of towns and domestic and stock users supplied by these systems could be provided for. Towns on these systems were subsequently placed on severe restrictions to keep demands at manageable levels.

As with all the major northern Victorian systems, concerns around the lack of storage recovery resulted in Goulburn-Murray Water ending the irrigation season early and directing water resource improvements after April 1 towards the 2009/10 season.

Central Highlands Water was required to keep Maryborough on Stage 4 restrictions as the town continued to experience severe water shortages. The qualification of rights reducing environmental flows downstream of Tullaroop Reservoir to retain water for town supplies remained critical to securing essential supplies for the town. The commissioning of a new groundwater supply also helped augment surface water supplies for Maryborough.

Bendigo and Castlemaine draw water supplies from the Campaspe basin, and were also severely affected by low inflows to their storages. However, Coliban Water used the Goldfields Superpipe to supplement Bendigo's supplies with water from the Goulburn system through a qualification of rights and by purchasing water on the market. These actions enabled it to ease restrictions for this town to Stage 3 from 1 January 2009. Bendigo had been on severe restrictions since November 2005.

Towns such as Boort and Pyramid Hill in the northern region of the Loddon basin are supplied from the Goulburn basin. Coliban Water was able to ease restrictions for these towns to Stage 2 in December 2008 as seasonal allocations increased and water became increasingly available on the market.

Licensed diverters across most of the basin were banned from taking water for the entire year.

Despite users in the Spring Hill WSPA and Campaspe Deep Lead WSPA being restricted, groundwater usage in the basin remained high due to the lack of surface water resources. Licence holders extracted around 30,000 ML during the year, which is almost equivalent to the total volume of surface water inflows.

12.2 Responsibilities for management of water resources

Table 12-1 shows the responsibilities of various authorities within the Loddon basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 12-1 Responsibilities for water resources management within the Loddon basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water	Supplies Pyramid-Boort Irrigation District and domestic and stock supplies in Normanville area	Manages groundwater and surface water licensed diversions in the basin	Provides bulk supply to Coliban Water for towns supplied from the Loddon and Campaspe systems, including Pyramid Hill, Boort and Bendigo	Operates major reservoirs including Cairn Curran, Laanecoorie and Tullaroop reservoirs
GWMWater			Provides bulk supply to Coliban Water for towns supplied from the Wimmera Mallee system (Borung, Korong Vale, Wedderburn, Wychitella)	
Central Highlands Water			Supplies towns in the southern part of the Loddon basin, including Maryborough, Daylesford, Creswick and Clunes	Obliged to meet passing flow requirements
Coliban Water			Supplies towns in the eastern part of the Loddon basin including Bendigo and Castlemaine, Pyramid Hill and Boort	
Environment Minister				Holder of the Loddon Environmental Reserve
North Central Catchment Management Authority				Manages waterways for the whole of the Loddon basin

12.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall across the Loddon basin ranged between 60% and 80% of the long term average. However, inflows were only 8% of the long term average of 373,000 ML[10], which were lower than inflows for both 2007/08 (16%) and 2006/07 (11%).

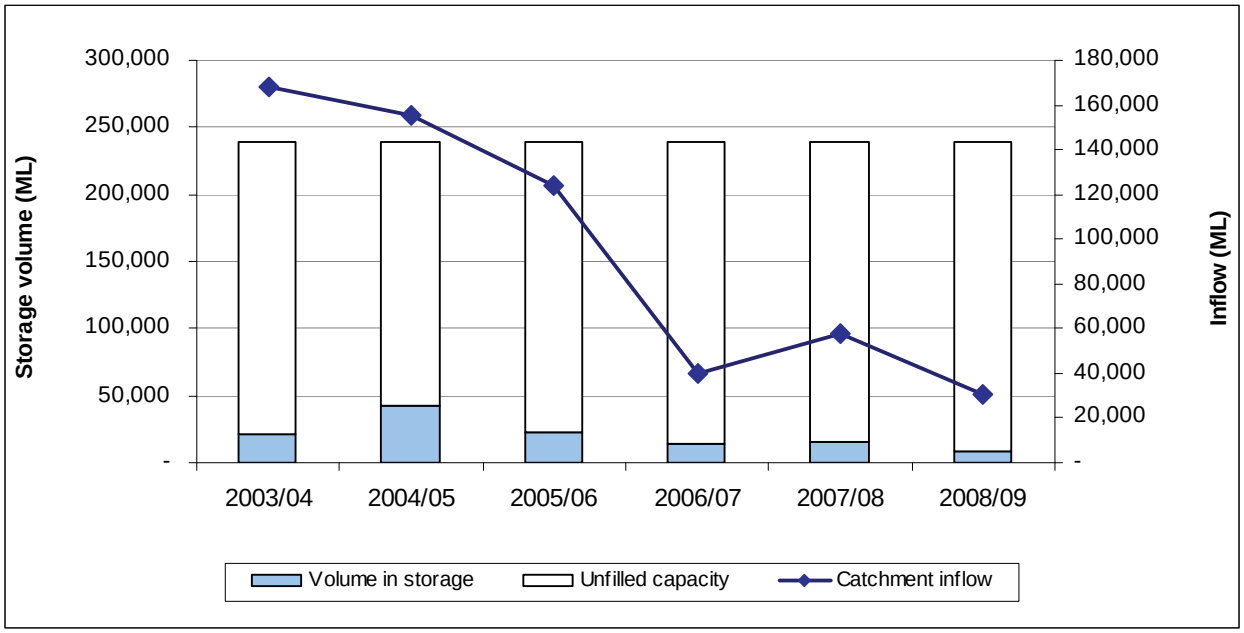
The amount of water flowing from the Loddon basin into the River Murray was 300 ML in 2008/09. This represents 1% of the total inflows into the basin, down from 6% in 2007/08.

The volume of water held in major storages (greater than 1,000 ML capacity) decreased from 15,000 ML at the beginning of the year to 8,400 ML, or 4% of the total storage capacity of 239,860 ML.

Only volumes for major on-stream storages have been included in the water balance and, as such, major storages such as Spring Gully and Sandhurst Reservoir have not been included. The volume of water in the major on-stream storages in the basin – Newlyn, Tullaroop, Cairn Curran, Laanecoorie Reservoir and Hepburn Lagoon – decreased by 5,710 ML from 11,900 ML to 6,190 ML. Cairn Curran Reservoir, which comprises almost two-thirds of the storage capacity in the basin, finished the year with 2,660 ML in storage – or 2% full.

[10] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 12-1 All major storages and catchment inflows in the Loddon basin



12.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Loddon basin are shown in Table 12-2. Total surface water use in 2008/09 decreased by 14,700 ML compared with the previous year, while groundwater use declined by 600 ML.

Table 12-2 Summary of total water resources and water use in the Loddon basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	32,500	24,700
Groundwater[2]	59,000	31,200
Recycled water	5,430	3,930

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 12-8 and the estimated domestic and stock use as presented in Table 12-9.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

12.4.1 Infrastructure projects to improve water availability

A number of infrastructure projects were completed in the Loddon basin during 2008/09.

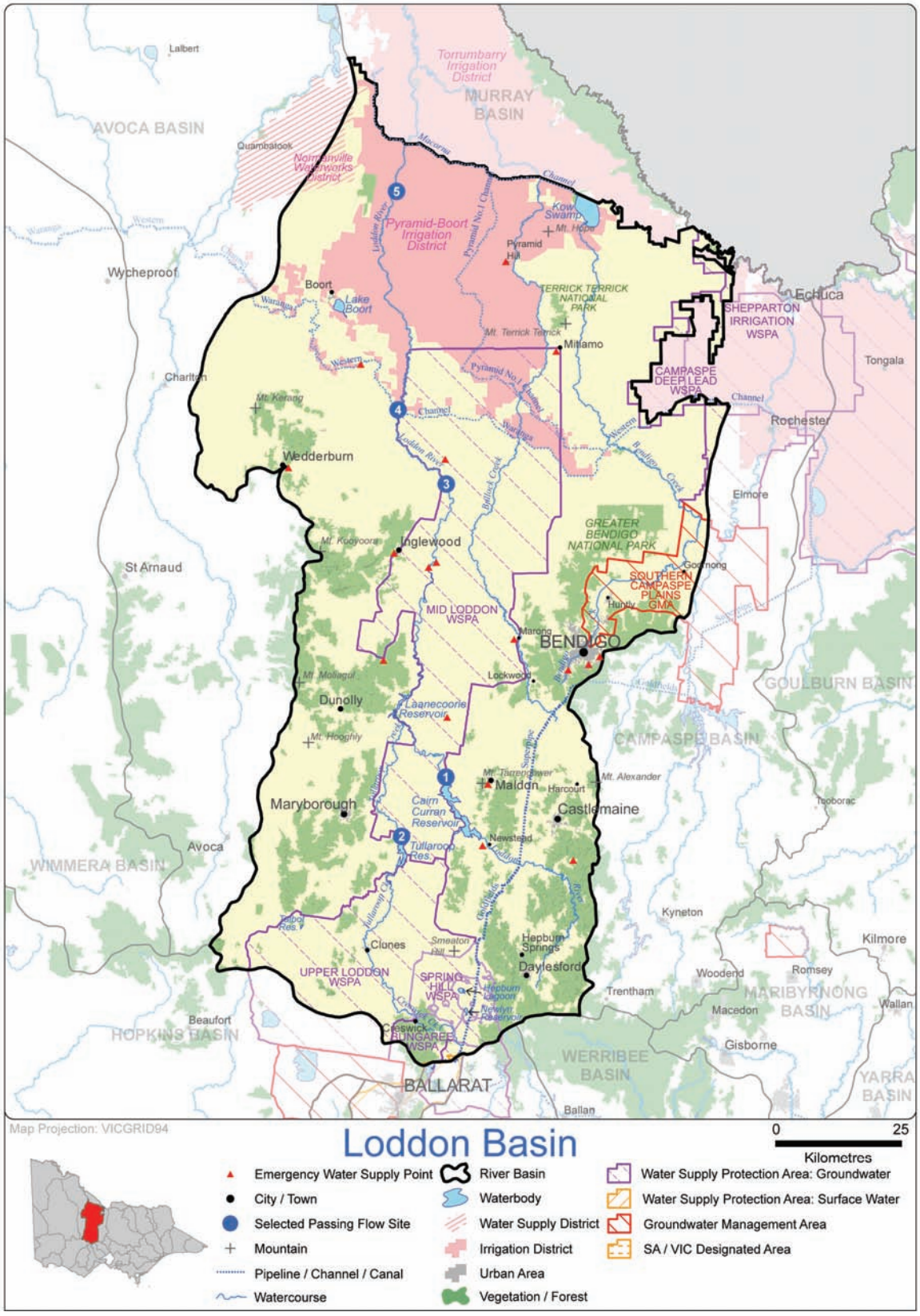
Coliban Water completed the Epsom Spring Gully Recycled Water Project to supply recycled water for recreational, commercial and agricultural uses in and around Bendigo.

Central Highlands Water completed the Moolort groundwater project, which will provide an additional 505 ML of water entitlement annually to augment urban water supply. Central Highlands Water also began work on connecting Stoney Creek bore into the raw water pipeline feeding Maryborough.

In June 2009, Central Highlands Water completed the Coomora Groundwater project to augment Daylesford's supplies with groundwater.

12.5 Location of water resources

Figure 12-2 Map of the Loddon basin



12.6 Surface water resources

12.6.1 Water balance

A surface water balance for the Loddon basin is shown in Table 12-3. Only those storages with capacity greater than 1,000 ML have been included in the water balance. This includes Laanecoorie, Cairn Curran, Tullaroop and Newlyn Reservoirs and Hepburn Lagoon. Diversions from regulated and unregulated streams were very low in 2008/09, with a 0% allocation on the Loddon system.

Table 12-3 Balance of surface water in the Loddon basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	11,900	11,600
Volume in storage at end of year	6,200	11,900
Change in storage	**-5,700**	**300**
Inflows		
Catchment inflow(1)	31,300	57,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,200	1,960
Sub-total	**32,500**	**59,900**
Usage		
Urban diversions	1,930	2,500
Licensed diversions and irrigation diversions from regulated streams	1,200	500
Licensed diversions from unregulated streams	100	13,800(5)
Small catchment dams(2)	21,500	21,500
Sub-total	**24,700**	**38,300**
Losses		
Net evaporation losses from major storages	3,700	5,800
Losses from small catchment dams(2)	5,500	5,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	4,000	6,600
Sub-total	**13,200**	**17,900**
Water passed at outlet of basin		
Loddon River outflow to River Murray (Appin South)	0	100
Wandella Creek at Fairlea(4)	n/a	n/a
Mount Hope Creek at Mitiamo	300	3,300
Bullock Creek, Calivil and Nine Mile Creek(4)	n/a	n/a

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from water harvested.

(3) Losses estimated using the Goulburn Simulation Model (REALM), and exclude losses from the Loddon River downstream of Loddon Weir and the Wandella Creek system (which were not readily available).

(4) The outflows at these points are not measured.

(5) This figure was incorrectly reported in 2007/08. The correct usage was 700 ML.

12.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 12-4 are based on the methodology outlined in Chapter 5.

Table 12-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	31,600	6,800	n/a
Registered commercial and irrigation	40,700	14,700	n/a
Total	**72,300**	**21,500**	**27,000**

n/a: Information not available.

12.6.3 Water entitlement transfers

Surface water was moved into, out of and within the Loddon basin during 2008/09 through water share transfers and variations, and allocation trade. No temporary or permanent trade of bundled water entitlements occurred in 2008/09 in the Loddon basin.

Table 12-5 summarises the transfers and variations in both high reliability and low reliability water shares in 2008/09. In total a net export of water shares from the Loddon basin occurred, with 8,168 ML of high reliability water shares, and 9,423 ML of low reliability water shares traded out of the basin. The Pyramid-Boort delivery system accounted for a majority of water trades within the Loddon basin in 2008/09.

Table 12-5 Transfers and variations of water shares in the Loddon basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Pyramid-Boort	4,727	12,896	-8,169	8,467	17,890	-9,423
Loddon River	785	783	2	291	291	0
Bullarook	19	19	0	10	10	0
Total	**5,531**	**13,698**	**-8,168**	**8,758**	**18,181**	**-9,423**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Loddon basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

Table 12-6 summarises the trade of allocation in the Loddon basin during 2008/09. A total of 106 ML of allocation was traded into the Loddon basin, which included 70 ML traded within the basin, and a net import to the basin of 28 ML.

Table 12-6 Allocation trade in the Loddon basin, 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Loddon basin	70
Trade from other Victorian basins	36
Trade to other Victorian basins	8
Interstate trade - inbound	0
Interstate trade - outbound	0
Total trade into the Loddon basin	**106**
Net trade into the Loddon basin	**28**

Notes:

(1) This table summarises allocation trades approved into, out of and within the Loddon basin trading zones (Zone 1B Boort & Zone 5B Bullarook) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

12.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 12-7. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 12-7 Volume of water diverted under surface water entitlements in the Loddon basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(1)
Central Highlands Water					
Creswick	1	500	0	497	Yes
Daylesford	1	916	0	571	Yes
Lexton	1	45	0	17	Yes
Loddon System (part Maryborough)	1	1,200	0	543	Yes
Evansford and Talbot System (part Maryborough)	1	3,000	0	0	Yes
Coliban Water					
Loddon system	1	820	6	304	Yes
Goulburn-Murray Water					
Bullarook Creek	1	1,235	n/a	13	n/a
Loddon	1	125,391	0	1,214	Yes
Environment Minister					
Loddon River – Environmental Reserve	1	2,000	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**135,107**	**6**	**3,159**	
Total annual volume of bulk entitlements 2007/08		**134,621**	**8**	**2,986**	
Licensed diversions from unregulated streams 2008/09		*27,949*		*100*	
Licensed diversions from unregulated streams 2007/08		*27,949*		*13,800*(2)	

Notes:

(1) Compliance is also assessed against the Murray-Darling basin annual cap target for the Goulburn, Loddon and Broken basins – which is reported in the MDBC's Water Audit Monitoring Report 2008/09.

(2) This figure was incorrectly reported in 2007/08. The correct useage was 700 ML.

n/a: Information not available.

12.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Loddon basin, excluding domestic and stock use, is presented in Table 12-8.

The Loddon basin contains all of the Mid Loddon WSPA and Spring Hill WSPA as well as part of the Upper Loddon WSPA, Bungaree WSPA, Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA. The Ellesmere GMA, which was reported in 2006/07 has been cancelled and the Southern Campaspe Plains GMA is a new management unit created in 2007/08. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Groundwater usage in the Loddon basin changed little from the previous year, despite the reduction in surface water use. Groundwater licences in the Spring Hill WSPA and the Campaspe Deep Lead WSPA were subject to restrictions during 2008/09. Groundwater levels are generally declining in all GMUs in this area.

Table 12-8 Licensed groundwater volumes, Loddon basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Bungaree WSPA (10%)[5]	All depths	520	520	428	1	429	288
Campaspe Deep Lead WSPA (8%)	>25	3,944	3,848	2,012	0	2,012	2,374
Mid Loddon WSPA (100%)	All depths	37,200	34,014	19,422	0	19,422	21,382
Spring Hill WSPA (100%)	≤70 all zones except Cones (all depths)	5,062	4,909	2,041	0	2,041	2,156
Upper Loddon WSPA (76%)	All depths	10,366	10,074	3,848	0	3,848	3,629
Southern Campaspe Plains GMA (45%)	All depths	3,952	3,710	1,567	0	1,567	1,310
Total[6]		**61,044**	**57,075**	**29,318**	**1**	**29,319**	**31,139**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) The licensed entitlement volume for Bungaree WSPA was greater than its PCV as it included 70 ML per annum of mineral water licence. The PCV for Bungaree WSPA was revised after the 2007/08 VWA to include this volume.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 12-9.

Table 12-9 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Bungaree WSPA (10%)	27	54
Campaspe Deep Lead WSPA (8%)	19	38
Mid Loddon WSPA (100%)	348	696
Spring Hill WSPA (100%)	151	302
Upper Loddon WSPA (76%)	328	656
Southern Campaspe Plains GMA (45%)[4]	45	135
Total	**918**	**1,881**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 12-8.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

(4) Estimated domestic and stock use of 135 ML in the Southern Campaspe Plains GMA includes 45% of 100 ML entitlement for Goulburn Murray Water.

In the Loddon basin, groundwater provides a water supply for the townships of Forest Hill, Dean, Waubra, Learmonth and Clunes. The licensed entitlements and metered use for these groundwater supplies is provided in Table 12-10.

Table 12-10 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Clunes	350	154	234
Dean	30	25	14
Forest Hill	350	207	154
Learmonth	100	59	51
Waubra	100	34	33
Maryborough(1)	805	544	n/a
Smeaton(1)	48	0	n/a
Total	**1,783**	**1,024**	**486**

Notes:

(1) New supply in 2008/09, provided by Central Highlands Water.

12.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Loddon basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- water carting
- connection of drought relief bores for Daylesford, Beaufort and Maryborough
- the continuation of two temporary qualifications of rights as detailed in Table 12-11.

Coliban Water carted water from Bendigo to Axedale, Raywood, Sebastian and Serpentine throughout the year to supplement local supplies impacted by the extreme water shortage. Central Highlands Water carted water from Ballarat to Lexton from February 2009 to supplement its supplies.

As with all the major northern Victorian systems, concerns around the lack of storage recovery resulted in Goulburn-Murray Water ending the irrigation season early and directing water resource improvements after April 1 towards the 2009/10 season.

Table 12-11 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Loddon Water System July 2007 Amendment to Temporary Qualification of Rights in the Loddon Water System April 2008 Further Amendment to Temporary Qualification of Rights in the Loddon Water System May 2008 Second Further Amendment to Temporary Qualification of Rights in the Loddon Water System April 2009	1 July 2008 to 30 June 2009 (continuing from 1 July 2007)	Differential access by priority entitlements	While allocations are less than 50%: • right provided to take the volume of water necessary for household, pet, stock, firefighting purposes • right provided to take either the water allocation or the volume necessary only for essential domestic and stock and commercial and industrial uses, whichever is the greatest • restriction rules in bulk entitlement relaxed to allow Central Highlands Water access to up to 1,300 ML in Tullaroop Reservoir • Coliban Water allowed to access 410 ML of water to supply towns. Remove: • obligation for Goulburn-Murray Water to supply entitlements only after meeting environmental entitlement • obligation to provide East Loddon Waterworks district when allocation is 0% • supply restrictions. Reduce obligation to provide East Loddon Waterworks district to 800 ML/yr when allocation is >0% and < 50%
		Reduced passing flow requirements	While Stage 4 restrictions on Creswick: • remove passing flow requirements for Creswick Creek, downstream of Cosgrove Reservoir. While allocations are 0%: • remove obligation to provide minimum passing flow requirements and river freshening flows below Cairn Curran Dam, Laanecoorie Reservoir, Serpentine Weir and Loddon Weir • reduce obligation to provide a minimum flow of 10 ML/day below Tullaroop dam to 5 ML/day (until 11/06/2008) • remove obligation to provide passing flows below Tullaroop dam (after 11/06/2008) • remove obligation to provide freshening flow below Tullaroop Dam
		Differential access by priority entitlements	Create a Loddon Weir withheld flow account to be borrowed by Goulburn-Murray Water for essential human needs and by Goulburn Broken Catchment Management Authority. The maximum volume which may be stored in the Deficit and Reimbursement account increased from 20,000 ML to 25,000 ML
		Differential access by priority entitlements	Persons who are taking water for domestic and stock and rural industrial/commercial essential needs from Tullaroop Dam or Tullaroop Creek can only do so when Goulburn-Murray Water advises them that the water is available. Volume in Tullaroop Reservoir, Talbot Reservoir, and Evansford Reservoir assigned to Central Highlands Water to supply Maryborough. Goulburn-Murray Water is entitled to 210 ML a year to meet its customers' essential needs
		Volume carried over	Water that is allocated to a water share or the environmental manager and unused at the end of 2007/08 can be carried over for use in the following year, up to a maximum of 30% of entitlement and minus 5% for losses
		Differential access by priority entitlements	Allow the 500 ML of water, which may be transferred from the Loddon Withheld Flows account to the Wetland Entitlement, to be delivered to Little Lake Boort
Temporary Qualification of Rights in the Bullarook Water System 2007	1 July 2008 to 30 June 2009 (continuing from 1 July 2007)	Differential access by priority entitlements	Right provided to take the volume of water necessary for household, pet, stock, firefighting purposes. Right provided to take either the water allocation or the volume necessary only for essential domestic and stock and commercial and industrial uses, whichever is the greatest, while allocations are less than 50%

12.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown Table 12-12.

Central Highlands Water was required to keep Maryborough on Stage 4 restrictions as it continued to experience severe water shortages. Towns supplied by the Loddon and Wimmera-Mallee systems were also kept on Stage 4 restrictions for the entire year.

Bendigo and Castlemaine, which draw water supplies from the Campaspe basin, also began the year on Stage 4 restrictions. However, Coliban Water was able to ease Bendigo's restrictions to Stage 3 from 1 January 2009 due to system augmentations. Bendigo had been on severe restrictions since November 2005.

Towns such as Boort and Pyramid Hill in the northern region of the Loddon basin are supplied from the Goulburn basin. Coliban Water was able to ease restrictions for these towns to Stage 2 in December 2008 as seasonal allocations increased and water became increasingly available on the market.

Licensed diverters across most of the basin were banned from taking water for the entire year.

The severe water shortage prevented seasonal allocations being announced on both the regulated Loddon and Bullarook systems.

Table 12-12 Seasonal allocations and restrictions on water use in Loddon basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Maryborough system (Maryborough, Creswick, Talbot)	Stage 4 restrictions from July 2008 to June 2009
	Learmonth, Waubra, Dean	Stage 1 restrictions from July 2008 to June 2009
	Forest Hill	Stage 3 restrictions from July 2008 to February 2009, and Stage 4 from March to June 2009
	Clunes	Stage 2 restrictions from July 2008 to June 2009
	Daylesford, Hepburn Springs, Hepburn	Stage 2 restrictions from July 2008 to June 2009
	Lexton	Stage 3 restrictions from July 2008 to February 2009, Stage 4 March to June 2009
	Bendigo and region	Stage 4 restrictions from July to December 2008, Stage 3 restrictions from January to June 2009
	Bridgewater, Inglewood, Laanecoorie, Bealiba, Dunolly, Tarnagulla, Jarklin and Serpentine	Stage 4 restrictions from July 2008 to June 2009
	Borong, Korong Vale, Wedderburn, Wychitella	Stage 4 restrictions from July 2008 to June 2009
	Boort, Pyramid Hill, Lockington, Mysia, Mitiamo, Dingee, Macorna	Stage 3 restrictions from July to December 2008, Stage 2 from January to June 2009
	Goornong	Stage 4 restrictions from July 2008 to June 2009
	Castlemaine and area	Stage 4 July 2008 to June 2009
Unregulated diversions	Leitch's Creek	Irrigation ban July to September 2008
	Jim Crowe Creek, Sailors Creek	Irrigation ban from July to December 2008
	Upper Loddon River (above Cairn Curran),	Irrigation ban July to August 2008, November 2008 to June 2009
	Barkers Creek, Lower Loddon River below Fernihurst Weir, Jim Crowe Creek, Campbells Creek, Green Gully Creek, Joyces Creek, Muckleford Creek, Sailors Creek, Lake Meran, Wallaby Creek, Wombat Creek, Coghills Creek, McCallum Creek, Lake Meran	Irrigation ban July 2008 to June 2009
	Rocky Lead Creek, Bullock Creek above Newly, Back Creek, Langdons Creek above Hepburns Lagoon, Pinchgut Creek, Kangaroo Creek	Suspension of winter-fill pumping from July 2008 to June 2009
Irrigation and regulated diversions	Loddon system	0% allocation for 2008/09 year
	Bullarook Creek system – Hepburns Lagoon	0% allocation for 2008/09 year
Groundwater	Campaspe Deep Lead WSPA	Restrictions in place in 2008/09 year
	Spring Hill WSPA	Restrictions in place in 2008/09 year

12.10 Recycled water

Coliban Water and Central Highlands Water operate wastewater treatment plants in the Loddon basin. The total volume of wastewater produced during 2008/09 decreased compared to 2007/08. The proportion of wastewater recycled during 2008/09 increased to 72%, compared to 37% in 2007/08. A large portion of the increase was due to the Bendigo wastewater treatment plant, which increased its proportion of wastewater recycled from 45% in 2007/09 to 90% in 2008/09 (Table 12-13).

Table 12-13 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bendigo	3,832	3,455	90%	1,257	2,198	0	0	382	-5
Boort(4)	0	0	0%	0	0	0	0	0	0
Bridgewater / Inglewood	0	0	0%	0	0	0	0	0	0
Castlemaine	897	132	15%	132	0	0	0	765	0
Clunes	1	1	100%	0	1	0	0	0	0
Creswick	51	1	0%	0	0	0	1	50	0
Daylesford	160	160	100%	11	149	0	0	0	0
Dunolly(4)	0	0	0%	0	0	0	0	0	0
Kerang	300	0	0%	0	0	0	0	0	300
Maryborough	183	183	100%	99	84	0	0	0	0
Pyramid Hill(4)	0	0	0%	0	0	0	0	0	0
Wedderburn(4)	0	0	0%	0	0	0	0	0	0
Total 2008/09	**5,424**	**3,932**	**72%**	**1,499**	**2,432**	0	**1**	**1,197**	**296**
Total 2007/08	6,544	2,389	37%	1,254	1,135	0	0	1,959	2,196

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site effluent storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) All effluent at these treatment plants was evaporated on-site.

12.11 Water for the environment

12.11.1 Environmental Water Reserve (EWR)

Important environmental assets, such as endangered flora and fauna species including Murray Cod and Painted Snipe and threatened riparian vegetation communities, depend on the EWR in the Loddon basin. Water from the Loddon basin also feeds into the Murray basin helping to maintain internationally significant environmental assets including the Kerang Wetlands.

In 2008/09 the Loddon basin EWR comprised the following components:

- The Bulk Entitlement (Loddon River – Environmental Water Reserve) Order 2005 of 2,000 ML high reliability and 2,105 low reliability water entitlements held by the Environment Minister
- water set aside for the environment under the temporary qualification of rights described in Table 12-11
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and Goulburn-Murray Water (where qualifications did not apply)
- water set aside for the environment through the operation of licensed diversions in passing flow conditions.
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

12.11.2 Entitlements for the environment

The environment's formal entitlements in the Loddon basin in 2008/09 comprised the Bulk Entitlement (Loddon River Environmental Reserve) Order 2005 held by the Environment Minister.

12.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

As listed in Table 12-11, a number of Loddon passing flow requirements were qualified in 2008/09. Goulburn-Murray Water and Coliban Water reported meeting all qualified passing flow requirements in the Loddon basin in 2008/09. Central Highlands Water reported non-compliance on Kangaroo Creek, downstream of Bullarto Reservoir. This was due to concerns regarding the safety of the dam, leading to changed operation of the reservoir.

Table 12-14 shows passing flow compliance in the Loddon basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 12-2.

Table 12-14 Selected passing flow compliance in the Loddon basin

River	Passing flows	
Loddon River	Instrument where passing flows are specified	Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005
	Responsible authority	Environment Minister
	Compliance point	Loddon River, between Cairn Curran and Laanecoorie reservoirs (shown as 1 in Figure 12-2)

	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements.
		• From November to April inclusive, the lesser of 20 ML/day or natural flow
		• From May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • greater than 60,000 ML, the authority must pass 35 ML/day
		  • less than or equal to 60,000 ML, the authority must pass 20 ML/day
		• River freshening (3 flows of 35 ML/day for 7 consecutive days between November and April)

	Compliance point	Tullaroop Creek, between Tullaroop Dam and Laanecoorie Reservoir (shown as 2 in Figure 12-2)
	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements. • The lesser of 10 ML/day or natural flow • River freshening (4 flows of 13.5 ML/day for 7 consecutive days between November and April)
	Compliance point	Loddon River, between Laanecoorie Weir and Serpentine Weir (shown as 3 in Figure 12-2)

	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements.
		• From November to July inclusive, the lesser of 15 ML/day or natural flow
		• From August to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • greater than 60,000 ML, the authority must pass 52 ML/day
		  • less than or equal to 60,000 ML, the authority must pass 15 ML/day
		• River freshening (3 flows of 52 ML/day for 7 consecutive days between November and April)

	Compliance point	Loddon River, between Serpentine Weir and Loddon Weir (shown as 4 in Figure 12-2)

	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements.
		• From November to April inclusive, the lesser of 19 ML/day or natural flow
		• From May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • greater than 60,000 ML, the authority must pass 61 ML/day
		  • less than or equal to 60,000 ML, the authority must pass 19 ML/day
		• River freshening (3 flows of 61 ML/day for 7 consecutive days between November and April)

	Compliance point	Loddon River, between Loddon Weir and Kerang Weir (shown as 5 in Figure 12-2)

	Passing flow compliance	Passing flow requirements listed below were qualified during 2008/09, with Goulburn-Murray Water meeting the qualified requirements.
		• From November to April inclusive, cyclical over two weeks: rise from 7 to 12 ML/day in one week, followed by fall from 12 to 7 ML/day the next week
		• From May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • greater than 60,000 ML, the authority must pass 61 ML/day plus flow equal to calculated in-stream loss
		  • less than or equal to 60,000 ML, the authority must pass 10 ML/day plus flow equal to calculated in-stream loss
		• River freshening (flow of 50 ML/day plus flow equal to calculated in-stream loss for 14 consecutive days between January and February)

13 Avoca basin

This chapter sets out the accounts for the Avoca basin. For detailed information about how they have been compiled, refer to Chapter 5.

13.1 Avoca basin summary

At 24,200 ML, inflows into the Avoca basin in 2008/09, were again well below the long term average. For yet another year, no water flowed to the basin's terminal lakes located in the north of the basin.

Most towns in the basin are either supplied by groundwater, or from surface water from the Wimmera, Glenelg and Murray basins. These towns were initially placed on severe Stage 4 restrictions due to low water availability, but were eased to Stage 3 in January 2009. Restrictions were less severe for towns supplied by groundwater.

Amphitheatre and Quambatook, which are supplied from the Goulburn system, were subject to Stage 2 restrictions from June 2008 to December 2008, and Stage 3 restrictions from January to June 2009.

The fast tracking of the Wimmera Mallee Pipeline Project allowed water allocated to Grampians Wimmera Mallee system from the Goulburn system to be used to supply recreation water to Green Lake near Sea Lake.

Irrigation bans were in force on unregulated streams in the Avoca basin for the entire year, while users reliant on the Wimmera Mallee domestic and stock system received rostered supplies.

13.2 Responsibilities for management of water resources

Table 13-1 shows the responsibilities of various authorities within the Avoca basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 13-1 Responsibilities for water resources management within the Avoca basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Central Highlands Water			Supplies towns in the southern part of the Avoca basin, including Avoca and Redbank	Obliged to meet passing flow requirements
GWMWater	Provides domestic and stock supplies to farms via Wimmera Mallee Channel system, the Northern Mallee Pipeline, the western end of the Waranga Western Channel and diversions from rivers	Manages surface water and groundwater licensing	Supplies towns in the northern part of the Avoca basin, including Quambatook, St Arnaud, Charlton and Sea Lake(1)	
Goulburn-Murray Water	Supplies water from the Goulburn basin in bulk to GWMWater for domestic and stock use via the Waranga Main Channel		Supplies water from the Goulburn basin in bulk to GWMWater for towns via the Waranga Main Channel and to Quambatook via the Normanville supply system	
North Central Catchment Management Authority				Manages waterways in the Avoca basin

Note:

(1) Water for these towns is sourced from outside the Avoca basin.

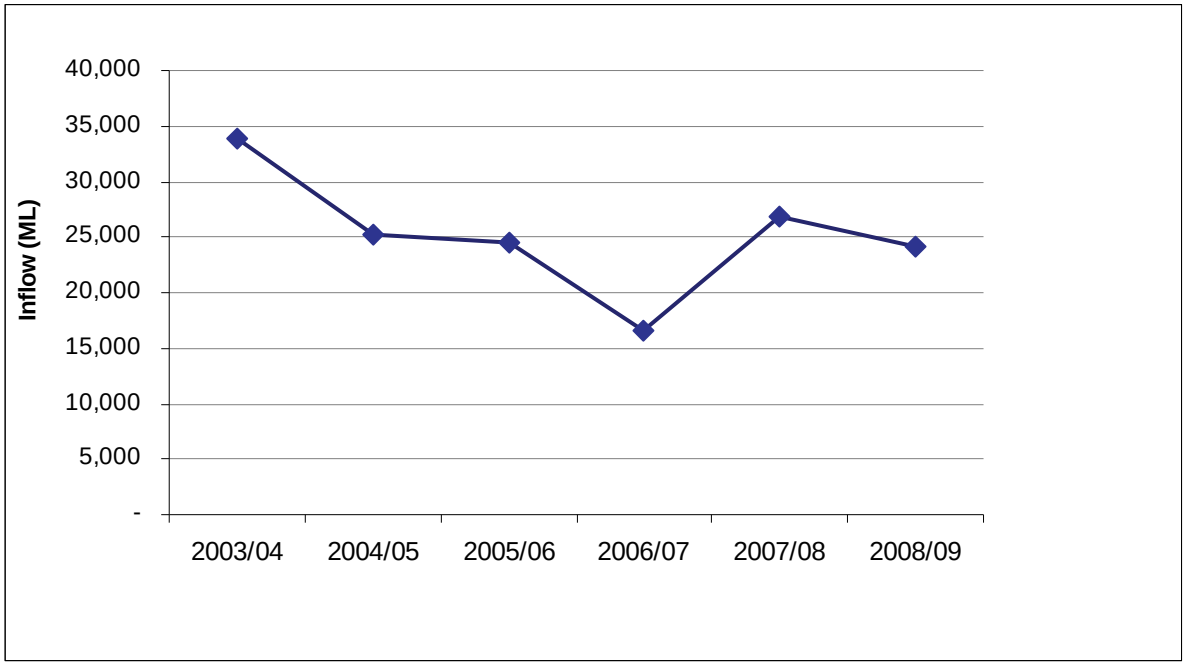
13.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall across the Avoca basin ranged between 60% and 100% of the long term average. The ongoing drought, particularly severe in the west of the state, continued to impact streamflows, with inflows decreasing to 18% in 2008/09.

As in 2007/08, no water flowed into the terminal lakes (Lake Bael Bael and the Marshes), which overflow to the Kerang Lakes during prolonged wet periods. The Kerang Lakes have not received any inflows from the Avoca basin in the past four years.

There are no storages with capacity greater than 1,000 ML in the Avoca basin.

Figure 13-1 Catchment inflows in the Avoca basin



13.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Avoca basin are shown in Table 13-2. Total surface water availability and use in 2008/09 decreased from the previous year, but groundwater use remained steady.

Table 13-2 Summary of total water resources and water use in the Avoca basin, 2008/09

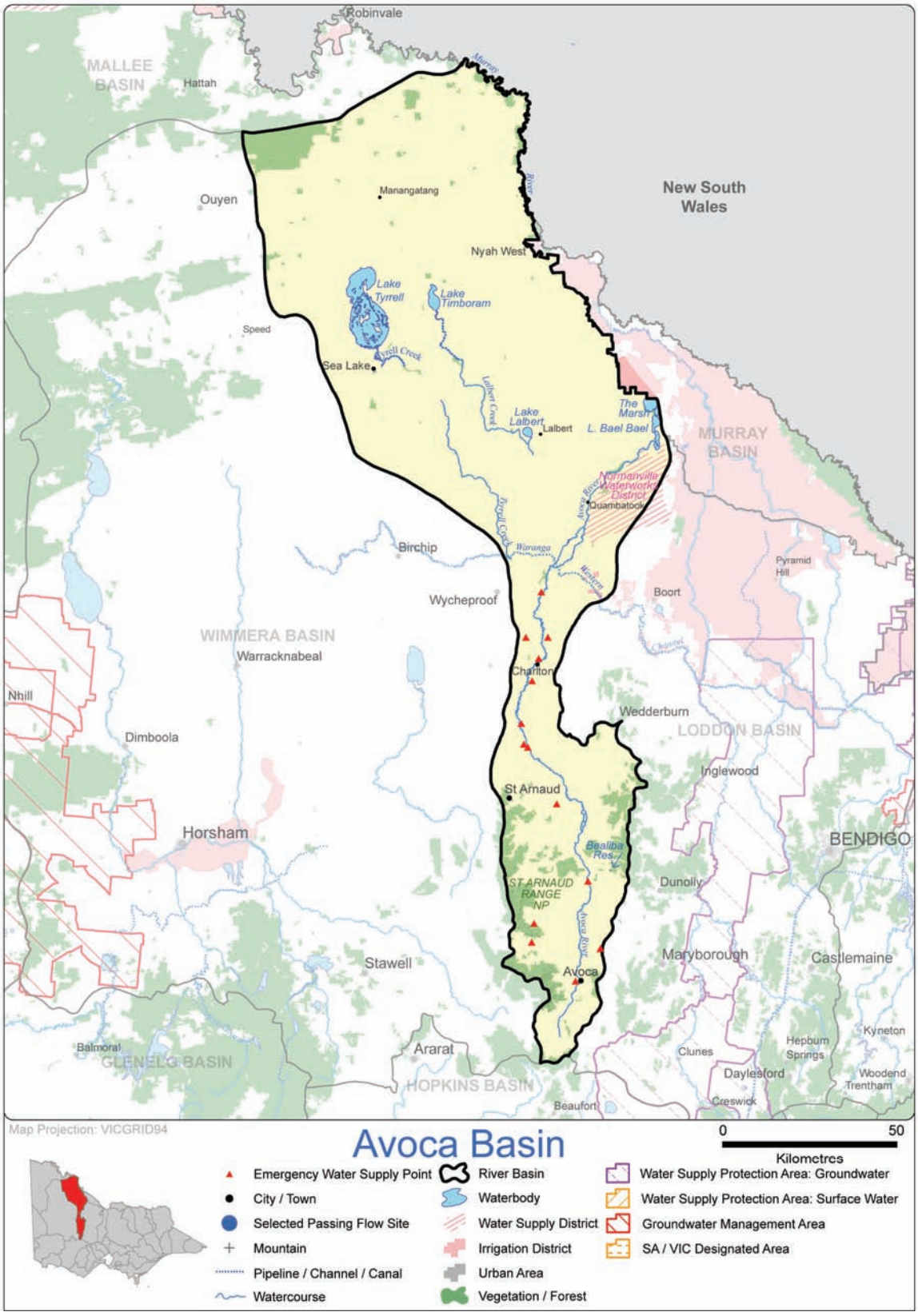
Water source	Total water resource (ML)	Total use (ML)
Surface water	24,200	14,300
Groundwater(1)	270	170
Recycled water	120	120

Note:

(1) Although there are no WSPAs or GMAs in the Avoca basin, the towns of Avoca and Redbank are supplied by groundwater located in an unincorporated area. The groundwater resource and use reflects the licensed volume and use for these towns.

13.5 Location of water resources

Figure 13-2 Map of the Avoca basin



13.6 Surface water resources

13.6.1 Water balance

A surface water balance for the Avoca basin is shown in Table 13-3. No storages greater than 1,000 ML are in the Avoca basin. Small catchment dams are the main source of water supply in the catchment and the main source of losses in dry years.

Table 13-3 Balance of surface water in the Avoca basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage[1]		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow	24,200	26,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**24,200**	**26,900**
Usage		
Urban diversions	10	100
Licensed diversions from unregulated streams	1,600	1,600
Small catchment dams[2]	12,700	12,700
Sub-total	**14,300**	**14,400**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams[2]	9,800	9,800
In-stream infiltration to groundwater, flows to floodplain and evaporation [3]	100	2,700
Sub-total	**9,900**	**12,500**
Water passed at outlet of basin		
Avoca River flow at Sandhill Lake Road (= outflow to terminal lakes)[4]	0	0
Avoca River overflow from the terminal lakes to the Kerang Lakes	0	0

Notes:

(1) Excludes wetlands in the Avoca basin.

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Losses represent the flow volume at the Avoca River gauge at Coonooer that did not enter the Avoca basin's terminal lakes.

(4) Outflow to the terminal lakes reported as the Avoca River flow at Quambatook in 2008/09.

13.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values provided in Table 13-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 13-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,500	5,300	n/a
Registered commercial and irrigation	8,900	7,400	n/a
Total	**19,400**	**12,700**	**22,500**

n/a: Information not available.

13.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

13.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 13-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 13-5 Volume of water diverted under surface water entitlements in the Avoca basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
Central Highlands Water					
Amphitheatre	1	25	0	11	Yes
Avoca[(1)]	1	233	0	4	Yes
Redbank[(1)]	1	20	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**278**	**0**	**15**	
Total annual volume of bulk entitlements 2007/08		**278**	**0**	**61**	
Licensed diversions from unregulated streams 2008/09		*3,621*		*1,600*	
Licensed diversions from unregulated streams 2007/08		*3,621*		*1,600*	

Notes:
(1) Urban water supply for the townships of Redbank and Avoca was sourced from groundwater in 2008/09.

13.7 Groundwater resources

There are no groundwater management areas or water supply protection areas located within the Avoca basin. Groundwater from an unincorporated area is being used to supply urban water for the townships of Avoca, Redbank and Amphitheatre. The licensed entitlements and metered use for these groundwater supplies is provided in Table 13-6.

Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Table 13-6 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Avoca	200	152	142
Redbank	50	4	6
Amphitheatre	20	11	0
Total	**270**	**167**	**148**

13.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Avoca basin in 2008/09. These include restricting urban and rural water use (as discussed below), and the continuation of GWMWater's extensive rural water carting program. This program provided emergency water supplies to rural customers in the Wimmera Mallee system who did not receive a house dam fill due to the ongoing dry conditions.

13.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 13-7.

Most towns in the basin are either supplied by groundwater, or from surface water from the Wimmera, Glenelg and Murray basins. Towns supplied by surface water were placed on severe Stage 4 restrictions due to low water availability, with restrictions eased to Stage 3 in January 2009. Restrictions were less severe for towns supplied by groundwater.

Amphitheatre and Quambatook, which are supplied from the Goulburn system, were subject to Stage 2 restrictions from June to December 2008, and Stage 3 restrictions from January to June 2009.

Irrigation bans were in force on unregulated streams in the Avoca basin for the entire year, while users reliant on the Wimmera Mallee domestic and stock system received rostered supplies.

Table 13-7 Seasonal allocations and restrictions on water use in Avoca basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Amphitheatre	Stage 2 restrictions from July to December 2008, Stage 3 from January to June 2009
	Avoca	Stage 2 restrictions from July 2008 to June 2009
	Redbank	Stage 2 restrictions from July 2008 to June 2009
	St Arnaud	Stage 4 restrictions from July 2008 to June 2009
	Lalbert, Manangatang, Sea Lake, Berriwillock, Charlton, Culgoa	Stage 4 restrictions from July 2008 to January 2009, Stage 3 restrictions from February to June 2009.
	Quambatook	Stage 2 restrictions from July 2008 to June 2009
Unregulated licensed diversions	Avoca River, Mosquito Creek, Lake Bael Bael, Lake Lookout, Lake Marmal, Sand Hill Lake, Tchum Lake North	Irrigation ban July 2008 to June 2009
Domestic and stock farm supplies	Wimmera Mallee domestic and stock supply system	Supply to one dam per enterprise in most areas and limited pipeline supply in areas where the pipelining is completed, from July 2008 to June 2009

13.10 Recycled water

GWMWater operates most wastewater treatment plants in the Avoca basin, with the exception of the Avoca plant, operated by Central Highlands Water.

The volume of wastewater produced in increased from 106 ML in 2007/08 to 121 ML in 2008/09, while the proportion of wastewater recycled in the Avoca basin treatment plants increased from 85% in 2007/08 to 100% in 2008/09.

Table 13-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Avoca	0	0	0%	0	0	0	0	0	0
Charlton	0	0	0%	0	0	0	0	0	0
Sea Lake	25	25	100%	0	25	0	0	0	0
St Arnaud	96	96	100%	24	72	0	0	0	0
Total 2008/09	121	121	100%	24	97	**0**	**0**	**0**	**0**
Total 2007/08	106	90	85%	24	67	0	0	0	16

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

13.11 Water for the environment

13.11.1 Environmental Water Reserve (EWR)

In 2008/09 the Avoca basin EWR comprised the following components:

- water set aside for the environment through flow-sharing arrangements set out in consumptive bulk entitlements held by Central Highlands Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

13.11.2 Passing flow compliance

The Avoca River is essentially unregulated, with no significant storages in the basin. Central Highlands Water operates several small urban storages in the upper reaches and reported that it complied with all flow-sharing requirements.

14 Mallee basin

This chapter sets out the accounts for the Mallee basin. For detailed information about how they have been compiled, refer to Chapter 5.

14.1 Mallee basin summary

Almost all surface water used in the Mallee basin is sourced from other basins. All towns in the basin supplied by surface water were subject to severe restrictions for the entire year due to low water availability in these water systems.

Groundwater is heavily relied on in the Mallee basin and extractions were again high relative to previous years. Use in the largest GMU in the basin, the Murrayville WSPA, increased slightly from 2007/08.

14.2 Responsibilities for management of water resources

Table 14-1 shows the responsibilities of various authorities within the Mallee basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 14-1 Responsibilities for water resources management within the Mallee basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater	Supplies rural water to farms in the north of the basin via the Northern Mallee Pipeline from the River Murray, and in the south of the basin via the Wimmera Mallee channel system	Acts as the licensing authority for the Murrayville WSPA and all other groundwater bores in the Mallee basin(1)	Supplies water to towns in the north of the basin via the Northern Mallee Pipeline from the River Murray, and in the south of the basin via the Wimmera Mallee channel system	
Mallee Catchment Management Authority				Manages waterways in the whole of the Mallee basin

Note:

(1) Under agreement with Lower Murray Water.

14.3 Rainfall, flows and storages in 2008/09

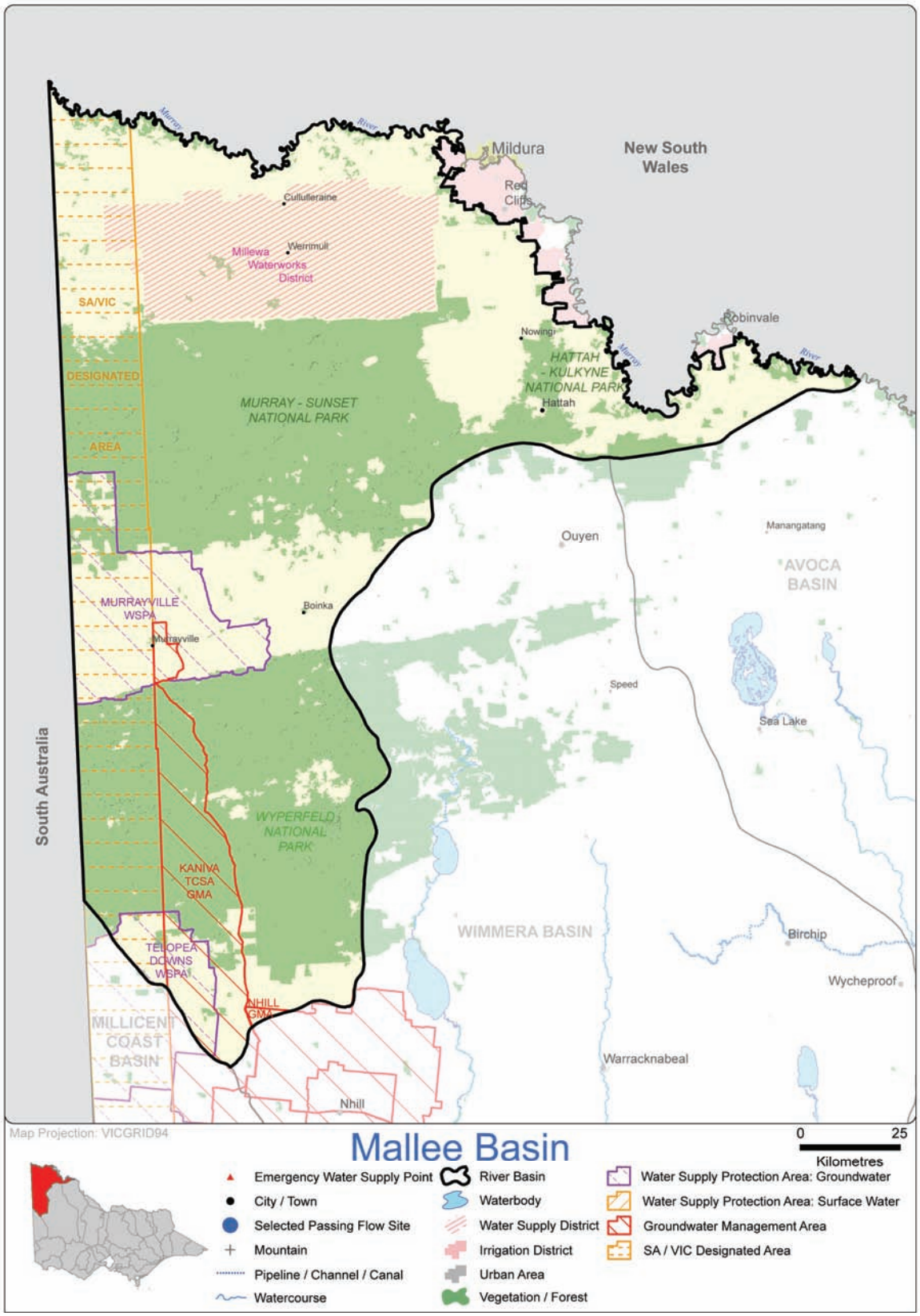
In 2008/09, rainfall across the basin generally ranged between 60% and 100% of the long term average.

The Mallee basin has no well-defined streams other than the River Murray, which runs along its entire northern edge of the basin, and has only a few small tributaries at various points close to the Murray. Since the Murray's surface water reporting is covered in Chapter 6, there is no surface water resource information presented in the Mallee basin.

There is no reliable estimate of surface flows in the Mallee basin to estimate the volume of water leaving the basin.

14.4 Location of water resources

Figure 14-1 Map of the Mallee basin



14.5 Total water resources in the basin

Table 14-2 below shows the water resources available and the water resource use in the Mallee basin during 2008/09.

Table 14-2 Summary of total water resources and water use in the Mallee basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	0	0
Groundwater[2]	14,200	7,900
Recycled water	0	0

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 14-3 and the estimated domestic and stock use as presented in Table 14-4.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

14.6 Surface water resources

14.6.1 Water balance

A water balance for the Mallee basin has not been presented. All surface water supplies are sourced from outside the basin.

14.6.2 Small catchment dams

Some small catchment dams are known to be in the Mallee basin, however there is no information on them and they are not a significant source of water to the region. Given the lack of information, the capacity of small catchment dams is assumed to be zero.

14.6.3 Water entitlement transfers

There were no transfers of water shares or allocations in the Mallee basin in 2008/09.

14.6.4 Volume diverted

There are no bulk entitlements supplied from surface water sourced from within the Mallee basin. The volume diverted under bulk entitlements for water supplied to the Mallee basin is presented in the water accounts for the adjacent river basins.

14.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Mallee basin, excluding domestic and stock use, is presented in Table 14-3.

The main water supply in the Mallee basin is groundwater. The Mallee basin contains all of the Murrayville WSPA as well as part of the Telopea Downs WSPA and Kaniva TCSA (tertiary confined sand aquifer) GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Overall groundwater use in 2008/09 in the Mallee basin increased slightly from 2007/08. Groundwater levels in the Murrayville WSPA are declining, however this is in line with the management plan objectives of 0.5 metres per year. Levels in the Telopea Downs WSPA and Kaniva TCSA are generally stable.

Table 14-3 Licensed groundwater volumes, Mallee basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Kaniva TCSA GMA (83%)	Tertiary confined sand aquifer	913	0	0	0	0	0
Murrayville WSPA (100%)	70-200	10,883	9,634	6,479	0	6,479	6,212
Telopea Downs WSPA (39%)	All depths	4,176	4,176	1,046	0	1,046	636
Total[5]		**15,972**	**13,810**	**7,525**	**0**	**7,525**	**6,848**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established (e.g. Telopea Downs WSPA), in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 14-4.

Table 14-4 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Kaniva TCSA GMA (83%)	0	0
Murrayville WSPA (100%)	180	360
Telopea Downs WSPA (39%)	12	24
Total	**192**	**384**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 14-3.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

In the Mallee basin, groundwater is used as an urban water supply for the townships of Cowangie and Murrayville. The licensed entitlements and metered use for these groundwater supplies is provided in Table 14-5.

Table 14-5 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Cowangie	40	13	14
Murrayville	475	140	151
Total	**515**	**153**	**165**

14.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Mallee basin in 2008/09. These include restrictions on urban and rural water usage (as discussed in section 14.9) and the continuation of GWMWater's extensive rural water carting program in 2008/09. This program provided emergency water supplies to rural customers in the Wimmera Mallee system who did not receive a house dam fill due to the ongoing dry conditions..

14.9 Seasonal allocations and restrictions on water use, diversions and extractions

A summary of the 2008/09 restrictions on water use in the Mallee basin is presented in Table 14-6.

All towns in the basin supplied by surface water were subject to severe restrictions for the entire year due to low water availability in these water systems. Groundwater users in the Murrayville WSPA were also restricted between December 2008 and March 2009.

Users reliant on the Wimmera Mallee domestic and stock system received rostered supplies.

Table 14-6 Seasonal allocations and restrictions on water use in Mallee basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Towns supplied from the Murray by the Northern Mallee Pipeline	Stage 4 restrictions from July 2008 to January 2009, Stage 3 restrictions from February to June 2009
	Towns supplied from Grampians via the Wimmera Mallee channel system	Stage 4 restrictions from July 2008 to June 2009
	Lower Murray Water customers	Stage 3 restrictions from July to December 2008, and Stage 3a from January to June 2009
Groundwater	Murrayville WSPA	Restrictions in place from December 2008 to March 2009
Domestic and stock farm supplies	Wimmera Mallee domestic and stock supply system	Supply to one dam per enterprise in most areas and limited pipeline supply in areas where the pipelining is completed from July 2008 to June 2009

14.10 Recycled water

There are no wastewater treatment plants within the Mallee basin.

14.11 Water for the environment

14.11.1 Environmental Water Reserve (EWR)

In 2008/09 the Mallee basin EWR comprised water outside the allocation limit for GMAs and WSPAs.

14.11.2 Entitlements for the environment

There were no entitlements for the environment in operation in the Mallee basin in 2008/09. Refer to Chapter 6 for environmental water provided to Red Gums along the River Murray floodplain that borders the Mallee basin.

14.11.3 Passing flow compliance

As all surface water supplies are externally sourced in the Mallee basin, there are no passing flow requirements.

15 Wimmera basin

This chapter sets out the accounts for the Wimmera basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

15.1 Wimmera basin summary

Catchment inflows into the Wimmera basin in 2008/09 were 15% of the long term average. Although very low, these were 89% higher than those experienced in 2007/08. After falling to 3.6% of capacity in May 2009, storages in the Wimmera basin did recover slightly to 8% by the end of June 2009.

Despite the water shortage, Grampians Wimmera Mallee Water was able to secure restricted supplies to both urban and rural customers due to the fast tracking of the Wimmera Mallee Pipeline and continuation of a number of drought contingency measures.

Over 7,700 kilometres of the Wimmera Mallee Pipeline was installed by year end and more than 50% of customers were receiving reliable piped water through Supply Systems 1, 2, 5 and 7. The project is now on target to be completed by early 2010.

Drought response initiatives implemented during 2008/09 included the continuation of water restrictions, the provision of emergency water supplies and water carting.

All towns supplied by the Wimmera system were on Stage 4 restrictions for the entire year. Only Landsborough, Navarre and Elmhurst, which are all supplied predominantly by groundwater, avoided the severe restriction levels.

Customers in Supply Systems 3 and 4 received water through the Grampians Wimmera Mallee Water domestic water carting program from 1 November 2008 as it was not possible to provide them with a dam fill during the year. Customers and towns south of Horsham, in the Supply System 6 area remained on the water carting program.

The lack of inflows again prevented Grampians Wimmera Mallee Water from providing an allocation in the Wimmera irrigation area. Licensed diverters on unregulated streams across the basin were also banned from taking water for the entire year.

All Wimmera and Glenelg rivers bulk entitlements were qualified until October 2008 to enable GWMWater to withhold water allocated for the environment in reserve.

Commencing in November 2008, some 490 ML of water was released from Lake Wartook to provide environmental benefits to the mid-Mackenzie River extending from the Wartook Valley to Brimpaen. The fast-tracking of the Wimmera Mallee Pipeline Project also allowed water allocated to Grampians Wimmera Mallee system from the Goulburn system to be used to supply recreation water to Tchum Lake, near Birchip.

15.2 Responsibilities for management of water resources

Table 15-1 shows the responsibilities of various authorities within the Wimmera basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 15-1 Responsibilities for water resources management within the Wimmera basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater	Manages the Wimmera Mallee supply system which delivers water to farms in the Wimmera basin(1)	Manages groundwater and surface water licensed diversions	Supplies most towns in the Wimmera basin(1) Provides bulk supply to some of Coliban Water's towns located in the Loddon basin	Operates the Wimmera Mallee water supply system that includes Lakes Bellfield, Wartook, Lonsdale and Fyans and Taylors, and Pine Lakes
Central Highlands Water			Supplies Landsborough and Navarre	Obliged to meet passing flow requirements
Coliban Water			Supplies Borung, Korong Vale, Wedderburn and Wychitella	
Goulburn-Murray Water	Provides GWMWater with bulk supplies for domestic and stock use from the Goulburn system via the Waranga Main Channel			
Wimmera Catchment Management Authority				Manages waterways in the Wimmera River catchment
North Central Catchment Management Authority				Manages waterways in the Avon and Richardson river catchments

Note:
(1) Also supplies farms located in the Avoca and Mallee basins.

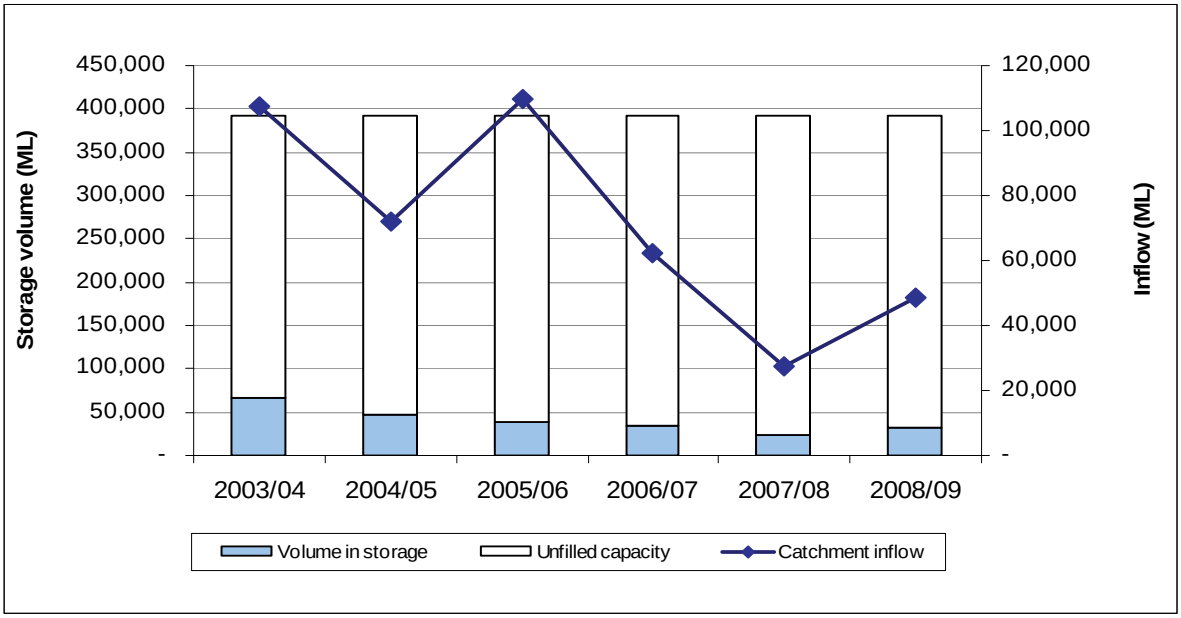
15.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall across the Wimmera basin ranged between 60% and 100% of the long term average. Catchment inflows in 2008/09 remained very low at 15% of the long term average (of 316,400 ML), but were still 89% higher than that experienced in 2007/08.

The volume of water flowing from the Wimmera basin into the basin's terminal lakes in 2008/09 was again very low at 100 ML. This represents less than 1% of total inflows into the basin.

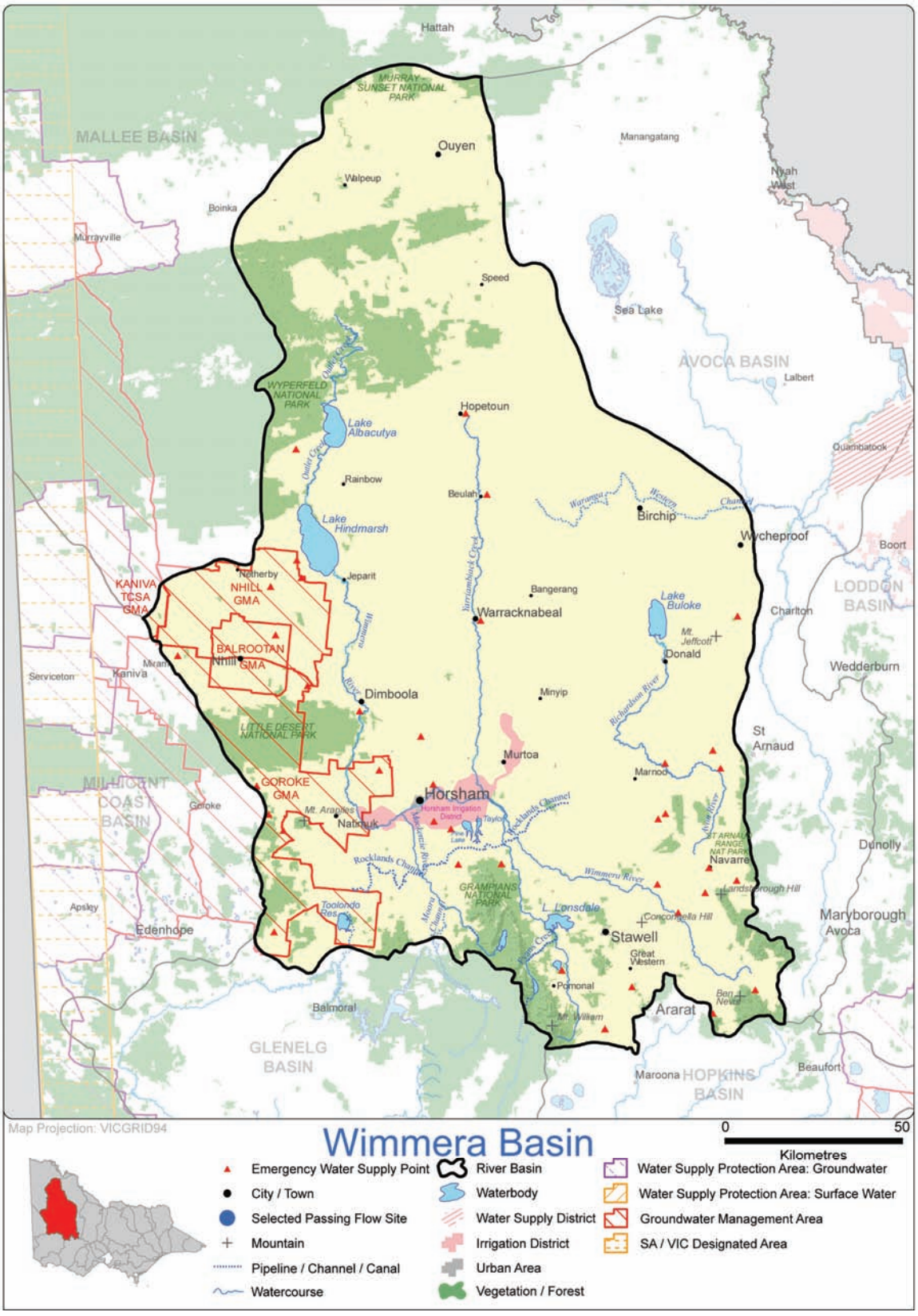
Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 23,900 ML in July 2008 to 31,200 ML by June 2009, or 8% of the total storage capacity of 391,950 ML ML. Only volumes for major on-stream storages have been included in the water balance. In the Wimmera basin, storages greater than 1,000 ML capacity include Dock, Pine, Taylors, Fyans, Green and Batyo Lakes, Lakes Lonsdale and Bellfield, and Wartook and Toolondo Reservoirs, all of which are on-stream storages.

Figure 15-1 All major storages and catchment inflows in the Wimmera basin



15.4 Location of water resources

Figure 15-2 Map of the Wimmera basin



15.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Wimmera basin are shown in Table 15-2.

Table 15-2 Summary of total water resources and water use in the Wimmera basin, 2008/09

Water source	Total water resource (ML)[2]	Total use (ML)
Surface water	53,400	23,100
Groundwater[1]	1,600	500
Recycled water	1,380	1,390

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 15-6 and the estimated domestic and stock use as presented in Table 15-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

15.5.1 Infrastructure projects to improve water availability

Construction of the Wimmera Mallee Pipeline continued in 2008/09. This project will ultimately replace 18,000 kilometres of open earthen channels with a pressurised pipeline system. By June 2009, Supply Systems 1, 2, 5 and 7 were fully installed and approximately 70% of Systems 3, 4 and 6 were complete. Overall, about 90% of the total Wimmera Mallee Pipeline was complete by the end of 2008/09.

15.6 Surface water resources

15.6.1 Water balance

A surface water balance for the Wimmera basin is shown in Table 15-3. Catchment inflow increased 89% compared to 2007/08.

Table 15-3 Balance of surface water in the Wimmera basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	23,900	34,900
Volume in storage at end of year	31,200	23,900
Change in storage	**7,300**	**-11,000**
Inflows		
Catchment inflow[1]	48,700	25,700
Transfer from Glenelg basin	4,700	14,100
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**53,400**	**39,800**
Usage		
Urban diversions and use	3,800	3,700
Diversions for irrigation and domestic and stock use	3,100	5,600
Licensed diversions from unregulated streams	1,800	1,800
Small catchment dams[2]	14,400	14,400
Sub-total	**23,100**	**25,500**
Losses		
Net evaporation losses from major storages	13,900	15,600
Losses from small catchment dams[2]	8,600	7,100
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	400	2,500
Sub-total	**22,900**	**25,200**
Water passed at outlet of basin		
River outflows to Lake Hindmarsh (measured at Tarranyurk)	100	100
River outflows to Lake Buloke	0	0

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Losses estimated using loss functions in the Grampians Wimmera Mallee REALM model.

15.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values provided in Table 15-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 15-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	12,900	6,500	n/a
Registered commercial and irrigation	9,400	7,900	n/a
Total	**22,300**	**14,400**	**23,000**

n/a: Information not available.

15.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

15.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 15-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 15-5 Volume of water diverted under surface water entitlements in the Wimmera basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(2)(3)
Coliban Water					
Wimmera and Glenelg(4)	1	450	0	276	Yes
Central Highlands Water					
Landsborough - Navarre	1	60	0	0	Yes
GWMWater					
Wimmera and Glenelg Rivers – Grampians Water(4)	1	16,109	0	3,532	Yes
Wimmera and Glenelg Rivers – Wimmera Mallee Water(4)	1	149,211	0	3,112	Yes
Wannon Water					
Wimmera and Glenelg Rivers(5)(6)	1	80	0	67	Yes
Environment Minister					
Wimmera and Glenelg Rivers(4)	5	40,563	0	8,175	Yes
Total annual volume of bulk entitlements 2008/09		**206,473**		**15,162**	
Total annual volume of bulk entitlements 2007/08		**206,473**	**0**	**9,403**	
Licensed diversions from unregulated streams 2008/09(6)		*2,490*		*1,800*	
Licensed diversions from unregulated streams 2007/08		*2,490*		*1,800*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) Compliance is also assessed against the Murray-Darling basin annual cap target for the Wimmera and Mallee basins, which is included in the MDBC's Water Audit Monitoring Report 2008/09.

(3) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(4) These bulk entitlements are also reported in the Glenelg basin, however are shown only in the water balance for the Wimmera basin.

(5) Diversion calculated for 1 November to 31 October in line with GWMWater reporting period.

(6) These bulk entitlements are also reported in the Glenelg basin, however are shown only in the water balance for the Glenelg basin.

15.7 Groundwater resources

A summary of the licensed entitlements and use for groundwater management areas that overlap the Wimmera basin, excluding domestic and stock use, is presented in Table 15-6.

The Wimmera basin contains all of the Balrootan (Nhill) GMA and the majority of the Nhill GMA and Goroke GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A. Groundwater levels are generally stable in all GMUs in this area.

All of the groundwater use in the Balrootan (Nhill) GMA was metered in 2008/09, while a portion of the use in 2007/08 was estimated. The accuracy of the groundwater use data from the Balrootan GMA has therefore increased from 2007/08.

Table 15-6 Licensed groundwater volumes, Wimmera basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Allocation limit (ML/year)[3]	Licensed entitlement (ML/year)[4]	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Balrootan (Nhill) GMA (100%)	60-125	1,522	1,522	449	0	449	690
Goroke GMA (63%)	Tertiary sand confined aquifer	1,393	0	0	0	0	0
Nhill GMA (100%)	Tertiary sand confined aquifer	1,200	0	0	0	0	0
Total[5]		**4,115**	**1,522**	**449**	**0**	**449**	**690**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 15-7.

Table 15-7 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Balrootan (Nhill) GMA (100%)	32	64
Goroke GMA (63%)	0	0
Nhill GMA (100%)	0	0
Total	**32**	**64**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 15-6.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is used as an urban water supply to the townships of Landsborough, Nhill, Boroka, Kiata and Horsham Mt Zero. The licensed entitlements and metered use for these groundwater supplies is provided in Table 15-8.

Table 15-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Kiata	40	4	3
Landsborough	150	32	4
Nhill	1,000	437	534
Boroka[1]	-	-	3
Horsham Mt Zero[2]	800	493	
Total	**1,990**	**966**	**544**

Note:
(1) No longer in use.
(2) New supply in 2008/09.

15.8 Drought contingency measures

A range of drought contingency measures was implemented in the Wimmera basin in 2008/09. These include:

- restricting urban and rural water use (discussed in section 15.9)
- continuation of emergency water carting program for GWMWater domestic and stock customers
- provision of emergency water supply points for private water carting for farms
- provision of emergency piped supplies to some towns in Supply Systems 3 and 4
- the continuation of a temporary qualification of rights as detailed in Table 15-9.

GWMWater continued its extensive rural water carting program in 2008/09. This program provided emergency water supplies to rural customers in the Wimmera Mallee system who did not receive a house dam fill due to the ongoing dry conditions. GWMWater also carted approximately 500 litres per day to Clear Lake.

Customers in Supply Systems 3 and 4 were provided with emergency piped supplies from 1 November 2008 as it was not possible to provide them with a dam fill during the year. Customers and towns south of Horsham in the Supply System 6 area also remained on the water carting program.

Table 15-9 Qualification of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Wimmera Glenelg Water Supply System December 2007	1 July 2008 to 31 October 2008 (continuing from 9 January 2008)	Differential access by priority entitlements	Withhold water allocated to the environment for 2007/08 and environmental carryover water in reserve until supply conditions improve

All Wimmera and Glenelg rivers bulk entitlements were qualified for a period from January 2008 until 31 October 2008. This enabled GWMWater to withhold water allocated for the environment, as well as carryover water, in reserve until supply conditions improve.

15.9 Seasonal allocations and restrictions on water use, diversions and extractions

Customers in both the rural and urban areas of the Wimmera basin faced significant restrictions on water use in 2008/09.

All towns supplied by the Wimmera system were on Stage 4 restrictions for the entire year. Only Landsborough, Navarre and Elmhurst, which are all supplied predominantly by groundwater, avoided the severe restriction levels.

The lack of inflows again prevented Grampians Wimmera Mallee Water from providing an allocation in the Wimmera irrigation area. Licensed diverters on unregulated streams across the basin were also banned from taking water during the entire year.

Groundwater use was unrestricted in the Wimmera basin during 2008/09.

Table 15-10 Seasonal allocations and restrictions on water use in Wimmera basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Waranga Channel customers	Stage 4 restrictions from July 2008 to June 2009
	Grampians Headworks customers – direct supply	Stage 4 restrictions from July 2008 to June 2009
	Grampians Headworks customers – summer channel run	Stage 4 restrictions from July 2008 to June 2009
	Grampians Headworks customers – winter channel run	Stage 4 restrictions from July 2008 to June 2009
	Landsborough, Navarre	Stage 1 restrictions from July 2008 to June 2009
	Elmhurst	Stage 2 restrictions from July 2008 to June 2009
Domestic and stock farm supplies	Wimmera Mallee domestic and stock supply system	Supply to one dam per enterprise in most areas and limited pipeline supply in areas where the pipelining is completed from July 2008 to June 2009
Irrigation diversions	Regulated Wimmera Mallee system	Zero allocation from July 2008 to June 2009
	Avon River	Irrigation ban from July 2008 to June 2009
	Richardson River	Irrigation ban from July 2008 to June 2009
	Burnt Creek, Concongella Creek, Dunmunkle Creek, Fyans Creek, Green Lake, Mackenzie River, Mt Cole Creek, Mt William Creek, Shepherds Creek, Toolondo Reservoir, Wattle Creek, Wimmera River, Wimmera Tributary, Yarriambiack Creek, Lake Albacutya, Lake Batyo Catyo, Lake Natimuk, Lake Wartook, Colliers Gap Creek, Spring Creek, Sweetwater Creek, Middle Creek and Unnamed Spring	Irrigation ban from July 2008 to June 2009

15.10 Recycled water

GWMWater operates 16 wastewater treatment plants in the Wimmera basin and reuses all wastewater at nine of these plants for purposes including irrigation of pasture, horticulture and vineyards, and urban and industrial uses (Table 15-11). Wastewater produced at six other plants is evaporated on-site.

Table 15-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Birchip	13	13	100%	0	13	0	0	0	0
Dimboola	38	38	98%	0	37	0	1	0	0
Donald	40	40	100%	0	40	0	0	0	0
Halls Gap	43	43	100%	0	43	0	0	0	0
Hopetoun[4]	0	0	0%	0	0	0	0	0	0
Horsham[5]	677	689	102%	120	557	12	0	0	-12
Jeparit[4]	0	0	0%	0	0	0	0	0	0
Minyip[4]	0	0	0%	0	0	0	0	0	0
Murtoa[5]	33	34	100%	0	34	0	0	0	0
Natimuk[4]	0	0	0%	0	0	0	0	0	0
Nhill	59	59	100%	59	0	0	0	0	0
Ouyen[4]	0	0	0%	0	0	0	0	0	0
Rainbow[4]	0	0	0%	0	0	0	0	0	0
Stawell	374	374	100%	164	210	0	0	0	0
Warracknabeal	58	58	100%	0	58	0	0	0	0
Wycheproof	40	40	100%	0	40	0	0	0	0
Total 2008/09	**1,375**	**1,388**	**101%**	**343**	**1,032**	**12**	**1**	**0**	**-12**
Total 2007/08	1,379	1,379	100%	398	980	0	1	0	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) All wastewater is evaporated on site.

(5) Volume of water recycled exceeded volume produced as water stored on-site carried over from previous year.

15.11 Water for the environment

15.11.1 Environmental Water Reserve (EWR)

The Wimmera River is a heritage river that depends on the EWR. Other important environmental assets dependent on the Wimmera basin EWR include platypus, freshwater catfish and river blackfish.

In 2008/09 the Wimmera basin EWR comprised the following components:

- the Bulk Entitlement (Wimmera and Glenelg Rivers - Flora and Fauna) Order 2005 containing 75,299 ML of water, of which 40,560 is water held and released from storages and 34,739 ML is associated with passing flow rules.
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by GWMWater
- water set aside for the environment through the operations of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

15.11.2 Entitlements for the environment

The formal entitlement for the environment in the Wimmera basin in 2008/09 is the Bulk Entitlement (Wimmera and Glenelg Rivers - Flora and Fauna) Order 2005 held by the Environment Minister. The Inter Catchment Advisory Group determines the share of environmental allocations between the Wimmera and Glenelg catchments.

Commencing in November 2008, some 1,390 ML of water from this entitlement was released from Lake Wartook, 900 ML was used to provide environmental benefits for the Glenelg River (discussed in the Glenelg basin chapter) and 490 ML was delivered to the mid-MacKenzie River extending from the Wartook Valley to Brimpaen. The fast tracking of the Wimmera Mallee Pipeline Project also allowed water allocated to the Grampians Wimmera Mallee System from the Goulburn system to be used to supply recreation water to Tchum Lake, near Birchip.

15.11.3 Passing flow compliance

As noted in section 15.8, all Wimmera and Glenelg Rivers bulk entitlements were qualified in 2008/09 from 1 July to 31 October 2008, enabling GWMWater to withhold water allocated for the environment until supply conditions improve.

15.11.4 Streamflow management plans (SFMPs)

Work continued on the proposed SFMP for the upper Wimmera River during 2008/09.

16 East Gippsland basin

This chapter sets out the accounts for the East Gippsland basin. For detailed information about how they have been compiled, refer to Chapter 5.

16.1 East Gippsland basin summary

Despite inflows being 21% of the long term average in 2008/09, surface water use in the basin was unrestricted.

Consumptive use in the basin is very low compared to water availability. Almost 99% of inflows passed to Bass Strait in 2008/09.

16.2 Responsibilities for management of water resources

Table 16-1 shows the responsibilities of various authorities within the East Gippsland basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 16-1 Responsibilities for water resources management within the East Gippsland basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages licensed diversions from groundwater and surface water sources		
East Gippsland Water			Supplies urban water to towns including Mallacoota, Cann River and Bemm River	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority				Manages waterways in the whole of the East Gippsland basin

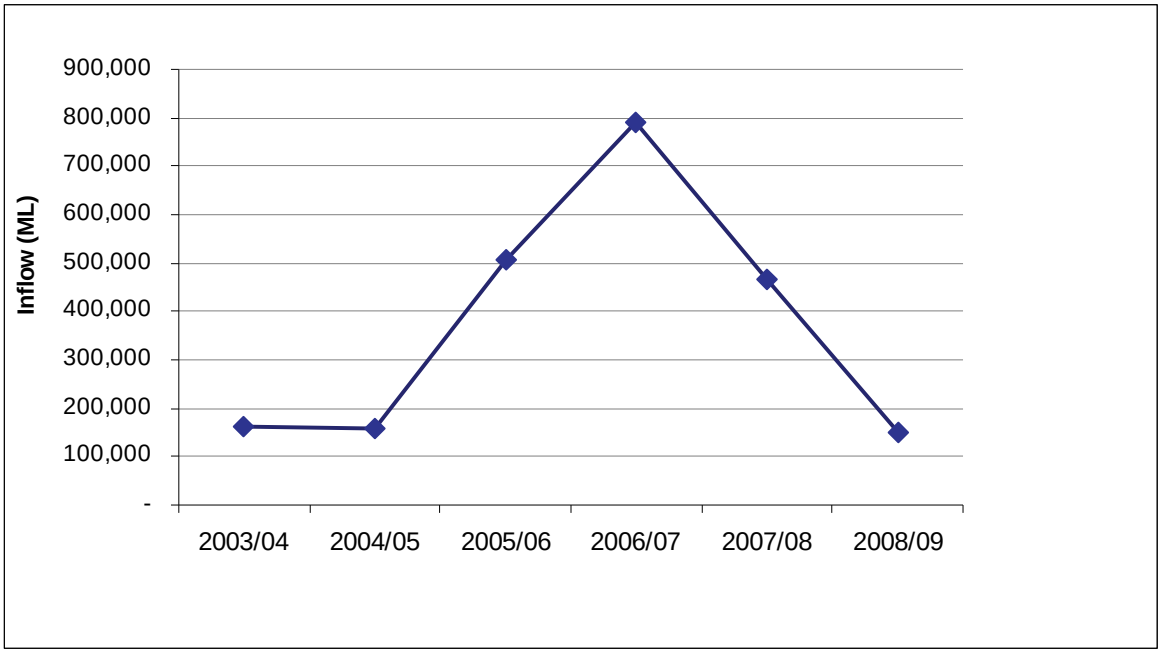
16.3 Rainfall and flows in 2008/09

In 2008/09, rainfall in the East Gippsland basin ranged between 60% and 80% of the long term average. Inflows were 21% of the long term average (of 714,000 ML[11]), a significant decline from the 65% recorded in 2007/08.

The amount of water flowing from the East Gippsland basin into Bass Strait was 149,100 ML in 2008/09, compared with 464,900 ML in 2007/08. Basin outflow represented about 99% of total inflows into the basin.

There are no major storages located within the East Gippsland basin.

Figure 16-1 Catchment inflows in the East Gippsland basin



[11] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

16.4 Location of water resources

Figure 16-2 Map of the East Gippsland basin

16.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the East Gippsland basin are shown in Table 16-2. There is very low use of surface water relative to the available resource in the basin (1.0% in 2008/09), and only limited groundwater extraction. All wastewater is recycled for productive purposes.

Table 16-2 Summary of total water resources and water use in the East Gippsland basin, 2008/09

Water source	Total water resource (ML)	Total use (ML)
Surface water	150,700	1,500
Groundwater(1)	120	80
Recycled water	30	30

Note:

(1) Although there are no WSPAs or GMAs in the East Gippsland basin, the town of Mallacoota is supplied by groundwater located in an unincorporated area. The groundwater resource and use reflects the licensed volume and use for Mallacoota.

16.6 Surface water resources

16.6.1 Water balance

The surface water balance for the East Gippsland basin for 2008/09 is presented in Table 16-3.

No reservoir information is recorded in the water balance as there are no storages in the East Gippsland basin with a capacity greater than 1,000 ML.

The inflows to the East Gippsland basin originate from New South Wales and Victoria. On average, New South Wales contributes around 26% of total inflows to the basin. The water balance includes total flow for the basin in both states.

Less than 1% of the catchment inflows were diverted for consumptive use, predominantly in small catchment dams.

Table 16-3 Balance of surface water in the East Gippsland basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	150,700	466,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**150,700**	**466,700**
Usage		
Urban diversions	130	200
Licensed diversions from unregulated streams	300	400
Small catchment dams	1,100	1,100
Sub-total	**1,500**	**1,700**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	100	100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**100**	**100**
Water passed at outlet of basin		
River outflows	149,100	464,900

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Assumed to be zero because data is not readily available.

16.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 16-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 16-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	800	400	n/a
Registered commercial and irrigation	900	700	n/a
Total	**1,700**	**1,100**	**1,200**

n/a: Information not available.

16.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

16.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk water entitlements is shown in Table 16-5.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 16-5 Volume of water diverted under surface water entitlements in the East Gippsland basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Bemm River	1	100	0	19	Yes
Cann River	1	192	0	43	Yes
Mallacoota	1	330	0	65	Yes
Total annual volume of bulk entitlements 2008/09		**622**		**127**	
Total annual volume of bulk entitlements 2007/08		**622**	**0**	**200**	
Licensed diversions from unregulated streams 2008/09		*908*		*327*	
Licensed diversions from unregulated streams 2007/08		*922*		*395*	

16.7 Groundwater resources

There are no groundwater management areas or water supply protection areas located within the East Gippsland basin. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

East Gippsland Water operates a groundwater bore in the East Gippsland basin for the town of Mallacoota with a licensed volume of 120 ML a year. Some 80 ML was extracted from the bore in 2008/09, an increase from the 42 ML extracted during 2007/08.

Table 16-6 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Mallacoota(1)	120	80	42
Total	**120**	**80**	**42**

Notes:

(1) Licensed volume increased by 40 ML from the 80 ML used in 2007/08.

16.8 Drought contingency measures

No drought contingency measures were implemented in 2008/09.

16.9 Seasonal allocations and restrictions on water use, diversions and extractions

All towns in the East Gippsland region were under permanent water savings rules during 2008/09. Groundwater use was unrestricted during 2008/09.

16.10 Recycled water

East Gippsland Water operates the wastewater treatment plants at Mallacoota and Cann River. The volume of wastewater produced during 2008/09 decreased by around 65% compared with 2007/08, largely due to reduced volumes produced at Mallacoota. All the wastewater was recycled for applications including pasture and tree plantations.

Table 16-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Cann River	22	22	100%	0	22	0	0	0	0
Mallacoota	13	13	100%	0	13	0	0	0	0
Total 2008/09	**35**	**35**	**100%**	**0**	**35**	**0**	**0**	**0**	**0**
Total 2007/08	97	97	100%	0	97	0	0	0	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. to maintain biological processes. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

16.11 Water for the environment

16.11.1 Environmental Water Reserve (EWR)

In 2008/09 the East Gippsland basin EWR comprised the following components:

- water set aside for the environment through flow-sharing arrangement conditions within consumptive bulk entitlements held by East Gippsland Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

16.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlements in 2008/09.

Table 16-8 shows passing flow compliance in the East Gippsland basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this compliance point is presented in Figure 16-2.

Table 16-8 Selected passing flow compliance in the East Gippsland basin

River	Passing flow	
Betka River	Instrument where passing flows are specified	Bulk Entitlement (Mallacoota) Conversion Order 1997
	Responsible authority	East Gippsland Water
	Compliance point	Mallacoota Diversion Weir (shown as 1 in Figure 16-2)
	Passing flow compliance	• Half the flow was passed for flows less than or equal to 3.1 ML/day • A minimum of 1.55 ML/day was passed for flows greater than 3.1 ML/day

17 Snowy basin

This chapter sets out the accounts for the Snowy basin. For detailed information about how they have been compiled, refer to Chapter 5.

17.1 Snowy basin summary

Consumptive entitlements in the Snowy basin are low compared with the total water resource. Although inflows from Victoria were 42% of the long term average in 2008/09, more than 98% flowed into Bass Strait.

Urban and rural water users were unrestricted throughout the year. Groundwater users were also unrestricted.

17.2 Responsibilities for management of water resources

Table 17-1 shows the responsibilities of various authorities within the Victorian portion of the Snowy basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 17-1 Responsibilities for water resources management within the Snowy basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
East Gippsland Water			Supplies towns including Buchan, Bonang, Orbost and Marlo	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority				Manages waterways for the whole of the Snowy basin

17.3 Rainfall, flows and storage levels in 2008/09

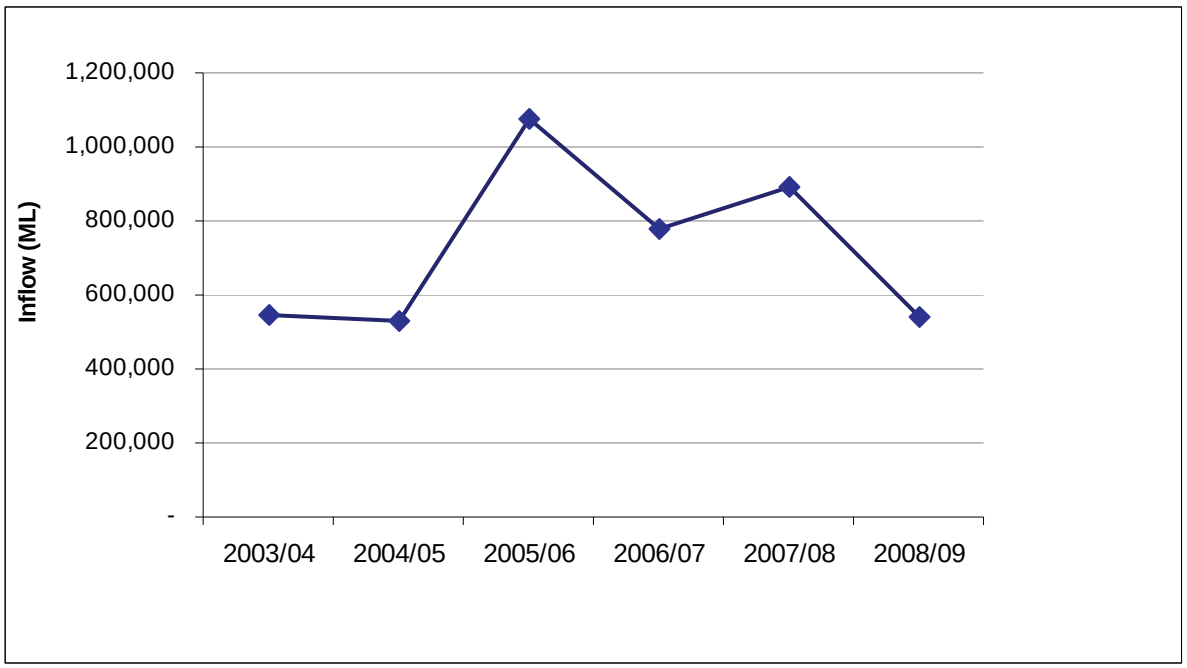
In 2008/09, rainfall in the Snowy basin ranged between 60% and 100% of the long term average. Total inflows to the Victorian portion of the basin were 431,000 ML or 42% of the long term average (of 1,022,000 ML[12]), compared with 672,600 ML or 66% in 2007/08. Catchment inflows from Victoria were 35% lower than the previous year, while inflows from New South Wales were 52% lower. Inflows from NSW are regulated by the Snowy Mountains Hydro Electricity Scheme.

The amount of water flowing from the Snowy basin into Bass Strait was 531,600 ML in 2008/09. This represents almost 99% of total inflows to the Victorian portion of the basin.

There are no major storages (greater than 1,000 ML capacity) located within the Victorian portion of the Snowy basin.

[12] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 17-1 Catchment inflows to the Snowy basin (including contribution from NSW)



17.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Snowy basin are shown in Table 17-2. The basin experiences a very low consumptive use of surface water relative to the available resource in its Victorian portion. All treated wastewater is reused for productive purposes. Approximately 95% of the Snowy basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

Table 17-2 Summary of total water resources and water use in the Snowy basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	538,000	5,700
Groundwater[2]	1,200	600
Recycled water	220	220

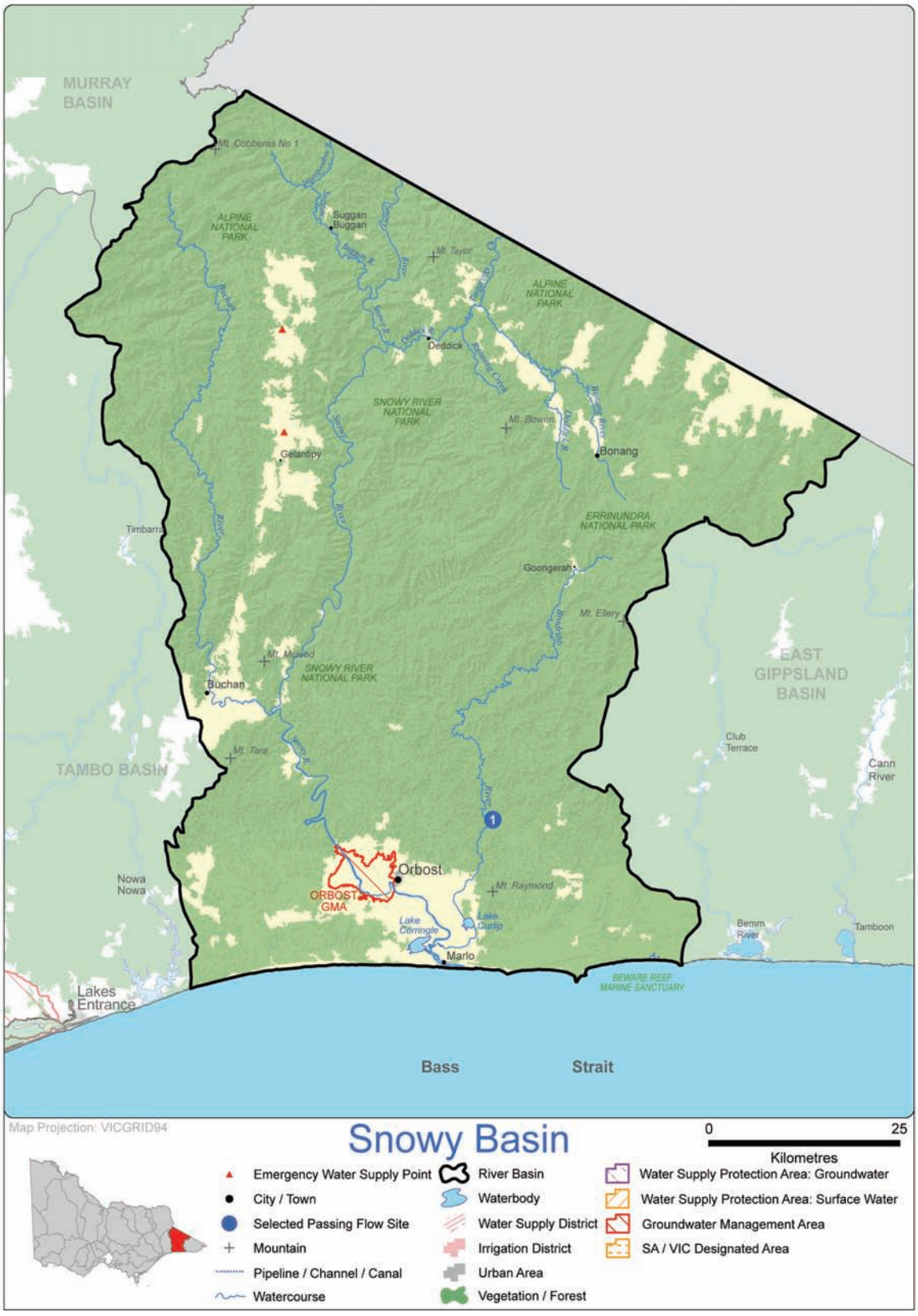
Note:

(1) For groundwater the total water resource is the licensed entitlement volume as presented in Table 17-7 and the estimated domestic and stock use as presented in Table 17-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

17.5 Location of water resources

Figure 17-2 Map of the Snowy basin



17.6 Surface water resources

17.6.1 Water balance

A surface water balance for the Snowy basin is shown in Table 17-3. As these accounts provide a record of water availability and use across Victoria, this balance considers only the Victorian portion of the Snowy basin.

No reservoir information is recorded in the water balance as there are no storages with a capacity greater than 1,000 ML in the Victorian portion of the Snowy basin.

Victorian inflows accounted for 80% of the total inflows to the basin, compared with 75% in 2007/08. Diversions in Victoria from the Snowy basin represent less than 2% of total inflows. Small catchment dams are estimated to be the largest source of diversions.

Table 17-3 Balance of surface water in the Snowy basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow from Victoria(1)	431,000	672,600
Catchment inflow from NSW(2)	107,000	221,300
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**538,000**	**893,900**
Usage		
Urban diversions	810	800
Licensed diversions from unregulated streams	1,500	900
Small catchment dams	3,400	3,400
Sub-total	**5,700**	**5,100**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	700	700
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**700**	**700**
Water passed at outlet of basin		
River outflows to the ocean	531,600	888,100

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Inflows from NSW recorded on the Snowy River at Burnt Hut Crossing (gauge 222013).
(3) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.
(4) Assumed to be zero because data is not available.

17.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 17-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 17-4 Catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	3,100	1,600	n/a
Registered commercial and irrigation	2,100	1,800	n/a
Total	**5,200**	**3,400**	**4,100**

n/a: Information not available.

17.6.3 Water entitlement transfers

In 2008/09, no net movement of surface water resources occurred into or out of the Snowy basin. Trades of temporary bundled water rights did occur within the basin.

Table 17-5 summarises the trade in bundled surface water entitlements in 2008/09. Some 53 ML of temporary entitlements were traded within the Snowy unregulated system in this year.

Table 17-5 Transfers of surface water bundled entitlements in the Snowy basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Snowy unregulated	0	0	0	53	53	0
Total 2008/09	**0**	**0**	**0**	**53**	**53**	**0**
Total 2007/08[(1)]	n/a	n/a	n/a	n/a	n/a	n/a

Note:
(1) No data available for 2007/08.

17.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk entitlements is shown in Table 17-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 17-6 Volume of water diverted under surface water entitlements in the Snowy basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Buchan	1	170	0	25	Yes
Orbost	1	2,031	0	780	Yes
Total annual volume of bulk entitlements 2008/09		**2,201**	**0**	**805**	
Total annual volume of bulk entitlements 2007/08		**2,201**	**0**	**796**	
Licensed diversions from unregulated streams 2008/09		*3940*		*1,466*	
Licensed diversions from unregulated streams 2007/08		*3925*		*907*	

17.7 Groundwater resources

The Snowy basin contains the entire Orbost GMA. Licensed groundwater entitlements and use for the Orbost GMA in the Snowy basin, excluding domestic and stock use, are shown in Table 17-7. Groundwater levels in Orbost GMA are generally stable.

Table 17-7 Licensed groundwater volumes, Snowy basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[6]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Orbost GMA (100%)	20-45	1,201	1,201	578	0	578	490
Total[5]		**1,201**	**1,201**	**578**	**0**	**578**	**490**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit is represented by the permissible consumptive volume (PCV).
(4) Licensed entitlement includes domestic and stock usage in those cases where this forms part of a licensed volume.
(5) Total volumes are based on the sum of management unit data prior to rounding.
(6) Non-metered use includes dairy wash and low consumption commercial use.

An estimate of domestic and stock groundwater use in the Snowy basin is provided in Table 17-8. Groundwater is not used as an urban supply in the Snowy basin.

Table 17-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Orbost GMA (100%)	21	42
Total	**21**	**42**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 17-7.
(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Total volumes are based on the sum of management unit data prior to rounding.

17.8 Drought contingency measures

No drought contingency measures were implemented in 2008/09.

17.9 Seasonal allocations and restrictions on water use, diversions and extractions

There were no urban or rural restrictions on surface water or groundwater use in the Snowy basin in 2008/09.

17.10 Recycled water

The Orbost wastewater treatment plant is the only town in the Snowy basin with a recycled water scheme in place. In 2008/09 all of the wastewater passing through this treatment plant was recycled and used for a number of applications including pasture and tree plantations (Table 17-9).

Table 17-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Orbost	217	217	100%	0	217	0	0	0	0
Total 2008/09	**217**	**217**	**100%**	**0**	**217**	**0**	**0**	**0**	**0**
Total 2007/08	268	268	100%	0	268	0	0	0	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

17.11 Water for the environment

17.11.1 Environmental Water Reserve (EWR)

The health of the Snowy River is dependent on the Snowy basin's EWR.

In 2008/09 the Snowy basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of the water licence issued to Snowy Hydro
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- environmental allocations from outcomes of the Snowy Water Inquiry
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

17.11.2 Entitlements for the environment

The Victorian volume of environmental entitlements for the Snowy basin as at June 2009 was 23,496 ML. The Snowy environmental entitlements were created through the inter-governmental commitment between the Commonwealth, Victorian and New South Wales Governments, often referred to as the Snowy Water Inquiry. The commitment is to provide for the return of 212,000 ML (21%) of the original flow to the Snowy River below Jindabyne by 2012, and 28% in the longer term. It is envisaged that the environmental water for the Snowy River will be achieved through the investment in water recovery projects in the Goulburn, Murray and Murrumbidgee basins.

The first interim target of providing 38,000 ML of entitlements to the Snowy River by 2005 was met. The next interim target under the Snowy Water Inquiry is to provide 142,000 ML of entitlements to the Snowy River by 2009. This target was effectively met.

17.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlements in 2008/09.

Table 17-10 shows passing flow compliance in the Snowy basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this compliance point is presented in Figure 17-2.

Table 17-10 Selected passing flow compliance in the Snowy basin

River	Passing flow	
Rocky River, Brodribb River	Instrument where passing flows are specified	Bulk Entitlement (Orbost) Conversion Order 1997
	Responsible authority	East Gippsland Water
	Compliance point	Rocky River, downstream of the offtake weir (shown as 1 in Figure 17-2)
	Passing flow compliance	The lesser of 1 ML/day or natural inflow was passed

18 Tambo basin

This chapter sets out the accounts for the Tambo basin. For detailed information about how they have been compiled, refer to Chapter 5.

18.1 Tambo basin summary

The Tambo basin was one of the only basins in Victoria in which inflows, at 57% of the long term average, were higher in 2008/09 than in 2007/08.

There are no large authorised diversions in the Tambo basin as its bigger towns, such as Lake Entrance, are now supplied by the Bairnsdale water system. As such, about 96% of basin inflows flow to the Gippsland Lakes.

Licensed surface water users were unrestricted during the year.

18.2 Responsibilities for management of water resources

Table 18-1 shows the responsibilities of various authorities within the Tambo basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 18-1 Responsibilities for water resources management within the Tambo basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
East Gippsland Water			Supplies towns including Lakes Entrance, Bruthen, and Swifts Creek	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority				Manages waterways in the whole of the Tambo basin

18.3 Rainfall, flows and storages in 2008/09

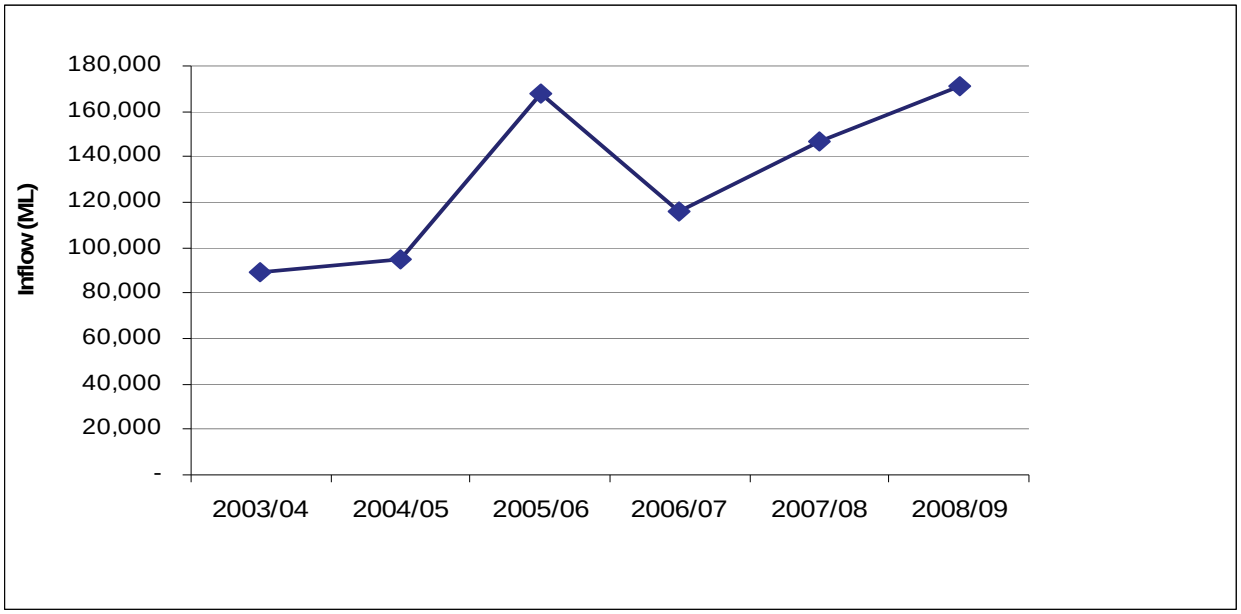
In 2008/09, rainfall in the Tambo basin ranged mostly between 60% and 80% of the long term average, with some areas ranging between 80% and 100%. Higher rainfall compared to 2007/08 resulted in higher streamflows in 2008/09. Inflows in 2008/09 were about 57% of the long term average (of 297,800 ML[13]), compared with 49% in 2007/08.

The amount of water flowing from the Tambo basin into the Gippsland Lakes was 163,400 ML in 2008/09, approximately 96% of total inflows to the basin.

There are no major storages located within the Tambo basin.

[13] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 18-1 Catchment inflows in the Tambo basin



18.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Tambo basin are shown in Table 18-2.

The total diversions do not include the surface water transferred from the Mitchell River to the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance. Consumptive use in the Tambo basin is low compared to the available resource in the basin.

Table 18-2 Summary of total water resources and water use in the Tambo basin, 2008/09

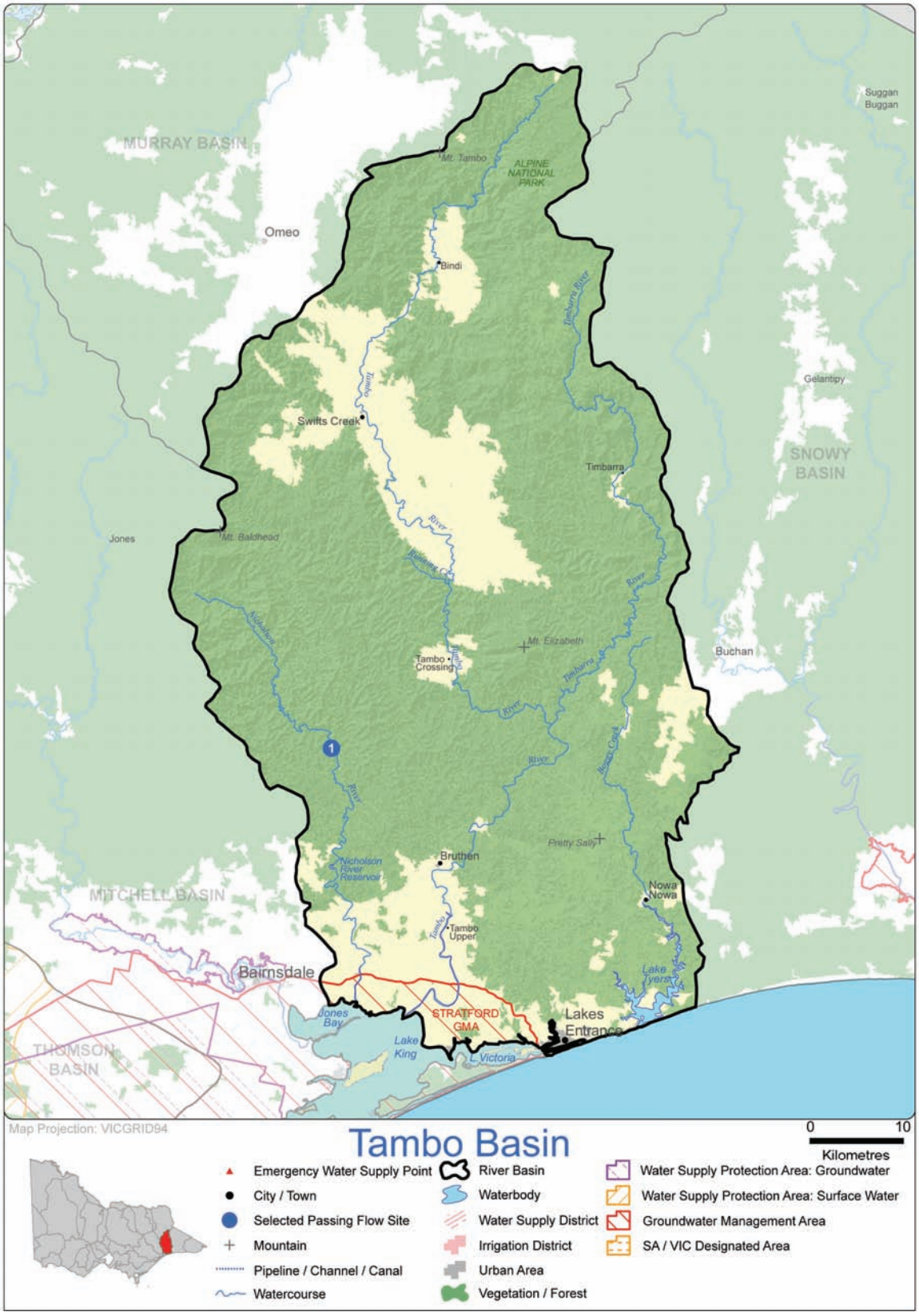
Water source	Total water resource (ML)	Total use (ML)
Surface water	170,700	5,200
Groundwater	0	0
Recycled water	730	730

18.4.1 Infrastructure projects to improve water availability

East Gippsland Water completed the installation of a liner and floating cover at the Sunlakes storage at Lakes Entrance to reduce losses from the water supply system.

18.5 Location of water resources

Figure 18-2 Map of the Tambo basin



18.6 Surface water resources

18.6.1 Water balance

A surface water balance for the Tambo basin is shown in Table 18-3.

No reservoir information is recorded in the water balance as there is no reservoir in the Tambo basin with a capacity greater than 1,000 ML.

Table 18-3 Balance of surface water in the Tambo basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	170,700	146,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**170,700**	**146,700**
Usage		
Urban diversions	40	50
Licensed diversions from unregulated streams	1,300	1,100
Small catchment dams	3,900	3,900
Sub-total	**5,200**	**5,100**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	2,100	2,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**2,100**	**2,100**
Water passed at outlet of basin		
River outflows to the ocean	163,400	139,500

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Assumed to be zero because data is not readily available.

18.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 18-4 below are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 18-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,500	2,200	n/a
Registered commercial and irrigation	2,100	1,700	n/a
Total	**6,600**	**3,900**	**6,000**

n/a: Information not available.

18.6.3 Water entitlement transfers

Surface water movement in the Tambo basin was limited to transfers of bundled entitlement within the basin. In 2008/09, some 4 ML of bundled entitlement in the Tambo basin was transferred on a permanent basis, and 10 ML on a temporary basis. There was no net movement of water into the basin during the year.

Table 18-5 summarises the movement of bundled entitlements in the Tambo basin during 2008/09.

Table 18-5 Transfers of surface water bundled entitlements in the Tambo basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Tambo unregulated	4	4	0	10	10	0
Total 2008/09	**4**	**4**	**0**	**10**	**10**	**0**
Total 2007/08[1]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

18.6.4 Volume diverted

Table 18-6 shows the volume of water diverted under East Gippsland Water's bulk entitlements. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the average annual bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

No water was extracted under the Bruthen and Lakes Entrance bulk entitlements. These towns were supplied with water taken from the Mitchell basin under East Gippsland Water's Bairnsdale bulk entitlement.

Table 18-6 Volume of water diverted under surface water entitlements in the Tambo basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Bruthen[1]	1	313	0	0	Yes
Lakes Entrance[1]	1	2,993	0	0	Yes
Nowa Nowa[1]	1	118	0	0	Yes
Swifts Creek	1	224	0	37	Yes
Total annual volume of bulk entitlements 2008/09		**3,648**	**0**	**37**	
Total annual volume of bulk entitlements 2007/08		**3,648**	**0**	**52**	
Licensed diversions from unregulated streams 2008/09		*4,177*		*1,337*	
Licensed diversions from unregulated streams 2007/08		*4,115*		*1,083*	

Note:
(1) No water was extracted under the Bruthen, Lakes Entrance and Nowa Nowa bulk entitlements. Water is provided under the Bairnsdale entitlement, reported in Table 19-6 in the Mitchell basin.

18.7 Groundwater resources

There are no GMAs or WSPAs located within the Tambo basin.

There is no urban groundwater supply in the Tambo basin.

Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

18.8 Drought contingency measures

No drought contingency measures were in place in the Tambo basin in 2008/09.

18.9 Seasonal allocations and restrictions on water use, diversions and extractions

No restrictions on water use, diversions or extractions occurred in the Tambo basin in 2008/09.

18.10 Recycled water

East Gippsland Water operates the wastewater treatment plants at Lakes Entrance and Metung. All of the wastewater passing through these treatment plants was recycled and used for a number of applications including pasture and tree plantations, racecourses and golf courses (Table 18-7).

Table 18-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Lakes Entrance	626	626	100%	0	626	0	0	0	0
Metung	105	105	100%	0	105	0	0	0	0
Total 2008/09	**731**	**731**	**100%**	**0**	**731**	**0**	**0**	**0**	**0**
Total 2007/08	763	763	100%	0	763	0	0	0	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

18.11 Water for the environment

18.11.1 Environmental Water Reserve (EWR)

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Tambo basin. They are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from the Tambo basin to ecologically function.

In 2008/09 the Tambo basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

18.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

East Gippsland Water reported that it met all passing flow requirements in the Tambo basin under its bulk entitlements in 2008/09.

Table 18-8 shows passing flow compliance in the Tambo basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this compliance point is presented in Figure 18-2.

Table 18-8 Selected passing flow compliance in the Tambo basin

River	Passing flow	
Nicholson River	Instrument where passing flows are specified	Bulk Entitlement (Lakes Entrance) Conversion Order 1997
	Responsible authority	East Gippsland Water
	Compliance point	Nicholson River Reservoir Weir (shown as 1 in Figure 18-2)
	Passing flow compliance	From June to November inclusive: • Half the flow was passed when flow was less than 60 ML/day • 30 ML/day was passed when flow was greater than 60 ML/day From December to May inclusive: • Half the flow was passed when flow was less than 14 ML/day • 7 ML/day was passed when flow was greater than 14 ML/day Instantaneous minimum passing flow: • Half the flow was passed when flow was less than 6 ML/day • 3 ML/day was passed when flow was greater than 6 ML/day

19 Mitchell basin

This chapter sets out the accounts for the Mitchell basin. For detailed information about how they have been compiled, refer to Chapter 5.

19.1 Mitchell basin summary

Inflows in the Mitchell basin in 2008/09 were 41% of the long term average and comparable to inflows experienced in 2006/07. About 93% of these inflows were not diverted and entered the Gippsland Lakes.

Despite the low inflows, surface water users, including those supplied from the Bairnsdale water system, were largely unrestricted during the year. This is because consumptive use is low compared to the total surface water resource. Only licensed diverters on the Mitchell River were restricted, however these restrictions only applied during March and April 2009.

Licensed groundwater use in the basin was approximately 25% higher than in 2007/08, but at 3,914 ML was still 36% of the total licensed volume.

19.2 Responsibilities for management of water resources

Table 19-1 shows the responsibilities of various authorities within the Mitchell basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 19-1 Responsibilities for water resources management within the Mitchell basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
East Gippsland Water			Supplies towns, including Bairnsdale and Paynesville	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority				Manages waterways in the entire Mitchell basin

19.3 Rainfall, flows and storages in 2008/09

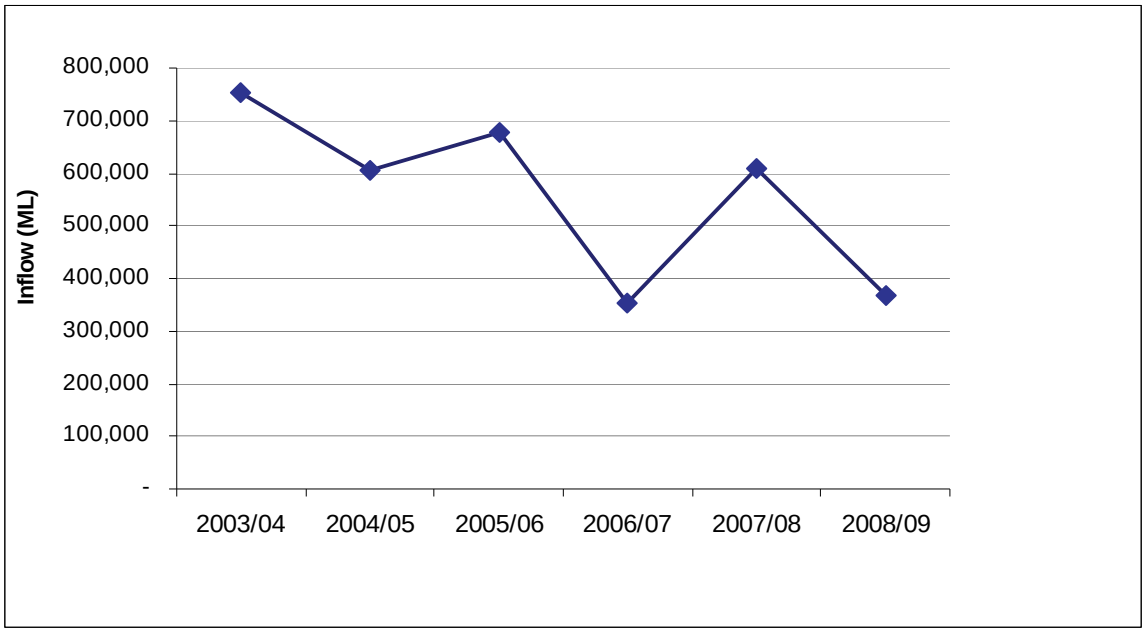
In 2008/09, rainfall in the Mitchell basin ranged between 60% and 80% of the long term average, lower than the 80% to 100% experienced in 2007/08. Inflows to the basin were 41% of the long term average (of 884,500 ML[14]) compared to 69% in 2007/08. Inflows in 2008/09 were only marginally higher than in 2006/07.

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 340,700 ML in 2008/09, a significant reduction from 590,700 ML recorded in 2007/08 and only marginally higher than the 335,700 ML in 2006/07. The 2008/09 outflows represent 93% of total inflows into the basin, which is slightly lower than that of 2007/08.

There are no major storages located within the Mitchell basin.

[14] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Figure 19-1 Catchment inflows in the Mitchell basin



19.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Mitchell basin are shown in Table 19-2. As well as supplying Bairnsdale, the Mitchell River is the source of supply for the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance in adjacent river basins, and supports irrigation on the Lindenow Flats. Overall, consumptive use in the Mitchell basin is low compared to the available resource in the basin.

Table 19-2 Summary of total water resources and water use in the Mitchell basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	365,900	23,800
Groundwater[2]	11,400	4,100
Recycled water	1,350	1,350

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 19-7 and the estimated domestic and stock use as presented in Table 19-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

19.4.1 Infrastructure projects to improve water availability

East Gippsland Water progressed with its $45 million program of works to secure high quality, long term water supplies for its customers reliant on the Mitchell River. Work in 2008/09 included commencement of construction of a 650 ML off-stream water storage at Woodglen. Other work included completion of projects to replace the Eagle Point tank and another to line and cover Wy Yung storage. These projects will reduce water loss from the supply system and improve water quality.

19.5 Location of water resources

Figure 19-2 Map of the Mitchell basin

19.6 Surface water resources

19.6.1 Water balance

A surface water balance for the Mitchell basin is shown in Table 19-3. Diversions make up a relatively small proportion of total inflows, with approximately 7% of the total basin inflows diverted for consumptive use.

No storage information is recorded in the water balance as there are no on-stream storages in the Mitchell basin with a capacity greater than 1,000 ML.

Table 19-3 Balance of surface water in the Mitchell basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	365,800	609,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river(2)	90	70
Sub-total	**365,900**	**609,500**
Usage		
Urban diversions	4,490	4,690
Licensed diversions from unregulated streams	14,800	8,000
Small catchment dams	4,500	4,500
Sub-total	**23,800**	**17,200**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	1,100	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	300	500
Sub-total	**1,400**	**1,600**
Water passed at outlet of basin		
River outflows to the ocean	340,700	590,700

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Comprised of water returned to rivers within the basin from alpine resorts in 2008/09 and 2007/08.

(3) Evaporation losses are calculated by subtracting estimated usage from water harvested.

(4) Losses are calculated from the Wonnangatta River between Waterford and Angusvale and part upstream of Waterford. This length of river covers approximately 50% of the basin.

19.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 19-4 have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 19-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,200	2,100	n/a
Registered commercial and irrigation	2,900	2,400	n/a
Total	**7,100**	**4,500**	**5,600**

n/a: Information not available.

19.6.3 Water entitlement transfers

Surface water movement in the Mitchell basin was limited to transfers of bundled entitlement within the basin. In 2008/09, no entitlements in the Mitchell basin were transferred on a permanent basis, but 192 ML was traded on a temporary basis. There was no net movement of water into the Mitchell basin in this year.

Table 19-5 summarises the movement of bundled entitlements in the Mitchell basin during 2008/09.

Table 19-5 Transfers of surface water bundled entitlements in the Mitchell basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Mitchell unregulated	0	0	0	192	192	0
Total 2008/09	**0**	**0**	**0**	**192**	**192**	**0**
Total 2007/08[1]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

19.6.4 Volume diverted

The volume of water diverted under the bulk entitlement established for the Mitchell basin is shown in Table 19-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 19-6 Volume of water diverted under surface water entitlements in the Mitchell basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Bairnsdale	1	5,902	0	4,491	Yes
Total annual volume of bulk entitlements 2008/09		**5,902**	**0**	**4,491**	
Total annual volume of bulk entitlements 2007/08		**5,902**	**0**	**4,688**	
Licensed diversions from unregulated streams 2008/09[1]		*16,285*		*14,817*	
Licensed diversions from unregulated streams 2007/08		*16,206*		*7,999*	

Notes:
(1) Increase due to expanded development and unrestricted water supply.

19.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Mitchell basin, excluding domestic and stock use, is presented in Table 19-7.

The Mitchell basin contains the entire Wy Yung WSPA as well as part of the Sale WSPA and Stratford GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A. Groundwater levels in the Wy Yung WSPA are declining, while levels in the Sale WSPA and Stratford GMA are generally stable.

Groundwater use in 2008/09 increased compared to 2007/08 due to the decreased availability of surface water resources.

Table 19-7 Licensed groundwater volumes, Mitchell basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[6]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	2,050	2,050	7	1,988	1,995	1,787
Sale WSPA (8%)	25-200	1,697	1,685	893	2	895	760
Wy Yung WSPA (100%)	≤25	7,463	7,462	1,009	15	1,024	631
Total[5]		**11,210**	**11,197**	**1,909**	**2,005**	**3,914**	**3,178**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed volume.

(5) Total volumes are based on the sum of management unit data prior to rounding.

(6) Non-metered use includes dairy wash and low consumption commercial use.

An estimate of domestic and stock groundwater use is provided in Table 19-8. Groundwater is not used for urban supply within the Mitchell basin.

Table 19-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Stratford GMA (7%)	4	8
Sale WSPA (8%)	34	68
Wy Yung WSPA (100%)	70	140
Total	**108**	**216**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 19-7.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

19.8 Drought contingency measures

A diversion ban on the Mitchell River was the only drought contingency measure in place in the Mitchell basin in 2008/09 (refer to section 19.9).

19.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions experienced by urban and rural customers in the Mitchell basin are detailed in Table 19-9.

Table 19-9 Seasonal allocations and restrictions on water use in Mitchell basin, 2008/09

Type of restriction	Area	Nature of restriction
Licensed diversions on unregulated streams	Mitchell River	Stage 5 restrictions March 2009 to April 2009

19.10 Recycled water

The wastewater treatment plants at Bairnsdale, Lindenow and Paynesville are operated by East Gippsland Water. All the wastewater passing through the Paynesville and Lindenow treatment plants was recycled and used for a number of applications including pasture and tree plantations, racecourses and golf courses (Table 19-10).

The Bairnsdale wastewater treatment plant has, as part of its treatment process, a series of constructed wetlands located within the Macleod Morass. The constructed wetlands provide additional filtration for water discharged from the treatment plant before it is released into the morass as environmentally beneficial water for the deep freshwater marsh. This discharge is considered a beneficial allocation.

Table 19-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bairnsdale	1,110	1,110	100%	0	21	1,089	0	0	0
Lindenow	7	7	100%	0	0	7	0	0	0
Paynesville	231	231	100%	0	231	0	0	0	0
Total 2008/09	**1,348**	**1,348**	**100%**	**0**	**252**	**1,096**	**0**	**0**	**0**
Total 2007/08	1,522	1,522	100%	0	395	1,127	0	0	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

19.11 Water for the environment

19.11.1 Environmental Water Reserve (EWR)

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Mitchell basin. The lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from the Mitchell basin to ecologically function.

In 2008/09 the Mitchell basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

19.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlement in 2008/09.

Table 19-11 shows passing flow compliance in the Mitchell basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this compliance point is presented in Figure 19-2.

Table 19-11 Selected passing flow compliance in the Mitchell basin

River	Passing flow	
Mitchell River	Instrument where passing flows are specified	Bulk Entitlement (Bairnsdale) Conversion Order 2000
	Responsible authority	East Gippsland Water
	Compliance point	Mitchell River, downstream of Glenaladale pump station (shown as 1 in Figure 19-2)
	Passing flow compliance	Flows were passed according to the following rules: • No diversion when flow was less than 30 ML/day • 30 ML/day passed when flow was between 30 and 46 ML/day • When flow was between 46 and 246 ML/day, the entire flow, less 16 ML/day, was passed • 230 ML/day passed when flow was between 246 and 265 ML/day • When flow was greater than 265 ML/day the authority passed the entire flow, less 35 ML/day

20 Thomson basin

This chapter sets out the accounts for the Thomson basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

20.1 Thomson basin summary

Inflows in the Thomson basin were extremely low in 2008/09 at 408,300 ML. This is nearly 20% below any of the annual inflows experienced in the past five years. For the six months ending 30 June 2009, streamflows into Thomson Reservoir were the lowest on record.

Storages began the year at 24% and had fallen to 17% by the end of June 2009. This equates to a reduction of nearly 88,000 ML. Thomson Reservoir, Melbourne's biggest water storage, was holding 16% of capacity. It was last full in 1996.

Despite total inflows into the basin being extremely low, inflows into the Macalister River in the first half of the year were adequate to fill Lake Glenmaggie. This enabled seasonal allocations in the Macalister Irrigation District to reach 100% of high reliability water shares and 10% of low reliability water shares.

Diversions in the Thomson basin decreased in 2008/09 compared to 2007/08, due mainly to Melbourne Water reducing the volume of water it transferred across to the Melbourne system. Water use in the Macalister Irrigation District was similar to the volume used in 2007/08.

Licensed groundwater use in the basin of 37,885 ML increased by around 20% compared to 31,648 ML in 2007/08, most likely as a result of the dryer conditions.

Urban water users and licensed groundwater diverters across the basin were unrestricted in 2008/09. However, licensed surface water diverters on Valencia Creek and the Avon River were affected by the extremely dry conditions in the second half of the year and were subject to severe restrictions or bans during this period.

A range of drought contingency measures were again implemented in the Thomson basin to help secure supplies for systems located outside the basin. The qualification of rights transferring part of the environment's share of water in the Thomson River to Melbourne continued during the year to manage Melbourne's ongoing water shortage. Melbourne Water also put arrangements in place to enable it to access water from below the normal operating level of the reservoir.

Southern Rural Water again transferred 2,000 ML from its drought reserve stored in the Thomson Reservoir to the Werribee and Bacchus March irrigation districts to relieve the extreme supply shortages in those regions.

20.2 Responsibilities for management of water resources

Table 20-1 shows the responsibilities of various authorities within the Thomson basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 20-1 Responsibilities for water resources management within the Thomson basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Melbourne Water				Operates Thomson Reservoir, which supplies water to Melbourne and irrigators in the Macalister Irrigation District Releases water to the Thomson River for environmental flows Obliged to meet passing flow requirements
Southern Rural Water	Provides irrigation supplies to the Macalister Irrigation District	Manages groundwater and surface water licensed diversions	Delivers bulk water for towns supplied by Gippsland Water	Operation of Lake Glenmaggie Obligation to meet passing flow requirements
Gippsland Water			Supply towns including Sale, Maffra, Heyfield, Stratford and Boisdale	
Environment Minister				Manages environment entitlement in the regulated Thomson River
West Gippsland Catchment Management Authority				Manages waterways and environmental flows

20.3 Rainfall, flows and storages in 2008/09

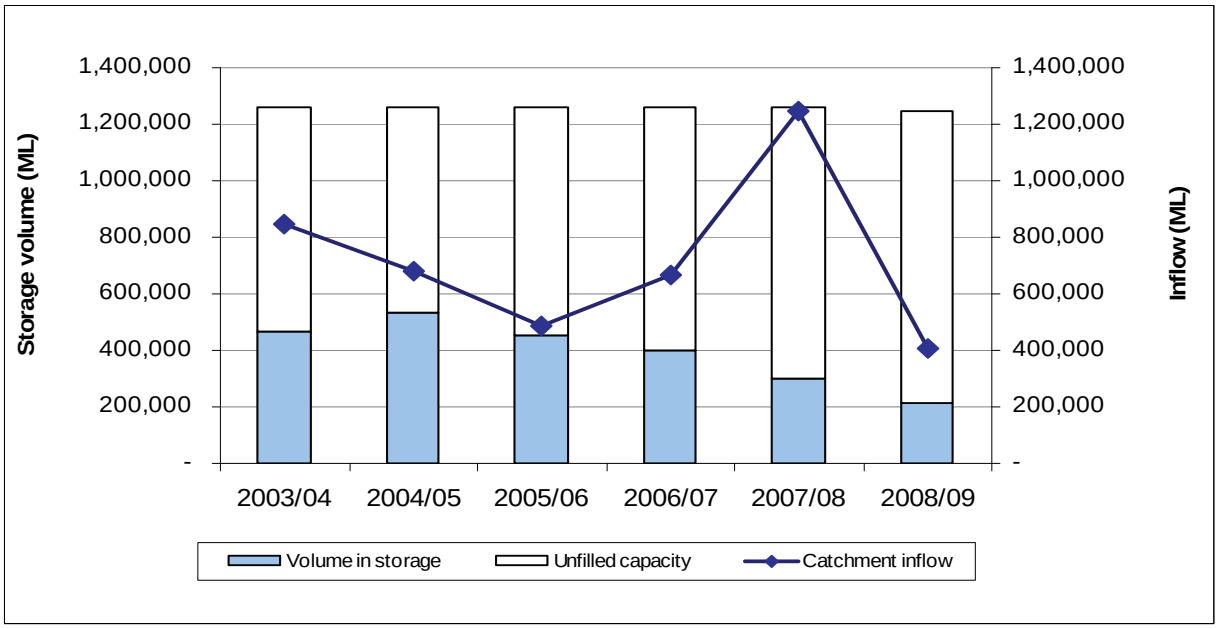
In 2008/09, rainfall in the Thomson basin ranged between 60% and 80% of the long term average. Inflows to the Thomson basin amounted to 408,300 ML in 2008/09, which is 37% of the long term average (of 1,101,760 ML[15]). This is nearly 20% below any of the annual inflows experienced in the past five years. For the six months ending 30 June 2009, inflows to Thomson Reservoir were the lowest on record.

The amount of water flowing from the Thomson basin into the Gippsland Lakes was also very low in 2008/09 at 164,100 ML. This represents 40% of catchment inflows. Outflows in 2008/09 were lower than the 326,600 ML of outflows in 2006/07.

The volume of water held in major storages (greater than 1,000 ML capacity) decreased from 299,400 ML in July 2008 to 211,470 ML by June 2009, or 17% of the total storage capacity of 1,245,600 ML.

In the Thomson basin, storages greater than 1,000 ML capacity include Thomson Reservoir and Lake Glenmaggie, both of which are on-stream storages. Lake Glenmaggie started the year at 55% full, filled by September, and was eventually drawn down to 22% by June 2009. Melbourne's biggest water storage, the Thomson Reservoir, began the year 19% full and was gradually drawn down to 16% in June 2009. It was last full in 1996.

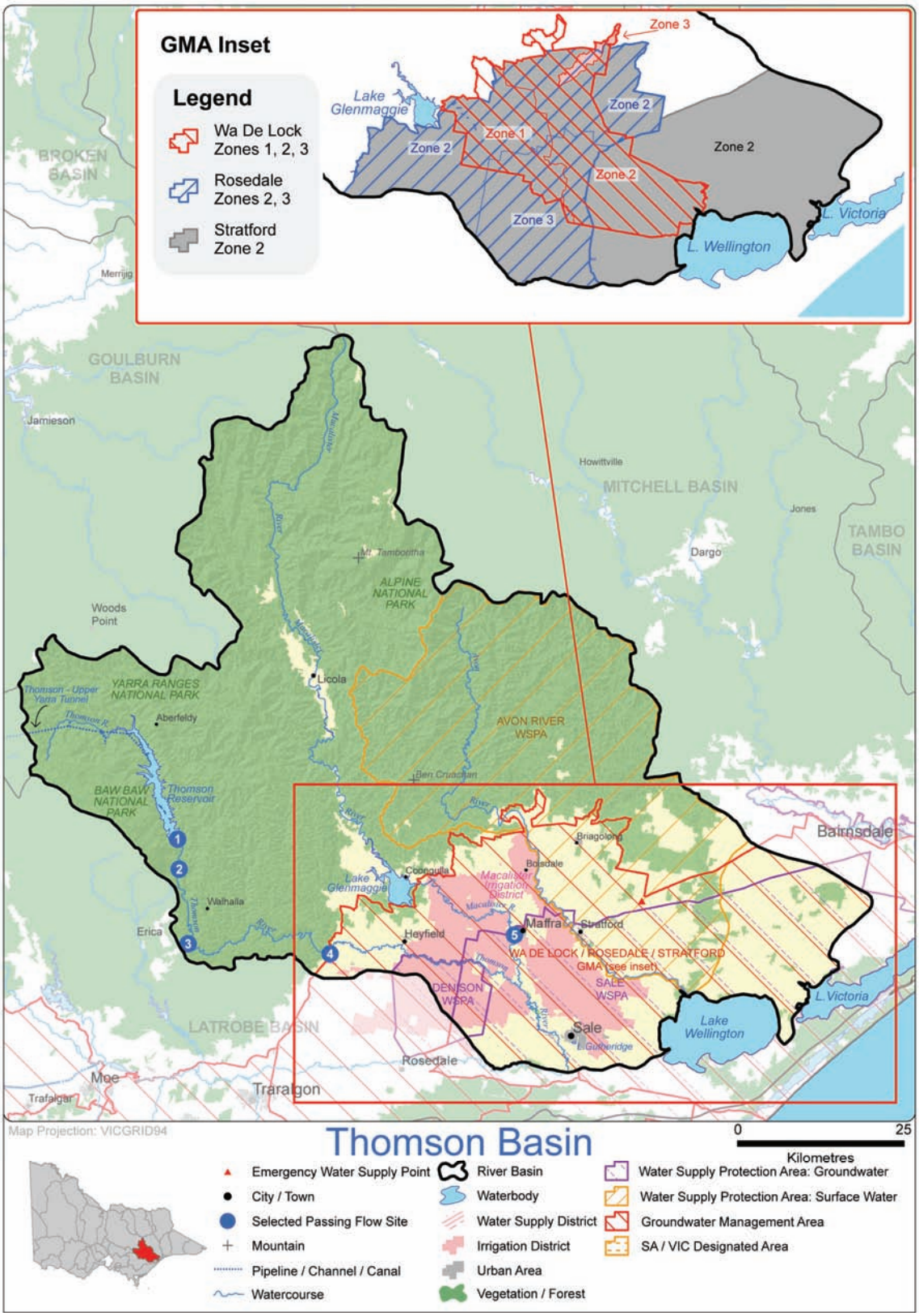
Figure 20-1 All major storages and catchment inflows in the Thomson basin



[15] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

20.4 Location of water resources

Figure 20-2 Map of the Thomson basin



20.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Thomson basin are shown in Table 20-2.

An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

Table 20-2 Summary of total water resources and water use in the Thomson basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	434,700	334,600
Groundwater[2]	75,000	40,000
Recycled water	360	320

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 20-9 and the estimated domestic and stock use presented in Table 20-10.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

20.5.1 Infrastructure projects to improve water availability

In order to improve system operational efficiency, automation of the main supply carrier and interface with the hydro power station was undertaken. All physical works were completed in 2008/09.

20.6 Surface water resources

20.6.1 Water balance

A surface water balance for the Thomson basin is shown in Table 20-3. Irrigation water use in the Macalister Irrigation District and transfers to the Yarra basin for urban use comprise the majority of diversions within the basin.

A total volume of 227,100 ML was diverted for irrigation purposes in 2008/09, which is similar to the volume used in 2007/08. Melbourne Water's diversion from the Thomson Reservoir decreased to 93,780 ML in 2008/09 compared to 124,500 ML in 2007/08.

Table 20-3 Balance of surface water in the Thomson basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	299,400	399,000
Volume in storage at end of year	211,500	299,400
Change in storage	**-87,900**	**-99,600**
Inflows		
Catchment inflow(1)	408,300	1,188,000
Transfers from other basins	0	0
Return flow from irrigation	26,400	25,100
Treated wastewater discharged back to river	40	40
Sub-total	**434,700**	**1,213,100**
Usage		
Diversions to towns in Thomson River basin	1,580	1,920
Transfers to Yarra River basin for urban use	93,780	124,500
Irrigation district diversions	227,100	225,600
Licensed diversions from unregulated streams	5,100	5,800
Transfers to other basins(2)	0	2,000
Small catchment dams(3)	7,000	7,000
Sub-total	**334,600**	**366,800**
Losses		
Net evaporation losses from major storages(4)	10,200	1,100
Evaporation from small catchment dams	2,500	2,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	11,200	14,700
Sub-total	**23,900**	**18,300**
Water passed at outlet of basin		
River outflows to the Latrobe River	130,200	727,000
River outflows direct to Lake Wellington	33,900	200,600

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Qualification of rights approved transfer of water to the Werribee and Bacchus Marsh irrigation districts under Southern Rural Water's Irrigation Districts Diversion bulk entitlement. The transfer of 2,000 ML is accounted for in Table 20-8 as part of the volume of water diverted under the Thomson/Macalister bulk entitlement.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Net evaporation losses from major storages calculated for 2008/09. Information was inadvertently excluded from the 2007/08 accounts.

(5) Losses estimated based on loss functions within the Thomson-Macalister REALM.

20.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 20-4 have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 20-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,600	2,800	n/a
Registered commercial and irrigation	5,000	4,200	n/a
Total	**10,600**	**7,000**	**9,500**

n/a: Information not available.

20.6.3 Water entitlement transfers

Surface water was moved into, out of and within the Thomson basin during 2008/09 through water share transfers and variations, allocation trade and temporary transfer of bundled entitlements. Water share and allocation transactions make up the bulk of this movement, with only 203 ML of Thomson basin bundled entitlements being transferred on a temporary basis during the year. This is the first year that water rights within the Thomson basin have been unbundled, resulting in water shares being disassociated with land and therefore no longer associated with any delivery system.

Table 20-5 summarises the movement of water shares into and out of the Thomson basin delivery systems during 2008/09. A net export of both high and low reliability water shares occurred, with 443 ML of high reliability and 221 ML of low reliability water shares leaving the basin in 2008/09.

Table 20-5 Transfers and variations of water shares in the Thomson basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Macalister Irrigation District	28375.4	28,331	44	13,441	13,385	56
Macalister River	373	575	-202	129	231	-103
Thomson River	3,151	3,436	-285	1,533	1,707	-174
Total	**31,899**	**32,342**	**-443**	**15,103**	**15,323**	**-221**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Thomson basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

Table 20-6 summarises the trade in water allocations into and out of the Thomson basin in 2008/09. The only trade in water allocations that occurred in this year was within the Thomson basin, therefore there was no net movement of water allocation in 2008/09.

Table 20-6 Allocation trade in the Thomson basin, 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Thomson basin	20,032
Trade from other Victorian basins	0
Trade to other Victorian basins	0
Interstate trade - inbound	0
Interstate trade - outbound	0
Total trade into the Thomson basin	**20,032**
Net trade into the Thomson basin	**0**

Notes:

(1) This table summarises allocation trades approved into, out of and within the Thomson basin trading zones (Zone 41 A Northern Macalister and Zone 42 B Mid Thomson) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

Table 20-7 summarises the movement of bundled entitlements in the Thomson basin during 2008/09. There was no net movement of water from the basin in 2008/09, with only temporary transfers occurring between users within the basin.

Table 20-7 Transfers of surface water bundled entitlements in the Thomson basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Thomson unregulated	0	0	0	203	203	0
Total 2008/09	**0**	**0**	**0**	**203**	**203**	**0**
Total 2007/08[1]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

20.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement in the basin is shown in Table 20-8.

Bulk entitlements held by the Melbourne retailers and Southern Rural Water in the basin are applied over a multi-year period, where the average usage over a defined rolling period (15 years for the Melbourne retailers and five years for Southern Rural Water) must be less than the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 20-8 Volume of water diverted under surface water entitlements in the Thomson basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[2][3]
Gippsland Water					
Thomson/Macalister towns	1	2,335	0	1,580	Yes
Melbourne metropolitan retailers					
Thomson River	15	171,800	0	93,780	Yes
Southern Rural Water					
Thomson/Macalister	5	274,800	0	227,113	Yes
Environment Minister					
Thomson River – Environment	1	10,000	0	4,587	Yes
Total annual volume of bulk entitlements 2008/09		**458,935**	**0**	**327,060**	
Total annual volume of bulk entitlements 2007/08		**458,935**	**0**	**356,642**	
Licensed diversions from unregulated streams 2008/09		*12,006*		*5,134*	
Licensed diversions from unregulated streams 2007/08		*13,816*		*5,784*	

Notes:
(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.
(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.
(3) Compliance for the entire Melbourne supply system is assessed against a long term (15 year) average volume limit of 555,000 ML. The corresponding long term average annual diversions for 2008/09 was 328,380 ML.

20.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management areas within the Thomson basin, excluding domestic and stock use, is presented in Table 20-9. The Thomson basin contains all of the Wa De Lock GMA as well as part of the Denison WSPA, Sale WSPA, Stratford GMA and Rosedale GMA.

The majority of the Stratford GMA and Rosedale GMA water use is for mine dewatering. While the groundwater levels in the Wa De Lock GMA and Denison WSPA are stable, levels in the Sale WSPA and GMAs are declining. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in the Thomson basin increased by around 20% in 2008/09 compared with 2007/08.

Table 20-9 Licensed groundwater volumes, Thomson basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[6]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Rosedale GMA (36%)	Zone 1 50-150, Zone 2 25-350, Zone 3 200-300	7,972	7,944	2,462	1,661	4,123	3,816
Stratford GMA (45%)	Zone 1 >150, Zone 2 >350	12,319	12,319	39	11,947	11,986	10,739
Wa De Lock GMA (100%)	≤25	30,172	28,458	9,512	5	9,517	7,195
Denison WSPA (53%)	≤25	9,396	9,396	4,432	8	4,440	3,256
Sale WSPA (70%)	25-200	14,829	14,724	7,802	17	7,819	6,644
Total[5]		**74,688**	**72,841**	**24,247**	**13,638**	**37,885**	**31,650**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed volume.

(5) Total volumes are based on the sum of management unit data prior to rounding.

(6) Non-metered use includes dairy wash and low consumption commercial use, as well as mine dewatering for Sale and Rosedale.

An estimate of domestic and stock groundwater use is provided in Table 20-10.

Table 20-10 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Rosedale GMA (36%)	56	112
Stratford GMA (45%)	23	46
Wa De Lock GMA (100%)	551	1,102
Denison WSPA (53%)	146	292
Sale WSPA (70%)	298	596
Total	**1,074**	**2,148**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 20-9.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

In the Thomson basin groundwater is used as an urban water supply for the townships of Sale, Briagolong and Boisdale. The licensed entitlements and metered use for these groundwater supplies are provided in Table 20-11.

Table 20-11 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Boisdale	37	0	0
Briagolong	160	119	90
Sale	3,500	1,981	1,846
Total	**3,697**	**2,100**	**1,936**

20.8 Drought contingency measures

A number of drought contingency measures were implemented in the Thomson basin in 2008/09. These included:

- restricting rural water use (discussed below)
- transferring water to augment supplies outside the basin
- preparing to access dead storage
- the continuation of two qualifications of rights and the making of one qualification of rights, as detailed in Table 20-12 below.

Southern Rural Water again transferred 2,000 ML from its drought reserve stored in the Thomson Reservoir to the Werribee and Bacchus March irrigation districts to relieve the extreme supply shortages in those regions. A qualification of rights was required to implement this measure.

Melbourne Water put arrangements in place to enable it to access water from below the normal operating level of the reservoir.

Table 20-12 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Declaration of Temporary Qualification of Rights in the Melbourne Water Supply System - March 2007	1 July 2008 to 30 June 2009 (continuing from 29 March 2007)	Differential access by priority entitlements	Provides more water for Melbourne by altering the operational tolerances specified in the environment's Thomson bulk entitlement to provide more flexibility for Melbourne Water to manage releases from Thomson Reservoir to meet environmental flow obligations
Temporary Qualification of Rights in the Melbourne Water Supply System - Thomson December 2007	1 July 2008 to 30 June 2009 (continuing from 20 December 2007)	Differential access by priority entitlements Reduced passing flow requirements	Allow Melbourne to use eight of the environment's 10GL of inflows to Thomson Reservoir. The remaining 2GL is also set aside each year for use by Melbourne, if needed, or else was available for use by the environment, if needed
Declaration of Temporary Qualification of Rights in the Thomson Water System 2008	26 October 2008 to 30 June 2009	Differential access by priority entitlements	Allows the transfer of 2,000 ML from Southern Rural Water's drought reserve to irrigators in Werribee and Bacchus Marsh

20.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 20-13.

Urban water users and licensed groundwater diverters across the basin were unrestricted in 2008/09. However, licensed surface water diverters on Valencia Creek and the Avon River were affected by the extremely dry conditions in the second half of the year and were subject to severe restrictions or bans during this period.

Irrigation allocations reached 100% of high reliability water shares and 10% of low-reliability water shares.

Table 20-13 Seasonal allocations and restrictions on water use in Thomson basin, 2008/09

Type of restriction	Area	Nature of restriction
Licensed diversions on unregulated streams	Valencia Creek	Stage 1 from July 2008 to March 2009, an irrigation ban from March to April 2009, returning to Stage 1 from May to June 2009.
	Avon River	Section 1: Irrigation ban from November to December 2008, Stage 4 from January 2009, returning to an irrigation ban for April 2009, and Stage 4 May to June 2009 Sections 2 and 3: Irrigation ban from November to December 2008, Stage 3 from January to March 2009, returning to an irrigation ban for April 2009, and Stage 1 May to June 2009
Irrigation	Macalister Irrigation District	Opening allocation of 55% of high reliability water shares from July 2008. Increased to 100% of high reliability water share and 10% low reliability water share by April 2009

20.10 Recycled water

Gippsland Water operates four wastewater treatment plants in the Thomson basin. Recycled water is mainly used to irrigate pasture and for watering facilities such as the Maffra Recreational Reserve. The volume of wastewater produced during 2008/09 reduced by about 27% compared with 2007/08. A total of 89% of wastewater was recycled in the basin in 2008/09 (Table 20-14).

Table 20-14 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Heyfield	94	94	100%	0	94	0	0	0	0
Maffra	136	136	100%	3	133	0	0	0	0
Rawson	40	0	0%	0	0	0	0	40	0
Stratford	88	88	100%	0	88	0	0	0	0
Total 2008/09	**358**	**318**	**89%**	**3**	**315**	**0**	**0**	**40**	**0**
Total 2007/08	496	454	91%	7	447	0	0	42	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

20.11 Water for the environment

20.11.1 Environmental Water Reserve (EWR)

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Thomson basin. The lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from basins including the Thomson to ecologically function.

In 2008/09 the Thomson basin EWR comprised the following components:

- the Bulk Entitlement (Thomson River – Environment) Order 2005
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Melbourne Water and Southern Rural Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated under entitlements.

20.11.2 Entitlements for the environment

A 10,000 ML bulk entitlement for the environment on the Thomson River was provided from water-saving initiatives implemented through the *Our Water Our Future* action plan. This bulk entitlement order was gazetted in August 2005, with the Environment Minister receiving: an entitlement for a 10,000 ML share of storage capacity in Thomson Reservoir; carry-over in-storage space in the reservoir not being used by other entitlement holders; and passing flows between Thomson Reservoir and Cowwarr Weir on the Thomson River, which were previously specified as an obligation in Melbourne Water's bulk entitlement.

However, due to the ongoing drought this entitlement was qualified in December 2007, holding 10 GL/year in storage to secure Melbourne's drinking water supplies, although 2,000 ML for each year of the qulaification is held in reserve to mitigate the risks to the environment during the qualification. This qualification continued during the 2008/09 year.

20.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Table 20-15 shows passing flow compliance in the Thomson basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 20-2.

In March 2007 passing flows under the Thomson River environmental bulk entitlement were temporarily qualified, enabling savings of up to 4,000 ML per year for the Melbourne system. This qualification was in place for all of 2008/09.

Melbourne Water (as storage operator) reported that all passing flow requirements were met in 2008/09.

Table 20-15 Selected passing flow compliance in the Thomson basin

River	Passing flow	
Thomson River	Instrument where passing flows are specified	Bulk Entitlement (Thomson River – Environment) Order 2005
	Responsible authority	Environment Minister(1)
	Compliance point	Thomson Reservoir (shown as 1 in Figure 20-2)
	Passing flow compliance	Flows were passed according to the following rules: • From November to February, 75 ML/day • From March to October, 25 ML/day
	Compliance point	The Narrows Gauging Station (shown as 2 in Figure 20-2)
	Passing flow compliance	From November to February 120 ML/day were passed, while 80 ML/day were passed from March to October
	Compliance point	Coopers Creek Gauging Station (shown as 3 in Figure 20-2)
	Passing flow compliance	The following rules applied: • In July, 216 ML/day • In August, 238 ML/day • In September, 245 ML/day • In October, 225 ML/day • In November, 205 ML/day • From December to January, 200 ML/day • In February, 180 ML/day • From March to April, 155 ML/day • From May to June, 150 ML/day
	Instrument where passing flows are specified	Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001
	Responsible authority	Southern Rural Water
	Compliance point	Thomson River between Cowwarr Weir and Wandocka (shown as 4 in Figure 20-2)
	Passing flow compliance	• Lesser of 125 ML/day or natural flow was passed • Where natural flow was less than 50 ML/day, 50 ML/day was passed
Macalister River	Instrument where passing flows are specified	Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001
	Responsible authority	Southern Rural Water
	Compliance point	Macalister River below Maffra Weir (shown as 5 in Figure 20-2)

	Passing flow compliance	Passing flows were qualified between July and August 2007, with Southern Rural Water meeting the qualified requirements:
		• 60 ML/day, was passed, but this was reduced to 30 ML/day when the following conditions occurred:
		  • Between June and October, if inflow to Lake Glenmaggie was less than the 80th percentile
		  • In November, if storage volume was less than 13,000 ML
		• Once dropped to 30 ML/day, passing flows had to stay as this until the end of May
		• Passing flows could be increased back up to 60 ML/day:
		  • If between June to October, inflow for the previous month is greater than the 80th percentile
		  • If between August to January, storage volume is greater than 185,000 ML
		  • If inflow to Lake Glenmaggie is less than the calculated passing flows, then passing flow may be reduced to this value

Notes:

(1) While the Environment Minister holds the environmental bulk entitlement, Melbourne Water manages the releases of the passing flows immediately downstream of the Thomson Reservoir and reports on compliance with these requirements.

20.11.4 Streamflow management plans (SFMPs)

The Avon River was declared a WSPA in 2006/07, which is the first step towards developing a SFMP. Work continued on the Avon River SFMP in 2008/09.

21 Latrobe basin

This chapter sets out the accounts for the Latrobe basin. For detailed information about how they have been compiled, refer to Chapter 5.

21.1 Latrobe basin summary

Total inflows to the Latrobe basin were 49% of the long term average in 2008/09 and nearly 27% less than those recorded in 2007/08. By the end of the year storages were at 67% of capacity, which is slightly lower than where they began.

Although inflows were low, surface water use across the basin increased slightly in 2008/09 compared to 2007/08 as supplies were adequate to meet the needs of major industry and Gippsland Water without restriction. These users account for the majority of surface water diversions in the basin.

The total volume of water taken by licensed diverters reduced slightly, while licensed groundwater use increased marginally.

The February 2009 bushfires swept across parts of the Latrobe basin, directly impacting water supplies for a number of its towns. Water supplies were temporarily cut to Boolarra due to the substantial demand for water from the Boolarra Water Treatment Plant, while three of Gippsland Water's major assets were directly threatened by the fires. Gippsland Water also installed temporary emergency water standpipes in Boolarra, Traralgon South and Jeeralang Junction for five months to ensure the community had access to safe drinking water.

21.2 Responsibilities for management of water resources

Table 21-1 shows the responsibilities of various authorities within the Latrobe basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 21-1 Responsibilities for water resources management within the Latrobe basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages the Macalister Irrigation District (which is supplied from the Thomson basin)	Manages groundwater and surface water licensed diversions		Operates part of the Latrobe water supply system including Blue Rock Lake and Lake Narracan for supply to Gippsland Water, power stations and licensed diverters Obliged to meet passing flow requirements
Gippsland Water			Supplies towns including Moe, Morwell and Traralgon. Provides industrial supply to Hazelwood and Energy Brix power stations(1), and other major industries	Operates Moondarra Reservoir Obliged to meet passing flow requirements
West Gippsland Catchment Management Authority				Manages waterways in the whole of the Latrobe basin

Note:

(1) Three power stations – Loy Yang A, Loy Yang B and Yallourn – are responsible for their own water supply from the Latrobe system (Blue Rock Lake and Lake Narracan).

21.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Latrobe basin ranged between 60% and 100% of the long term average. Inflows were 49% of the long term average (of 847,400 ML[16]), which is 19% lower than the 68% recorded in 2007/08.

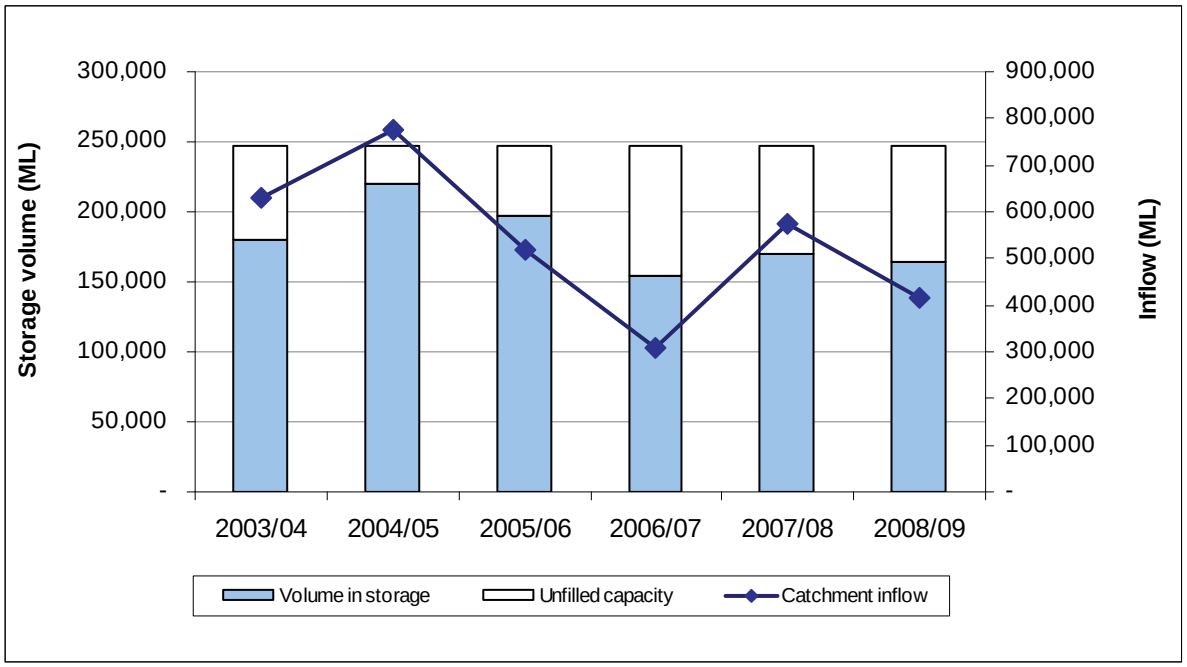
The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River) decreased to 284,200 ML in 2008/09, about two-thirds of the 426,700 ML recorded in 2007/08.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin decreased from 169,300 ML in July 2008 to 164,400 ML by June 2009, or 67% of the total storage capacity of 246,500 ML.

[16] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Only volumes for major on-stream storages have been included in the water balance. In the Latrobe basin this include Blue Rock Lake, Lake Narracan and Moondarra Reservoir. The largest storage in the basin is Blue Rock Lake, which has a capacity of approximately 208,000 ML. The volume of water held in Blue Rock Lake started and ended the year at about 145,000 ML, which was 88% of the basin's total storage in June 2009.

Figure 21-1 All major storages and catchment inflows in the Latrobe basin



21.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Latrobe basin are shown in Table 21-2.

Table 21-2 Summary of total water resources and water use in the Latrobe basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	462,500	166,800
Groundwater[2]	42,300	26,500
Recycled water	18,340	590

Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 21-7 and the estimated domestic and stock use as presented in Table 21-8.

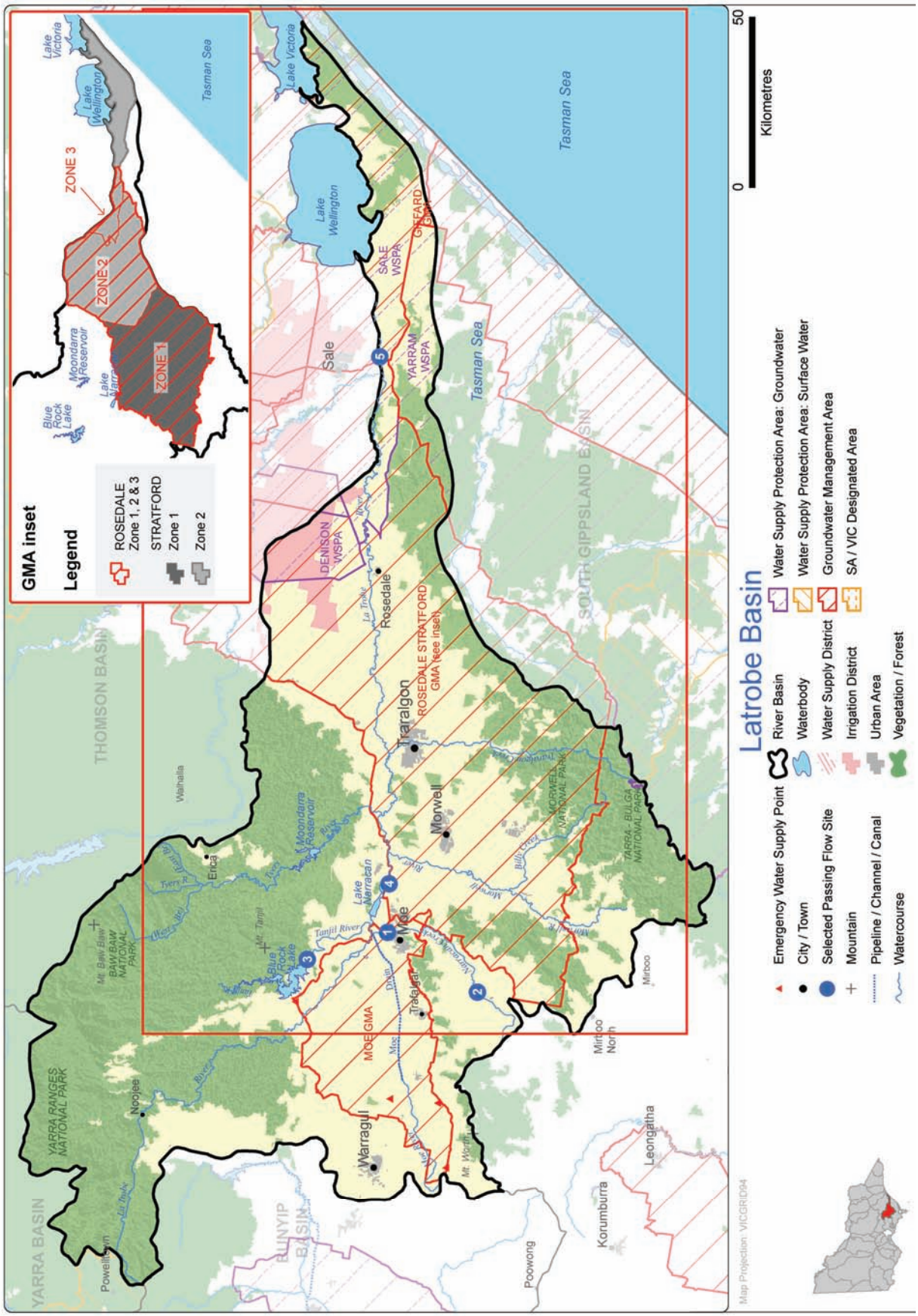
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

21.4.1 Infrastructure projects to improve water availability

Gippsland Water undertook planning and design work on a pipeline to connect Boolara to the main Latrobe Valley water supply grid. This pipeline will improve the water security of Boolara. Work on the Rokeby raw water pump station also continued in 2008/09. This pump station will allow Warragul and Drouin to be supplemented from the Tarago - Westernport Pipeline.

21.5 Location of water resources

Figure 21-2 Map of the Latrobe basin



21.6 Surface water resources

21.6.1 Water balance

The major industrial water users in the basin include a number of electricity generators and Australian Paper. In 2008/09, these entities accounted for more than half of the surface water diversions in the Latrobe basin, drawing 109,300 ML from river diversions and groundwater and returning approximately 43,300 ML to the Latrobe River system.

Table 21-3 Balance of surface water in the Latrobe basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	169,300	153,800
Volume in storage at end of year	164,400	169,300
Change in storage	-4,900	**15,500**
Inflows		
Catchment inflow(1)	416,200	575,200
Transfers from other basins	0	0
Return flow from power stations and major industry	43,300	40,500
Return flow from irrigation	0	0
Treated wastewater discharged back to river	2,960	3,060
Sub-total	**462,500**	**618,800**
Usage		
Urban and industrial diversions	130,740	124,490
Licensed diversions from regulated streams	7,030	8,650
Licensed diversions from unregulated streams	8,500	8,400
Small catchment dams	20,500	20,500
Sub-total	**166,800**	**162,000**
Losses		
Net evaporation losses from major storages	10,700	8,900
Evaporation from small catchment dams(2)	5,700	5,700
In-stream infiltration to groundwater, flows to floodplain and evaporation	0	0
Sub-total	**16,400**	**14,600**
Water passed at outlet of basin		
River outflows to the Gippsland Lakes (excluding Thomson River)	284,200	426,700
River outflows to the Gippsland Lakes (including Thomson River)	414,400	1,153,700

Notes:
(1) Inflows have been back-calculated from outflows plus diversions. Excludes Thomson River outflows.
(2) Evaporation losses are calculated by subtracting estimated usage from water harvested.

21.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 21-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 21-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	13,000	6,500	n/a
Registered commercial and irrigation	16,700	14,000	n/a
Total	**29,700**	**20,500**	**26,200**

n/a: Information not available.

21.6.3 Water entitlement transfers

Surface water movement in the Latrobe basin was limited to transfers of bundled entitlement within the basin. In 2008/09, some 3 ML of bundled entitlement in the Latrobe basin was transferred on a permanent basis, and 537 ML on a temporary basis.

Table 21-5 summarises the movement of bundled entitlements in the Latrobe basin during 2008/09.

Table 21-5 Transfers of surface water bundled entitlements in the Latrobe basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Latrobe unregulated	3	3	0	537	537	0
Total 2008/09	**3**	**3**	**0**	**537**	**537**	**0**
Total 2007/08[(1)]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:

(1) No data available for 2007/08.

21.6.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 21-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 21-6 Volume of water diverted under surface water entitlements in the Latrobe basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[2][3]
Gippsland Water					
Boolarra	1	145	11	75	Yes
CGRWA – Blue Rock	3	15,150	0	11,091	Yes
Erica	1	340	0	92	Yes
Mirboo North	1	270	0	206	Yes
Moe – Narracan Creek	1	3,884	0	1,567	Yes
Moondarra Reservoir	2	62,000	0	50,192	Yes
Noojee[4]	1	73	0	0	Yes
Thorpdale	1	80	5	19	Yes
Southern Rural Water					
Yallourn Energy Ltd for Southern Rural Water (Loy Yang B power station)	1	20,000	0	15,483	Yes
Latrobe licensed diverters	2	13,400	0	7,026	Yes
Great Energy Alliance Corporation Pty Ltd					
Yallourn Energy Ltd for Loy Yang Power Ltd	1	40,000	0	19,982	Yes
TRUenergy					
Yallourn Energy Ltd	1	36,500	0	32,030	Yes
Environment Minister (on behalf of the Treasurer)					
Yallourn Energy Ltd for SECV	1	25,000	0	0	
Total annual volume of bulk entitlements 2008/09		**216,842**	**16**	**137,763**	
Total annual volume of bulk entitlements 2007/08		**216,842**	**36**	**133,143**	
Licensed diversions from unregulated streams 2008/09[5]		*16,738*		*8,488*	
Licensed diversions from unregulated streams 2007/08		*18,073*		*8,446*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(3) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(4) Gippsland Water is not using the Noojee bulk entitlement because Noojee is supplied via the Neerim South system (i.e. Tarago).

(5) Reduction in licensed volumes due to improved information available during 2008/09.

21.7 Groundwater resources

The Latrobe basin contains the entire Moe GMA as well as part of the Sale WSPA, Yarram WSPA, Denison WSPA, Stratford GMA and Rosedale GMA. A summary of the licensed entitlements and use from groundwater management units within the Latrobe basin, excluding domestic and stock use, is presented in Table 21-7. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A. While groundwater levels in the Denison WSPA are stable, levels in the other WSPA and GMAs are declining, with off-shore oil and gas extractions impacting on the Yarram WSPA water levels. Licensed water used from the Stratford and Rosedal GMAs are generally related to mine dewatering.

The reported groundwater use in the Latrobe basin has increased from 2008/09 due to higher extraction volumes from all WSPA/GMAs except the Moe GMA.

Table 21-7 Licensed groundwater volumes, Latrobe basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[6]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Moe GMA (100%)	>25	8,200	3,772	1,076	5	1,081	1,414
Rosedale GMA (58%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	13,003	12,956	4,016	2,709	6,725	6,223
Stratford GMA (41%)	Zone 1 >150 Zone 2 >350	11,275	11,275	36	10,934	10,970	9,829
Denison WSPA (47%)	≤25	8,347	8,347	3,937	7	3,944	2,892
Sale WSPA (17%)	25-200	3,515	3,490	1,849	4	1,853	1,575
Yarram WSPA (5%)	Zone 1 >200 Zone 2 all depths	1,360	1,360	746	1	747	647
Total[5]		**45,700**	**41,200**	**11,660**	**13,660**	**25,320**	**22,580**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed volume.

(5) Total volumes are based on the sum of management unit data prior to rounding.

(6) Non-metered use includes dairy wash and low consumption commercial use, as well as mine dewatering in the case of Rosedale and Stratford.

An estimate of domestic and stock groundwater use is provided in Table 21-8.

Groundwater is currently not used to supplement town supplies in the Latrobe basin.

Table 21-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Moe GMA (100%)	243	486
Rosedale GMA (58%)	91	183
Stratford GMA (41%)	21	42
Denison WSPA (47%)	129	259
Sale WSPA (17%)	71	141
Yarram WSPA (5%)	19	38
Total	**574**	**1,149**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 21-7.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

21.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Latrobe basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- water carting and provision of emergency standpipes in response to bushfires
- purchasing water from the market to supplement urban supplies
- drilling drought relief groundwater bores.

The February 2009 bushfires swept across parts of the Latrobe basin, directly impacting water supplies for a number of its towns. Water supplies were temporarily cut to Boolarra due to the substantial demand for water from the Boolarra water treatment plant, while three of Gippsland Water's major assets were directly threatened by the fires. Gippsland Water carted water from Churchill while supplies were cut to Boolarra. It also installed temporary emergency water standpipes in Boolarra, Traralgon South and Jeeralang Junction for five months to ensure the community had access to safe drinking water.

Gippsland Water augmented Thorpdale's supplies by purchasing entitlement on the market and drilling drought relief groundwater bores. It also purchased water to supplement Boolarra's supplies.

21.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to licensed diversions on unregulated streams are shown in Table 21-9. Supplies were adequate to meet the needs of major industry and Gippsland Water's towns without restriction.

Table 21-9 Seasonal allocations and restrictions on water use in Latrobe basin, 2008/09

Type of restriction	Area	Nature of restriction
Licensed diversions from unregulated streams	Morwell River	Irrigation ban for March 2009, and Stage 3 restriction for April 2009
	Moe River	Irrigation ban for April 2009
	Ten Mile Creek	Irrigation ban from January to April 2009
Irrigation and regulated diversions	Macalister Irrigation District(1)	Opening allocation of 55% of high reliability water shares from July 2008. Increased to 100% of high reliability water shares and 10% of low reliability water shares by April 2009

Note:
(1) The Macalister Irrigation District is supplied from the Thomson basin.

21.10 Recycled water

Gippsland Water treated over 18,000 ML of wastewater in the Latrobe basin. The majority (over 80%) was highly saline and unsuitable for recycling, and was discharged into Bass Strait. The volume of water recycled in 2008/09 was similar to that for 2007/08 and represents around 3% of the wastewater produced.

Table 21-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Mirboo North	61	61	100%	31	30	0	0	0	0
Moe	1,629	0	0%	0	0	0	0	1,629	0
Morwell	522	522	100%	0	0	522	0	0	0
Dutson Downs (regional outfall sewer)	6,829	0	0%	0	0	0	0	0	6,829
Saline wastewater outfall pipeline	7,960	0	0%	0	0	0	0	0	7,960
Warragul	1,332	0	0%	0	0	0	0	1,332	0
Willow Grove	9	9	100%	0	9	0	0	0	0
Total 2008/09	**18,342**	**592**	**3%**	**31**	**39**	**522**	**0**	**2,961**	**14,789**
Total 2007/08	22,279	710	3%	29	49	632	0	3,058	18,510

Notes:
(1) Volume used to deliver specific environmental flow benefits.
(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.
(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

21.11 Water for the environment

21.11.1 Environmental Water Reserve (EWR)

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Latrobe basin. The lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from basins, including the Latrobe basin, to ecologically function.

In 2008/09 the Latrobe basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Southern Rural Water and Gippsland Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

21.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Gippsland Water reported it met all passing flow requirements under its bulk entitlements in the Latrobe basin in 2008/09.

Table 21-11 shows passing flow compliance in the Latrobe basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Table 21-2.

Table 21-11 Selected passing flow compliance in the Latrobe basin

River	Passing flow	
Narracan Creek	Instrument where passing flows are specified	Bulk Entitlement (Moe – Narracan Creek) Conversion Order 1998
	Responsible authority	Gippsland Water
	Compliance point	Narracan Creek, Moe diversion weir (shown as 1 in Table 21-2)
	Passing flow compliance	• The lesser of 11 ML/day or natural flow was passed • The authority passed 11 ML/day when flow was between 11 and 27 ML/day • The authority passed the entire flow, minus 16 ML/day, when flow was greater than 27 ML/day
Easterbrook Creek	Instrument where passing flows are specified	Bulk Entitlement (Thorpdale) Conversion Order 1997
	Responsible authority	Gippsland Water
	Compliance point	Thorpdale pumping station (shown as 2 in Table 21-2)
	Passing flow compliance	• The lesser of 1 ML/day or natural flow was passed • The authority passed 1 ML/day when flow was between 1 and 2.73 ML/day • The authority passed the entire flow, minus 1.73 ML/day, when flow was greater than 2.73 ML/day
Latrobe River and Tanjil River	Instrument where passing flows are specified	Bulk Entitlement (Latrobe – Southern Rural) Conversion Order 1996
	Responsible authority	Southern Rural Water
	Compliance point	Blue Rock Lake (to maintain flow at Tanjil South) (shown as 3 in Table 21-2)
	Passing flow compliance	• 90 ML/day was passed from January to April • 100 ML/day was passed from May to July • 150 ML/day was passed from August to November • 100 ML/day was passed during December
	Compliance point	Yallourn Weir (shown as 4 in Table 21-2)
	Passing flow compliance	• The lesser of a minimum average weekly of 350 ML/day, with a daily minimum of 300 ML/day, or modified natural flow, was passed
	Compliance point	Swing Bridge gauging station (Sale) (shown as 5 in Table 21-2)
	Passing flow compliance	• The lesser of a minimum average weekly of 750 ML/day, with a daily minimum of 700 ML/day, or modified natural flow, was passed

21.11.3 Streamflow management plans (SFMPs)

Work continued on the development of the upper Latrobe River SFMP in 2008/09.

22 South Gippsland basin

This chapter sets out the accounts for the South Gippsland basin. For detailed information about how they have been compiled, refer to Chapter 5.

22.1 South Gippsland basin summary

Inflows in the South Gippsland basin in 2008/09 were about half the long term average. Although low, levels in the basin's major storages continued to recover from the extremely low levels experienced in 2006/07. By the end of the year, the total volume held in store had increased from 3,300 ML to 4,500 ML, or 55% of capacity.

Increased water availability enabled urban water corporations to provide unrestricted supplies to most of their customers. Only towns supplied from the Tarra River were subject to restrictions during the year. Despite this, urban surface water use declined in 2008/09 compared to 2007/08.

In contrast, the total volume of licensed diversions increased by 40% in 2008/09 compared with 2007/08 despite diverters on a number of the basin's rivers being banned for much of the second half of the year. Licensed groundwater diversions also increased, but only marginally.

Extremely low streamflows in 2006/07 demonstrated that South Gippsland's towns are vulnerable to severe water shortages. Although water availability generally improved, a number of systems continued to rely on qualifications for at least part of the year. The qualifications allowed water corporations to supplement their supplies by extending pumping times or reducing environmental flow requirements.

22.2 Responsibilities for management of water resources

Table 22-1 shows the responsibilities of various authorities within the South Gippsland basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 22-1 Responsibilities for water resources management within the South Gippsland basin, 2007/08

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
South Gippsland Water			Supplies towns including Leongatha, Inverloch, Wonthaggi Korumburra and Foster	Obliged to meet passing flow requirements
Westernport Water			Supplies towns including San Remo and Phillip Island	
Gippsland Water			Supplies towns in the far east of the basin including Seaspray	Obliged to meet passing flow requirements
West Gippsland Catchment Management Authority				Manages waterways in most of the South Gippsland basin
Melbourne Water				Manages waterways in the far west of the South Gippsland basin

22.3 Rainfall, flow and storages in 2008/09

In 2008/09, rainfall across the South Gippsland basin ranged between 60% and 100% of the long term average. Inflows were 454,000 ML, or 50% of the long term average (of 911,500 ML[17]). This is less than the 2007/08 inflows of 538,300 ML or 59% of the long term average.

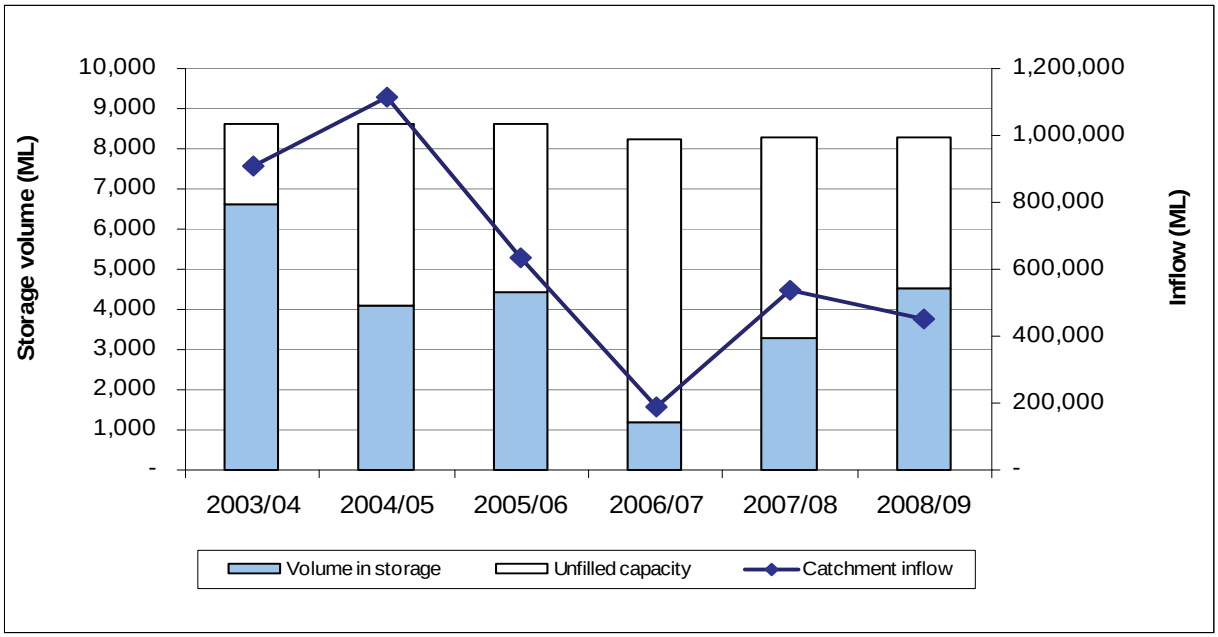
The amount of water flowing from the South Gippsland basin into Westernport and Bass Strait was 409,100 ML in 2008/09. This represents 90% of the total inflows into the basin.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 3,300 ML in July 2008 to 4,500 ML by June 2009, or 54% of the total storage capacity of 8,300 ML.

[17] This figure was revised during 2008/09. See Table 1-1, Note 6 in Part 1 of this report.

Only volumes for major on-stream storages have been included in the water balance. In the South Gippsland basin this includes Lance, Western, Candowie and Hyland reservoirs.

Figure 22-1 All major storages and catchment inflows in the South Gippsland basin



22.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the South Gippsland basin are shown in Table 22-2. Notwithstanding water shortages experienced over recent years, consumptive use in the South Gippsland basin is low compared to the available resource in the basin.

Table 22-2 Summary of total water resources and water use in the South Gippsland basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	456,200	39,600
Groundwater[2]	41,200	23,200
Recycled water	4,470	320

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 22-7 and the estimated domestic and stock use as presented in Table 22-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

22.4.1 Infrastructure projects to improve water availability

A number of infrastructure projects were undertaken in the South Gippsland basin during 2008/09 to improve water availability.

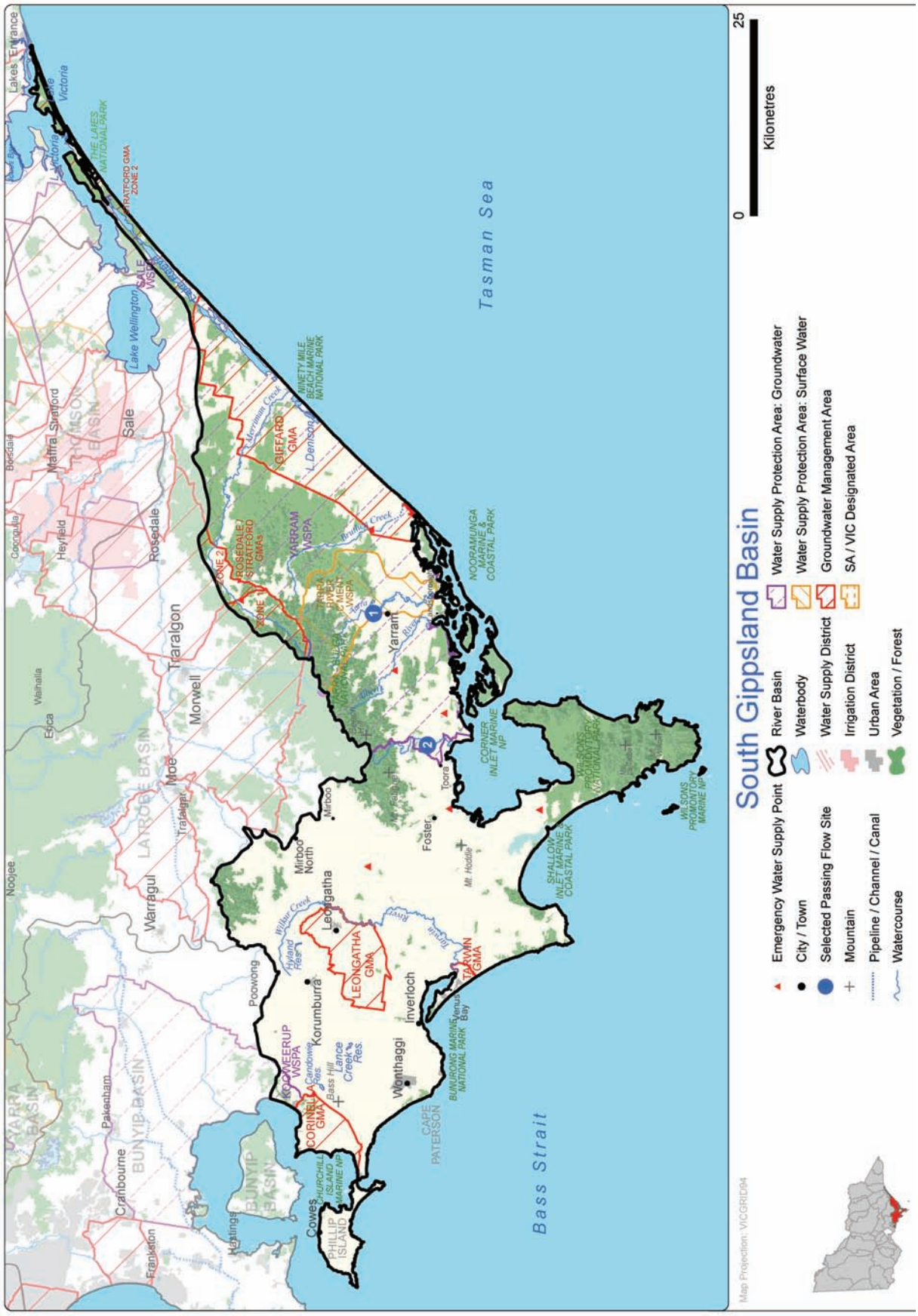
Westernport Water is constructing three bores in the Corinella aquifer. In 2008/09, two bores were developed and field testing undertaken.

South Gippsland Water constructed a bore on Racecourse Road to supplement supplies to Leongatha.

Gippsland Water commenced planning and design of an off-stream storage basin near Seaspray water treatment plant. This basin will improve the security of supply for Seaspray.

22.5 Location of water resources

Figure 22-2 Map of the South Gippsland basin



22.6 Surface water resources

22.6.1 Water balance

A surface water balance for the South Gippsland basin is shown Table 22-3.

Diversions make up a relatively small proportion of total inflows, with around 9% of basin inflows diverted for consumptive use in 2008/09. Most inflows leave the basin and flow into Bass Strait or Westernport.

Table 22-3 Balance of surface water in the South Gippsland basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	3,300	1,200
Volume in storage at end of year	4,500	3,300
Change in storage	**1,200**	**2,100**
Inflows		
Catchment inflow(1)	454,000	538,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	2,200	3,290
Sub-total	**456,200**	**541,600**
Usage		
Urban diversions	7,180	8,510
Licensed diversions from unregulated streams	8,100	5,800
Small catchment dams	24,300	24,300
Sub-total	**39,600**	**38,600**
Losses		
Net evaporation losses from major storages	1,200	1,100
Evaporation from small catchment dams(2)	5,100	5,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**6,300**	**6,200**
Water passed at outlet of basin		
River outflows to Bass Strait and Westernport	409,100	494,700

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from water harvested.

(3) Assumed to be zero because data is not readily available.

22.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 22-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 22-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	23,000	11,500	n/a
Registered commercial and irrigation	15,200	12,800	n/a
Total	**38,200**	**24,300**	**29,400**

n/a: Information not available.

22.6.3 Water entitlement transfers

Surface water movement in the South Gippsland basin in 2008/09 was limited to transfers of bundled entitlement within the basin. The only entitlement transfers that took place were the trade of 2 ML of temporary entitlements, with no net movement of water into, or out of, the basin in 2008/09.

Table 22-5 summarises the movement of bundled entitlements in the South Gippsland basin during 2008/09.

Table 22-5 Transfers of surface water bundled entitlements in the South Gippsland basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
South Gippsland unregulated	0	0	0	2	2	0
Total 2008/09	**0**	**0**	**0**	**2**	**2**	**0**
Total 2007/08[1]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

22.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 22-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Table 22-6 Volume of water diverted under surface water entitlements in the South Gippsland basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
Gippsland Water					
Seaspray	1	61	0	35	Yes
South Gippsland Water					
Devon North, Alberton, Yarram and Port Albert	1	853	0	456	Yes
Dumbalk	1	100	0	22	Yes
Fish Creek	1	251	0	141	Yes
Foster	1	326	0	178	Yes
Korumburra	1	1,000	0	627	Yes
Leongatha	1	2,476	0	1,304	Yes
Loch, Poowong and Nyora	1	420	0	261	Yes
Meeniyan[1]	1	1,800	0	444	Yes
Toora, Port Franklin, Welshpool and Port Welshpool	1	1,617	0	558	Yes
Wonthaggi – Inverloch[2]	1	3,800	0	1,131	Yes
Westernport Water					
Westernport	1	2,911	0	1,741	Yes
Bass River[3]	n/a	n/a	0	284	n/a
Total annual volume of bulk entitlements 2008/09		**15,615**	**0**	**7,182**	
Total annual volume of bulk entitlements 2007/08		**15,615**	**0**	**8,509**	
Licensed diversions from unregulated streams 2008/09		*13,290*		*8,099*	
Licensed diversions from unregulated streams 2007/08		*13,243*		*5,777*	

Notes:
(1) Entitlement was qualified to 1,800 ML in 2008/09.
(2) Volume diverted includes water taken from the Powlett River under a qualification of rights.
(3) Bass River bulk entitlement came into effect in August 2009.

22.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the South Gippsland basin, excluding domestic and stock use, is presented in Table 22-7.

The South Gippsland basin contains all of the Corinella GMA, Giffard GMA, Leongatha GMA and Tarwin GMA and most of the Yarram WSPA, as well as part of the Sale WSPA, Rosedale GMA and Stratford GMA. Groundwater entitlements and use for unincorporated areas have not been included in the 2008/09 water accounts.

Groundwater use in 2008/09 increased by some 12% compared with 2007/08.

Westernport Water undertook a pump test of two bores in the Corinella borefield in 2008/09 for potential additional urban water supply.

Table 22-7 Licensed groundwater volumes, South Gippsland basin 2008/09

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(ML)(6)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Corinella GMA (100%)	All depths	2,250	146	43	2	45	79
Giffard GMA (100%)	50-200	5,670	5,670	3,657	5	3,662	3,205
Leongatha GMA (100%)	All depths	6,500	4180	342	2	344	600
Rosedale GMA (6%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	1,337	1,333	413	279	692	640
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	2,001	2,001	6	1,940	1,947	1,744
Tarwin GMA (100%)	≤25	1,300	37	6	-	6	2
Sale WSPA (6%)	25-200	1,171	1,163	616	1	618	525
Yarram WSPA (95%)	Zone 1 >200 Zone 2 All depths	23,957	23,957	13,145	19	13,164	11,400
Total(5)		**44,186**	**38,487**	**18,228**	**2,248**	**20,478**	**18,195**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Total volumes are based on the sum of management unit data prior to rounding.

(6) Non-metered use includes dairy wash and low consumption commercial use, as well as Stratford mine dewatering.

An estimate of domestic and stock groundwater use is provided in Table 22-8.

Table 22-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)
Corinella GMA (100%)	118	236
Giffard GMA (100%)	52	104
Leongatha GMA (100%)	80	160
Rosedale GMA (6%)	9	19
Stratford GMA (7%)	4	7
Tarwin GMA (100%)	755	1,510
Sale WSPA (6%)	24	47
Yarram WSPA (95%)	338	676
Total[3]	**1,380**	**2,759**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the previous table.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use is based on the proportion of bores for each management unit data located in the basin prior to rounding.

The licensed entitlements and metered use for urban groundwater supplies is provided in Table 22-9.

Table 22-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Leongatha	400	381	166
Yarram	60	11	0
Total	**460**	**392**	**166**

22.8 Drought contingency measures

A range of drought contingency measures was undertaken in the South Gippsland basin in 2008/09 including:

- restricting rural water use (discussed below)
- use of groundwater to supplement surface water supplies
- continuation of two qualifications of rights as detailed in Table 22-10.

South Gippsland Water accessed groundwater to supplement supplies for Devon North, Alberton, Yarram and Port Albert.

Table 22-10 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights to Water in the Tarwin River 2008	1 July 2008 to 30 June 2009 (continuing from 13 June 2008)	Extended pumping/ diversion times Reduced passing flow requirements	Allows South Gippsland Water to access additional water from the Tarwin River, increase extraction rates, and reduces passing flow requirements to enable emergency supply to Korumburra and Leongatha/Koonwarra
Temporary Qualification of Rights to Water from the Powlett River 2008	1 July 2008 to 30 June 2009 (continuing from 20 December 2007)	Extended pumping/ diversion times New diversion point provided	Allows South Gippsland Water to access additional water from the Powlett River, extend the period in which pumping is permitted, and introduce passing flow requirements to enable emergency supply to Wonthaggi

22.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 22-11. Increased water availability enabled water corporations to provide unrestricted supplies to most of their customers. Only towns supplied from the Tarra River were subject to restrictions during the year.

Licensed diversions on a number of unregulated streams were banned for much of the second half of the year.

Increased water availability enabled urban water corporations to provide unrestricted supplies to most of their customers. Only towns supplied from the Tarra River were subject to restrictions during the year.

Licensed diverters on a number of unregulated streams were banned for much of the second half of the year.

Table 22-11 Seasonal allocations and restrictions on water use in South Gippsland basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Alberton, Devon North, Port Albert, Yarram	Stage 2 Restrictions February to May 2009
Licensed diversions from unregulated streams	Bruthen Creek	Irrigation ban July 2008 to June 2009
	Tarra River	Stage 1 restrictions September to October 2008 and an irrigation ban from November 2008 to June 2009
	Jack River,	Irrigation ban in November 2008, Stage 1 restrictions for December 2008, an irrigation ban for January to June 2009
	Greigs Creek	Irrigation ban November 2008 to June 2009

22.10 Recycled water

South Gippsland Water is responsible for eight wastewater treatment plants within the basin, with the Yarram (Tarraville) treatment plant the only site where all wastewater is recycled. Recycling opportunities are limited due to a small industrial base and crop types that are not suited to recycled water.

Westernport Water reuses water from its treatment plants at Coronet Bay and Cowes for sporting fields and gardens of significance.

Across the basin 7% of wastewater was reused, compared to 8% in 2007/08 (Table 22-12).

Table 22-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Coronet Bay	135	95	70%	0	95	0	0	0	40
Cowes	936	107	11%	88	14	0	5	0	829
Foster	108	0	0%	0	0	0	0	108	0
Korumburra	579	2	0%	2	0	0	0	578	-1
Leongatha domestic	504	0	0%	0	0	0	0	504	0
Leongatha trade waste	1,069	0	0%	0	0	0	0	0	1,069
Toora	13	3	20%	3	0	0	0	11	-1
Welshpool	0	0	0%	0	0	0	0	0	0
Wonthaggi/Cape Paterson/Inverloch	1,037	33	3%	0	33	0	0	1,004	0
Yarram (Tarraville)	84	84	100%	0	84	0	0	0	0
Total 2008/09	**4,465**	**324**	**7%**	**93**	**226**	0	**5**	**2,205**	**1,936**
Total 2007/08	4,487	357	8%	84	268	0	5	3,291	840

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

22.11 Water for the environment

22.11.1 Environmental Water Reserve (EWR)

Important environmental assets depend on water from the EWR in the South Gippsland basin. Corner Inlet and Westernport Bay are listed as internationally significant wetlands under the Ramsar convention and rely on freshwater inputs from the South Gippsland basin to ecologically function.

In 2008/09 the South Gippsland basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Gippsland Water and South Gippsland Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

22.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Gippsland Water and South Gippsland Water reported meeting all passing flow requirements under their bulk entitlements in the South Gippsland basin in 2008/09. Westernport Water's bulk entitlement does not contain any passing flow requirements.Table 22-13 shows passing flow compliance in the South Gippsland basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 22-2.

Table 22-13 Selected passing flow compliance in the South Gippsland basin

River	Passing flow	
Tarra River	Instrument where passing flows are specified	Bulk Entitlement (Devon North, Alberton, Yarram and Port Albert) Conversion Order 1997
	Responsible authority	South Gippsland Water
	Compliance point	Tarra River diversion weir (shown as 1 in Figure 22-2)
	Passing flow compliance	• The authority passed the entire flow when flows were between 0 and 3 ML/day • The authority passed 3 ML/day when flow was between 3 and 6 ML/day • The authority passed half the flow when flow was between 6 and 12 ML/day • The authority passed 6 ML/day when flow was greater than 12 ML/day
Agnes River	Instrument where passing flows are specified	Bulk Entitlement (Toora, Port Franklin, Welshpool and Port Welshpool) Conversion Order 1997
	Responsible authority	South Gippsland Water
	Compliance point	Agnes River storage diversion point (shown as 2 in Figure 22-2)
	Passing flow compliance	The lesser of 1 ML/day or natural flow was passed

22.11.3 Streamflow management plans (SFMPs)

Work continued on the development of the Tarra River SFMP during 2008/09.

23 Bunyip basin

This chapter sets out the accounts for the Bunyip basin. For detailed information about how they have been compiled, refer to Chapter 5.

23.1 Bunyip basin summary

Inflows to the Bunyip basin, at 296,800 ML, were 75% of those experienced in 2007/08 and 55% of the long term average.

Despite the dry conditions, most urban and rural users supplied from the basin were unrestricted during the year. Urban communities on the Mornington Peninsula, however, were on Stage 3a restrictions because their water is supplied from the Melbourne system.

Licensed groundwater use in 2008/09 rose by close to 13% compared to 2007/08, largely due to increased extractions in the Nepean GMA and Koo-Wee-Rup WSPA.

Tarago Reservoir, the only major storage located within the basin, was reconnected to the Melbourne system in June 2009, adding 15,000 ML a year to Melbourne's supplies. Levels in Tarago Reservoir fell slightly in 2008/09 to be 88% of capacity at the end of the year.

About 8% of the Westernport water supply catchment was burnt during the February 2009 bushfires. Melbourne Water managed to continue supplies to Melbourne without major interruptions.

23.2 Responsibilities for management of water resources

Table 23-1 shows the responsibilities of various authorities within the Bunyip basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 23-1 Responsibilities for water resources management within the Bunyip basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages surface water and groundwater private diversions		
Melbourne Water			Operates Eastern Treatment Plant Provides bulk water supply to South East Water	Operates Tarago Reservoir Obliged to meet passing flows Manages waterways
South East Water			Supplies towns in south-eastern metropolitan Melbourne including Dandenong, Frankston, Pakenham and the Mornington Peninsula(1)	
Gippsland Water			Supplies towns in the east of the basin including Drouin and Neerim South and Warragul (in the Latrobe basin)	Obliged to meet passing flows

Note:

(1) This water is sourced from the Yarra/Thomson supply system.

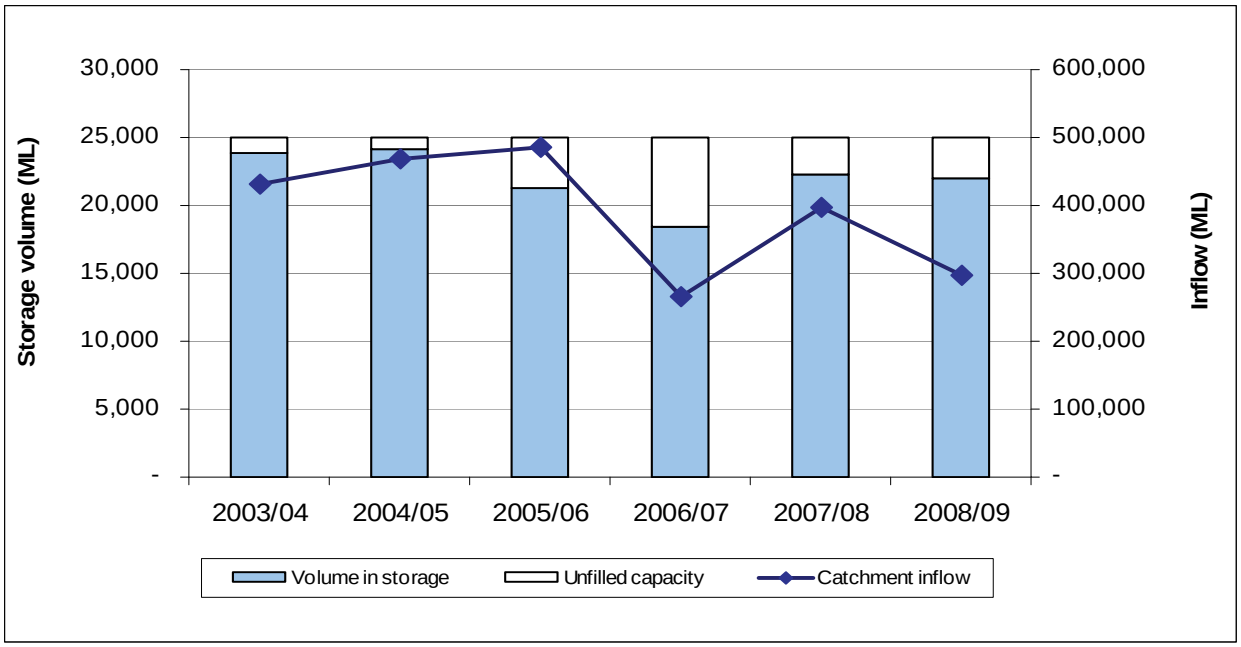
23.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Bunyip basin ranged mostly between 60% and 80% of the long term average, with rainfall in some areas ranging between 80% and 100%. Catchment inflows were 296,800 ML, which equates to 55% of the long term average of 541,000 ML. This was significantly less than the 398,300 ML of inflows in 2007/08.

The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport and Bass Strait was 279,600 ML in 2008/09. This represents 94% of the catchment inflows into the basin, the same as in 2007/08.

The Tarago Reservoir is the only major storage (greater than 1,000 ML) in the Bunyip basin. At the end of the year it held 22,000 ML, or 88% of its effective capacity of 25,000 ML. Tarago Reservoir has a capacity of 37,500 ML, however in 2008/09, as in previous years, it operated at a temporary dam safety capacity of 25,000 ML.

Figure 23-1 All major storages and catchment inflows in the Bunyip basin



23.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Bunyip basin are shown in Table 23-2. These figures exclude water delivered directly to customers from Melbourne Water's supply system in the Yarra and Thomson basins.

Table 23-2 Summary of total water resources and water use in the Bunyip basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	305,500	24,600
Groundwater[2]	26,700	15,100
Recycled water	133,990	25,770

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 23-7 and the estimated domestic and stock use as presented in Table 23-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

23.4.1 Infrastructure projects to improve water availability

The Tarago Reservoir was reconnected to Melbourne's water supply network with the commissioning of the Tarago treatment plant in July 2009. Water from Tarago Reservoir receives full treatment and can supply Melbourne with up to 20 GL of water per annum.

23.5 Location of water resources

Figure 23-2 Map of the Bunyip basin

23.6 Surface water resources

23.6.1 Water balance

A surface water balance for the Bunyip basin is shown in Table 23-3. Tarago Reservoir was reconnectioned to Melbourne's water supply system in June 2009. A small volume of 627 ML was supplied to the Westernport and Mornington Peninsula area during June 2009.

Cardinia Reservoir is an off-channel storage located within the Bunyip basin and stores water harvested and transferred from the Yarra. It is therefore not included in the Bunyip basin figures.

Table 23-3 Balance of surface water in the Bunyip basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	22,300	18,400
Volume in storage at end of year	22,000	22,300
Change in storage	**-300**	**3,900**
Inflows		
Catchment inflow(1)	296,800	398,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	8,680	9,210
Sub-total	**305,500**	**407,500**
Usage		
Urban diversions	3,130	3,290
Licensed diversions from regulated streams	0	3,000
Licensed diversions from unregulated streams	6,000	7,200
Small catchment dams	15,500	15,500
Sub-total	**24,600**	**29,000**
Losses		
Net evaporation losses from major storages(2)	-200	-100
Evaporation from small catchment dams(3)	600	600
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	1,200	1,500
Sub-total	**1,600**	**2,000**
Water passed at outlet of basin		
River outflows to the ocean and Port Phillip Bay and Westernport	279,600	372,600

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Net evaporation as calculated by Melbourne Water.
(3) Evaporation losses are calculated by subtracting usage from total water harvested.
(4) Losses estimated using loss functions in the Tarago River REALM.

23.6.2 Small catchment dams

Small catchment dams are responsible for diverting the largest volume of surface water in the basin. Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values provided in Table 23-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 23-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,000	4,000	n/a
Registered commercial and irrigation	13,700	11,500	n/a
Total	**21,700**	**15,500**	**16,100**

n/a: Information not available.

23.6.3 Water entitlement transfers

Surface water movement in the Bunyip basin was limited to transfers of bundled entitlements within the basin. In 2008/09, some 12 ML of bundled entitlements in the Bunyip basin were transferred on a permanent basis, and 281 ML on a temporary basis.

Table 23-5 summarises the movement of bundled entitlements in the Bunyip basin during 2008/09.

Table 23-5 Transfer of surface water bundled entitlements in the Bunyip basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Trading zone	12	12	0	281	281	0
Total 2008/09	**12**	**12**	**0**	**281**	**281**	**0**
Total 2007/08(1)	n/a	n/a	n/a	n/a	n/a	n/a

Note:
(1) No data available for 2007/08.

23.6.4 Volume diverted

The volume of water diverted in 2008/09 is shown in Table 23-6.

Licensed diversions from unregulated streams are a large component of surface water use in the basin. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 23-6 Volume of water diverted under surface water entitlements in the Bunyip basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
Gippsland Water					
Tarago/Bunyip(1)	n/a	n/a	75(1)	3,133	n/a
Melbourne Water					
Tarago/Bunyip	n/a	n/a	0	0	n/a
Southern Rural Water					
Tarago/Bunyip	n/a	n/a	0	0	n/a
Total annual volume of bulk entitlements 2008/09		**n/a**	**75**	**3,133**	
Total annual volume of bulk entitlements 2007/08		**n/a**		**6,287**	
Licensed diversions from unregulated streams 2008/09		*17,672*		*6,031*	
Licensed diversions from unregulated streams 2007/08		*14,391*		*7,155*	

Note:
(1) The Tarago system bulk entitlements were not finalised for 2008/09. In addition to the 3,133 ML extracted by Gippsland Water, an additional 75 ML was extracted from the Tarago Reservoir under agreement with Melbourne Water.
n/a: Bulk entitlement conversion order was not finalised for 2008/09.

23.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Bunyip basin, excluding domestic and stock use, is presented Table 23-7.

The Bunyip basin contains the whole of the Frankston GMA, Nepean GMA and Koo-Wee-Rup WSPA, as well as part of the Moorabbin GMA. While groundwater levels in the Frankston and Nepean GMAs are generally stable, insufficient observation bores are available to determine trends for the Moorabbin GMA. A management plan is under development for the Koo-Wee Rup WSPA in light of declining water levels. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Reported groundwater use in the Bunyip basin increased in 2008/09 compared with 2007/08, largely as a result of increased extractions from the Nepean GMA and Koo-Wee-Rup WSPA.

Table 23-7 Licensed groundwater volumes, Bunyip basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[6]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Frankston GMA (100%)	All depths	3,200	1,080	211	0	211	241
Moorabbin GMA (61%)	All depths	1,660	1,627	720	6	726	731
Nepean GMA (100%)	All depths	6,013	6,012	3,908	10	3,918	3,298
Koo-Wee-Rup WSPA (100%)	All depths	12,915	12,826	5,036	50	5,086	4,536
Total[5]		**23,788**	**21,545**	**9,875**	**66**	**9,941**	**8,806**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV).

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Total volumes are based on the sum of management unit data prior to rounding.

(6) Non-metered use includes dairy wash and low consumption commercial use.

An estimate of domestic and stock groundwater use is provided in Table 23-8. The number of domestic and stock bores in the Bunyip basin was lower in 2008/09 than reported in 2007/08. This is predominantly due to a revised calculation of the number bores in each management unit.

The estimated groundwater use for domestic and stock was lower in 2008/09 than reported in 2007/08, mainly due to a reduction in the estimated number of domestic and stock bores.

Table 23-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[4]
Frankston GMA (100%)	170	340
Moorabbin GMA (61%)	223	445
Nepean GMA (100%)[3]	2,440	1,220
Koo-Wee-Rup WSPA (100%)	1,563	3,126
Total	**4,396**	**5,132**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the previous table.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) The estimated domestic and stock use for Nepean GMA is estimated at 0.5 ML per bore, not 2 ML per bore, because most Nepean properties have access to potable water and bores are mainly used for domestic purposes such as watering gardens.

(4) Estimated domestic and stock use is based on the proportion of bores for each management unit data located in the basin prior to rounding.

Groundwater is not used for urban supply in the Bunyip basin.

23.8 Drought contingency measures

The restriction of urban and rural water use (discussed below in section 23.9) were the only drought contingency measures implemented in the Bunyip basin in 2008/09.

About 8% of the Melbourne's Westernport water supply catchment was burnt during the February 2009 bushfires, however Melbourne Water managed to continue supplies to Melbourne without major interruptions.

23.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 23-9.

Despite the dry conditions, most urban and rural users supplied from the Bunyip basin were unrestricted during the year. Urban communities on the Mornington Peninsula, however, were on Stage 3a restrictions because their water is supplied from the Melbourne system.

Groundwater use was unrestricted in the Bunyip basin during 2008/09.

Table 23-9 Seasonal allocations and restrictions on water use in Bunyip basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	South East Water customers	Stage 3a restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Monbulk Creek	Irrigation ban from January to April 2009, Stage 1 restrictions from May to June 2009

23.10 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin. Overall, 8% of wastewater was recycled for off-site purposes.

The largest treatment plant is the Eastern Treatment Plant operated by Melbourne Water, which recycled 7% of its total wastewater volume of 121,796 ML. The plant's recycled wastewater was predominantly used on-site and this volume has not been included in the percentage of water recycled. However, an increasing amount is being used by the Eastern Irrigation Scheme for horticultural, recreational and residential customers.

Table 23-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				To retailers	Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Blind Bight	180	180	83%	0	150	0	0	30	0	0
Boneo	3,055	23	0%	0	1	0	0	22	3,032	0
Drouin	430	215	50%	0	0	215	0	0	215	0
Eastern Treatment Plant	121,796	22,262	7%	8,243	0	0	0	14,019	0	99,534
Koo-Wee-Rup[3]	101	72	71%	0	40	32	0	0	30	-1
Lang Lang	56	55	98%	0	52	3	0	0	0	1
Longwarry	134	134	100%	0	0	134	0	0	0	0
Mt Martha	5,072	814	1%	0	67	0	0	747	4,259	0
Neerim South	47	0	0%	0	0	0	0	0	47	0
Pakenham	1,790	1,613	90%	0	440	1,168	0	5	177	0
Somers	1,325	407	31%	0	282	125	0	-	918	0
Total 2008/09	**133,986**	**25,775**	**8%**	**8,243**	**1,032**	**1,677**	0	**14,823**	**8,678**	**99,534**
Total 2007/08	**139,475**	**23,895**	**7%**	**7,881**	**1,009**	**1,080**	**0**	**13,924**	**9,211**	**106,370**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

23.11 Water for the environment

23.11.1 Environmental Water Reserve (EWR)

Westernport Bay is an important environmental asset dependent on water from the EWR in the Bunyip basin. The bay is listed as an internationally significant wetland under the Ramsar convention and relies on the freshwater inputs from the Bunyip basin to ecologically function.

In 2008/09 the Bunyip basin EWR comprised:

- the Tarago and Bunyip Rivers Environmental Entitlement 2009
- water set aside for the environment through the operations of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above the cap.

23.11.2 Environmental entitlements

The Tarago and Bunyip Rivers Environmental Entitlement 2009 was granted by the Water Minister to the Environment Minister in March 2009 and came into effect in May 2009. However the water held in this entitlement, a combination of passing flow requirements and a share of inflow and storage capacity, was not available for use by the environment until Melbourne customers were no longer subject to a level of restrictions equal to or more severe than Stage 3a.

23.11.3 Passing flow compliance

Melbourne Water operates Tarago Reservoir to provide a passing flow below the reservoir. A new environmental entitlement was introduced during 2008/09, however no passing flow releases were made during the year.

The Tarago and Bunyip Rivers Environmental Entitlement 2009 came into effect on 1 May 2009. However, the environment is not permitted to access inflows until a time when Melbourne customers are no longer subject to a level of restrictions equal to or more severe than Stage 3a, or six calendar months after the Water Minister issues a certificate of completion for Melbourne's desalination plant, whichever is the earlier.

24 Yarra basin

This chapter sets out the accounts for the Yarra basin. For detailed information about how they have been compiled, refer to Chapter 5.

24.1 Yarra basin summary

At 395,000 ML, inflows to the Yarra basin were less than 40% of the long term average for the third consecutive year. However, they were higher than those experienced in 2007/08.

The dry conditions forced water resource managers to continue restricting surface water use in the basin. Melbourne residents were again subject to Stage 3a restrictions the entire year, while licensed diverters on many of the Yarra basin's unregulated rivers were banned or restricted in some form.

Surface water use in the basin was again low as a result of the severe restriction levels.

Despite the low surface water use and a qualification of rights retaining environmental water for Melbourne's supplies, storage levels in the Yarra basin fell 53,600 ML over the year. By the end of June 2009, storages were holding 39% of capacity.

Construction of the Sugarloaf Pipeline connecting Melbourne's water supplies to the Goulburn River continued during 2008/09. By the end of the year, approximately 75% of the works had been completed.

About 16.5% of Melbourne's Yarra water supply catchment was burnt during the February 2009 bushfires. The Maroondah and O'Shannassy water supply catchments were most affected however the Upper Yarra catchment, which is one of Melbourne's most important, was largely protected. Melbourne Water managed to continue supplies to Melbourne without major interruptions.

24.2 Responsibilities for management of water resources

Table 24-1 shows the responsibilities of various authorities within the Yarra basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 24-1 Responsibilities for water resources management within the Yarra basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Melbourne Water		Manages surface water licensed diversions in the Yarra basin	Provides bulk water to the Melbourne retail water authorities	Manages waterways in the Yarra basin Operates storages for the Melbourne supply system and is obliged to meet passing flow requirements
Yarra Valley Water			Supplies towns for part of the Yarra basin	
South East Water			Supplies towns for part of the Yarra basin	
City West Water			Supplies towns for part of the Yarra basin	
Southern Rural Water		Manages groundwater licensed diversions		

24.3 Rainfall, flows and storages in 2008/09

In 2008/09 rainfall in the Yarra basin ranged between 60% and 80% of the long term average. Total inflows were 37% of the long term average of 1,054,000 ML. Although slightly higher than experienced in 2007/08, this was the third consecutive year inflows to the Yarra basin were less than 40% of the long term average.

The amount of water flowing from the Yarra basin into Port Phillip Bay was 135,400 ML in 2008/09. This represents 34% of the catchment inflows to the basin, compared with 40% in 2007/08.

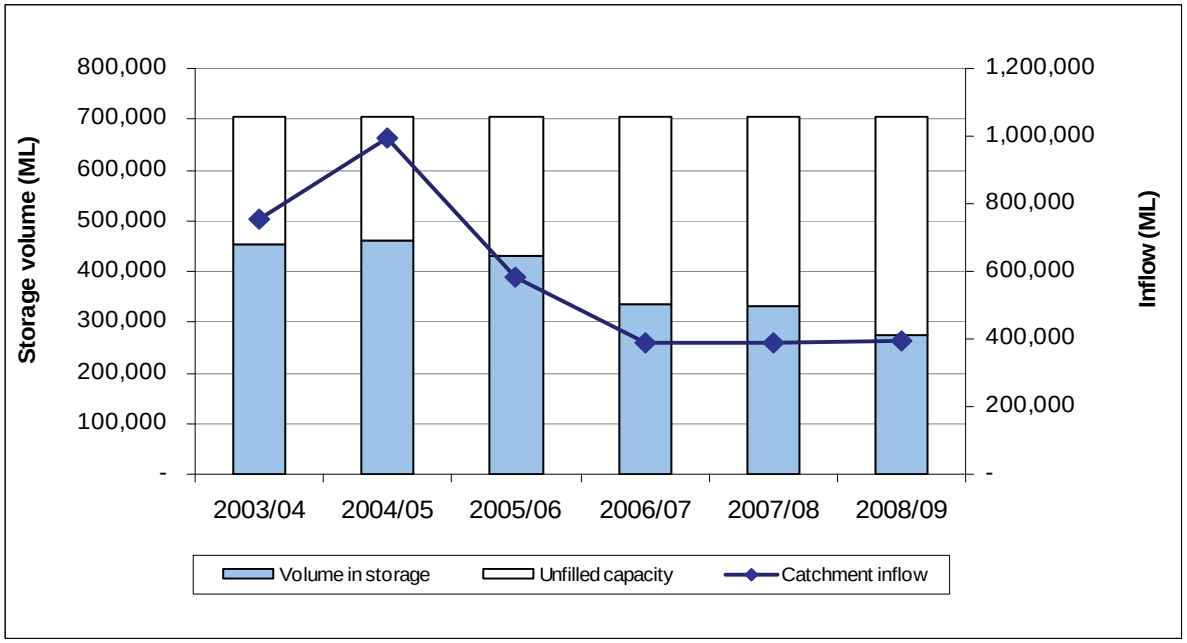
Melbourne Water operates seven major storages within the Yarra basin. Water is harvested by Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir. Sugarloaf Reservoir is an off-stream storage but has a dual role to harvest water and to act as a seasonal balancing reservoir. Silvan Reservoir, Yan Yean Reservoir, and Greenvale Reservoir are off-stream storages and act as seasonal balancing reservoirs. Another major Melbourne Water storage (Cardinia Reservoir) is an off-stream storage located within the Bunyip basin, although it stores water harvested from the Yarra basin.

Storage levels for all major storages (greater than 1,000 ML) in the basin decreased from 329,600 ML in July 2008 to 275,900 ML by the end of June 2009, or 39% of the total storage capacity of 705,000 ML in the Yarra basin, including Cardinia Reservoir.

Only volumes for major on-stream storages have been included in the water balance, and as such, major storages such as Cardinia, Sugarloaf, Greenvale and Silvan reservoirs have not been included. The volume of water in the major on-stream storages decreased from 108,500 ML in July 2008 to 96,000 ML in June 2009.

As a result of the Black Saturday bushfires experienced during February 2009 in the Upper Yarra Reservoir catchment, the use of Upper Yarra Reservoir water was minimised for a short period. Figure 24-1 includes figures for all major storages within the Yarra basin.

Figure 24-1 All major storages and catchment inflows in the Yarra basin



24.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Yarra basin are shown in Table 24-2.

Table 24-2 Summary of total water resources and water use in the Yarra basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	496,700	370,300
Groundwater[2]	4,900	1,900
Recycled water	9,010	2,250

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 24-7 and the estimated domestic and stock use presented in Table 24-9.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

24.4.1 Infrastructure projects to improve water availability

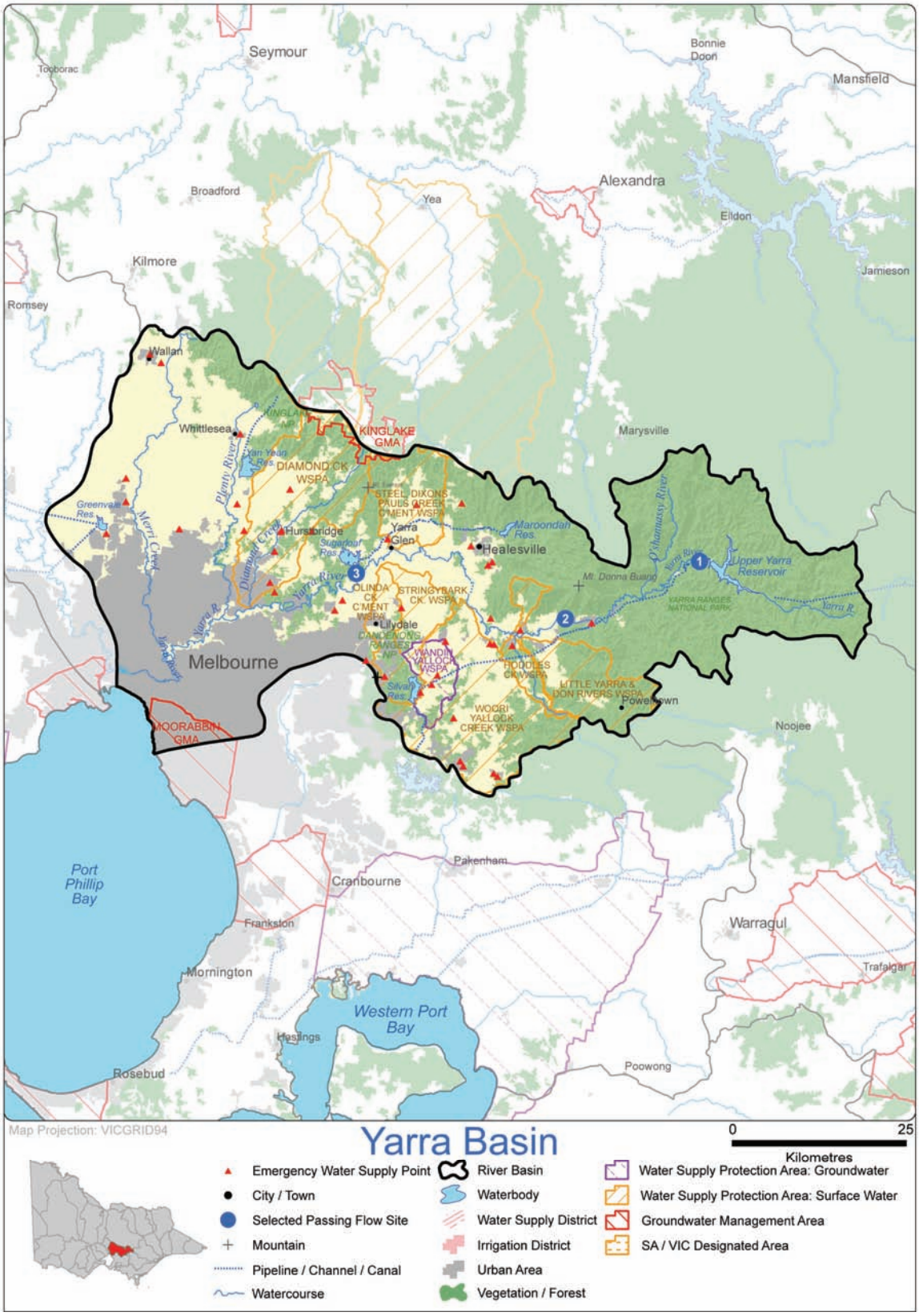
Construction of the Sugarloaf Pipeline connecting Melbourne's water supplies to the Goulburn River continued during 2008/09. By the end of the year, approximately 75% of the works had been completed.

Melbourne Water is undertaking membrane lining of aqueducts to reduce leakage. In 2008/09 some 3.2 kilometres of the Maroondah and 560 metres of the Coranderrk aqueduct were lined.

Yarra Valley Water constructed the first 1.6 kilometres of pipeline from Craigieburn Aurora treatment plant to new residential development.

24.5 Location of water resources

Figure 24-2 Map of the Yarra basin



24.6 Surface water resources

24.6.1 Water balance

A surface water balance for the Yarra basin is presented in Table 24-3.

Melbourne Water transferred 93,800 ML from the Thomson basin and 1,200 ML from Silver and Wallaby Creek to supply Melbourne's customers.

Table 24-3 Balance of surface water in the Yarra basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	108,500	115,300
Volume in storage at end of year	96,000	108,500
Change in storage	**-12,500**	**-6,800**
Inflows		
Catchment inflow(1)	395,000	386,900
Transfers from other basins	94,900	125,600
Return flow from irrigation	0	0
Treated wastewater discharged back to river	6,760	7,000
Sub-total	**496,700**	**519,500**
Usage		
Urban diversions(2)	339,190	341,070
Licensed diversions from unregulated streams	15,200	12,500
Small catchment dams(3)	15,900	15,900
Transfers to the Werribee system	0	0
Sub-total	**370,300**	**369,500**
Losses		
Net evaporation losses from major storages	2,300	2,500
Evaporation from small catchment dams(3)	1,200	1,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**3,500**	**3,700**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	135,400	153,100

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Diversions from the Melbourne supply system represent the total amount diverted for consumptive purposes and, due to a different calculation method, do not equate to the sum of the three individual Melbourne bulk entitlements.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Losses estimated to be zero since no loss function is available for the Yarra basin.

24.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 24-4 have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 24-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,500	5,300	n/a
Registered commercial and irrigation	12,600	10,600	n/a
Total	**23,100**	**15,900**	**17,100**

n/a: Information not available.

24.6.3 Water entitlement transfers

Surface water movement in the Yarra basin was limited to transfers of bundled entitlement within the basin. In 2008/09, some 130 ML of bundled entitlement in the Yarra basin was transferred on a permanent basis and 585 ML on a temporary basis.

Table 24-5 summarises the movement of bundled entitlements in the Yarra basin during 2008/09.

Table 24-5 Transfer of surface water bundled entitlements in the Yarra basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin	Bought (ML)	Sold (ML)	Net transfer to basin
Yarra unregulated	130	130	0	585	585	0
Total 2008/09	**130**	**130**	**0**	**585**	**585**	**0**
Total 2007/08[1]	n/a	n/a	n/a	n/a	n/a	n/a

Note:
(1) No data available for 2007/08.

24.6.4 Volume diverted

The Melbourne metropolitan retailers – City West Water, South East Water and Yarra Valley Water – hold bulk entitlements on the Yarra River. Western Water also holds a bulk entitlement on the Yarra River. The volume of water diverted by these corporations is shown in Table 24-6.

Bulk entitlements held by the Melbourne retailers are applied over a multi-year period, where the average usage over a defined rolling period (15 years for the Melbourne retailers) must be less than the average bulk entitlement volume. Compliance with bulk entitlements held by Western Water is deemed to occur if water use is not more than the maximum volume allowed to be diverted during 2008/09.

Water use from licensed diverters was low because most of the Yarra River's tributaries were on restrictions or irrigation bans during the year.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Melbourne Water.

Table 24-6 Volume of water diverted under surface water entitlements in the Yarra basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[2]
Melbourne metropolitan retailers					
Yarra River	15	400,000	-164[3]	233,900	Yes
Western Water					
Yarra River	1	11,250	0	10,485	Yes
Total annual volume taken in 2008/09		**411,250**	**-164**	**244,385**	
Total annual volume taken in 2007/08		**411,250**	**0**	**215,472**	
Licensed diversions from unregulated streams 2008/09		*45,291*		*15,200*	
Licensed diversions from unregulated streams 2007/08		*45,559*		*12,517*	

Notes:
(1) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.
(2) Compliance for the entire Melbourne supply system is assessed against a long term (15 year) average volume limit of 555,000 ML. The corresponding long term average annual diversions for 2008/09 was 328,380 ML.
(3) Sold to Goulburn Valley Water, ceased on 30 December 2008.

24.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Yarra basin, excluding domestic and stock use, is presented in Table 24-7.

The Yarra basin contains the whole Wandin Yallock WSPA as well as parts of the Kinglake GMA and Moorabbin GMA. Groundwater levels in the Wandin Yallock WSPA are generally stable, however insufficient observation bores are available to determine trends in the GMAs. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Yarra basin increased marginally in 2008/09 compared with 2007/08.

Table 24-7 Licensed groundwater volumes, Yarra basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit (ML/year)[3]	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2008/09[5]	Total licensed groundwater use (ML) 2007/08
Kinglake GMA (19%)	All depths	379	351	49	211	260	210
Moorabbin GMA (39%)	All depths	1,040	1,020	451	4	455	458
Wandin Yallock WSPA (100%)	All depths	2,924	2,939	565	35	600	564
Total[6]		**4,343**	**4,310**	**1,065**	**250**	**1,315**	**1,232**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used. The PCV for Wandin Yallock is currently under review. The licensed entitlement is greater than PCV.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 24-8. Groundwater is not used to augment urban supplies in the Yarra basin.

Table 24-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Kinglake GMA (19%)	55	109
Moorabbin GMA (39%)	139	278
Wandin Yallock WSPA (100%)	115	230
Total	**309**	**617**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 24-7.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

24.8 Drought contingency measures

A number of drought contingency measures were implemented in the Yarra basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- the continuation of a qualification of rights as detailed in Table 24-9.

About 16.5% of Melbourne's Yarra water supply catchment was burnt during the February 2009 bushfires. The Maroondah and O'Shannassy water supply catchments were most affected, however the Upper Yarra catchment, which is one of Melbourne's most important, was largely protected. Melbourne Water managed to continue supplies to Melbourne without major interruptions.

Table 24-9 Qualifications of rights

Legal instrument	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Melbourne Water Supply System - Yarra October 2007	1 July 2008 to 30 June 2009 (continuing from 20 October 2007)	Differential access by priority entitlements Reduced passing flow requirements	Delays the introduction of the new environmental flow regime for the Yarra River to retain water in storages for supply to Melbourne and further reduced environmental flows by up to 10 GL/year

24.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 24-10.

The dry conditions forced water resource managers to continue restricting surface water use in the basin. Melbourne residents were again subject to Stage 3a restrictions the entire year, while licensed diverters on many of the Yarra basin's unregulated rivers were banned or restricted in some form, particularly over summer.

Groundwater use was unrestricted in the Yarra basin during 2008/09.

Table 24-10 Seasonal allocations and restrictions on water use in Yarra basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Yarra Valley Water, South East Water and City West Water customers	Stage 3a restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Darebin Creek	Irrigation ban October 2008, December 2008, January and February 2009, and March and May 2009
	Diamond Creek	Irrigation ban July, September, October 2008, January to June 2009
	Hoddles Creek	Irrigation ban from July to October 2008, December 2008 to July 2009
	Yarra River	Restrictions in July 2008, and from September 2008 to March 2009, and June 2009
	Little Yarra River	Restrictions July 2008, September 2008, December 2008, April 2009, May 2009 Irrigation bans October 2008, January to March 2009, June 2009
	Don River	Irrigation ban in October 2008 and from January to March 2009, June 2009
	Pauls Creek	Irrigation ban July 2008 to June 2009
	Plenty River	Irrigation ban July to October 2008, January to June 2009
	Steels/Dixons Creek	Irrigation ban July 2008 to June 2009
	Wandin Yallock Creek	Irrigation ban in October 2008
	Woori Yallock Creek	Restrictions in December 2008, April, May 2009 Irrigation bans in July, September, October 2008, January to March 2009
	Mullum Mullum Creek	Irrigation ban in October 2008, January to March 2009
	Olinda Creek	Irrigation ban January to March 2009, June 2009
	Moonee Ponds Creek	Irrigation ban January and February 2009
	Stringybark Creek	Irrigation ban October 2008

24.10 Recycled water

Yarra Valley Water operates eight wastewater treatment plants within the Yarra basin. A summary of the volume of recycled water is provided below in Table 24-11.

Wastewater was reused at four of the plants in 2008/09. Compared with 2007/08, the volume of wastewater entering the treatment plants decreased during the year, while the volume of recycled water increased. Overall, around 5% of wastewater was reused in the basin, which is a reduction from the percentage recycled in 2007/08 (6%). This was mostly due to a reduction in agricultural reuse (and increased use within process).

Table 24-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Aurora	259	31	0%	0	0	0	31	228	0
Brushy Creek	4,166	865	2%	67	0	0	797	3,302	0
Craigieburn	533	220	18%	94	0	0	126	313	0
Healesville	279	66	0%	0	0	0	66	213	0
Lilydale	2,363	540	0%	3	0	0	537	1,822	1
Monbulk	19	-	0%	0	0	0	0	19	0
Upper Yarra	739	208	0%	0	0	0	208	530	1
Wallan	416	157	38%	0	157	0	0	259	0
Whittlesea	237	163	58%	137	0	0	26	74	0
Total 2008/09	**9,011**	**2,250**	**5%**	**301**	**157**	**0**	**1,791**	**6,760**	**2**
Total 2007/08	9,073	2,094	6%	322	240	0	1,533	6,978	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

24.11 Water for the environment

24.11.1 Environmental Water Reserve (EWR)

Important environmental assets, such as the Australian Grayling, River Blackfish, Macquarie Perch and numerous billabongs and wetlands depend on the Yarra basin EWR.

In 2008/09 the Yarra basin EWR comprised:

- the Yarra River Environmental Entitlement 2006
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Melbourne Water
- water set aside for the environment through the operation of streamflow management plans including operation of licensed diversions with passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above the cap.

24.11.2 Environmental entitlements

The Yarra River Environmental Entitlement was granted to the Environment Minister in 2006. However due to the ongoing drought it has been subject to a qualification of rights since this time. The qualification held 17,000 GL of the entitlement in storage and passing flows were reduced to secure Melbourne's water supplies. An emergency contingency plan is in place to manage the environmental risks associated with the qualification.

24.11.3 Passing flow compliance

Bulk entitlements require passing flows to be met at a number of points in the basin. These passing flows are established in Melbourne Water's operating rules and, in the case of the Yarra River at Warrandyte, established by the State Environment Protection Policy – Waters of Victoria (SEPP WoV), Schedule F7 (Waters of the Yarra Catchment).

Melbourne Water reported that compliance with the requirements of its State Environment Protection Policy environmental flow obligations were met for 2008/09. No flushing flows were released by Melbourne Water due to the qualification of rights.

Table 24-12 shows a number of passing flow requirements in the Yarra basin for selected compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 24-2.

Table 24-12 Selected passing flow compliance in the Yarra basin at selected sites

River	Passing flow	
Yarra River	Instrument where passing flows are specified	State Environment Protection Policy – Waters of Victoria (SEPP WoV), Schedule F7 (Waters of the Yarra Catchment)
	Responsible authority	Melbourne Water
	Compliance point	Upper Yarra Reservoir to Yarra River: Upper Yarra Dam (shown as 1 in Figure 24-2)
	Passing flow compliance	• Passing flow requirements were qualified during 2008/09, with Melbourne Water meeting the qualified requirements • Flows of 10 ML/day were passed downstream of Upper Yarra Reservoir
	Compliance point	Millgrove (shown as 2 in Figure 24-2)
	Passing flow compliance	• Passing flow requirements were qualified during 2008/09, with Melbourne Water meeting the qualified requirements • Flows of 98 ML/day were passed downstream of Milgrove
	Compliance point	Yering Gorge Pump Station (shown as 3 in Figure 24-2)
	Passing flow compliance	• Passing flow requirements were qualified during 2008/09, with Melbourne Water meeting the qualified requirements • Flows of 245 ML/day were passed downstream of Yering Gorge Pump Station

24.11.4 Streamflow management plans

The following streamflow management plans (SFMPs) were in operation in 2008/09:

- Diamond Creek SFMP
- Hoddles Creek SFMP
- Olinda Creek SFMP
- Plenty River SFMP
- Stringybark Creek SFMP
- Pauls, Steels and Dixons Creeks SFMP.

Consultative committees were appointed for the Woori Yallock WSPA and the Little Yarra and Don WSPA in 2008/09 and work began on developing SFMPs.

25 Maribyrnong basin

This chapter sets out the accounts for the Maribyrnong basin. For detailed information about how they have been compiled, refer to Chapter 5.

25.1 Maribyrnong basin summary

Inflows in the Maribyrnong basin were again extremely low in 2008/09 at 20,000 ML, or 18% of the long term average. Volumes in Rosslynne Reservoir continued to decline and by the end of the year had fallen to 800 ML, or 3% of capacity.

As a consequence, water managers were unable to use the reservoir to supply consumptive use commitments in the basin and the qualification of rights retaining environmental passing flows in storage for emergency supplies continued.

Licensed diverters on the regulated Maribyrnong River were again denied an allocation, while the majority of Western Water's urban customers were supplied from the Melbourne system.

The volume of licensed diversions from unregulated rivers was again extremely low as most users were subject to lengthy periods of ban. Licensed groundwater use in the basin was higher than in 2007/08 as extractions from the Lancefield GMA increased.

25.2 Responsibilities for management of water resources

Table 25-1 shows the responsibilities of various authorities within the Maribyrnong basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 25-1 Responsibilities for water resources management within the Maribyrnong basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Melbourne Water		Manages surface water licensed diversions in the lower Maribyrnong basin below the confluence with Deep Creek and the Maribyrnong River	Provides bulk water supplies to City West Water and Western Water (from Yarra/Thomson system)	Manages waterways, drainage and floodplains in part of the Maribyrnong basin
City West Water			Supplies metropolitan Melbourne (from Yarra/Thomson system)	
Western Water			Supplies towns in the basin located outside metropolitan Melbourne	Operates Macedon reservoirs Obliged to meet passing flow requirements
Southern Rural Water		Manages surface water licensed diversions in the upper Maribyrnong basin and groundwater licensed diversions in the whole of the basin		Operates Rosslynne Reservoir Obliged to meet passing flow requirements

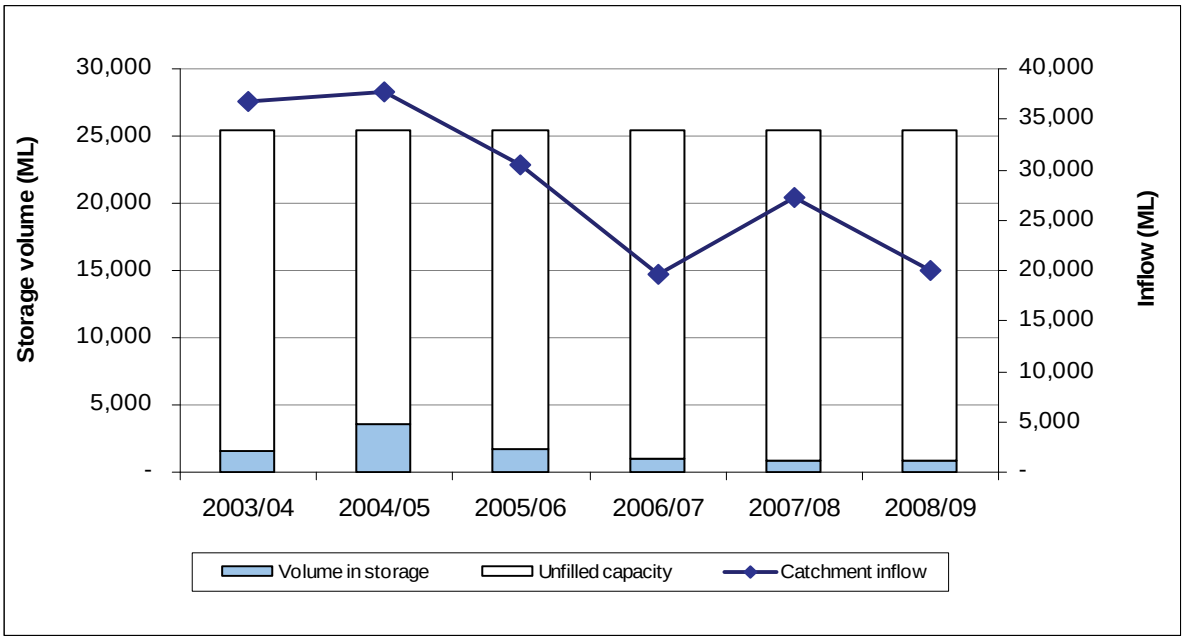
25.3 Rainfall, flows and storages in 2008/09

In 2008/09 the majority of the Maribyrnong basin experienced rainfall between 60% and 80% of the long term average.

Inflows into the Maribyrnong basin were again extremely low in 2008/09 at 18% of the long term average of 113,000 ML. This was similar to the volume recorded in 2006/07. The amount of water flowing into Port Phillip Bay in 2008/09 was 4,000 ML, compared with 11,000 ML in 2007/08. This represents 20% of the catchment inflows into the basin.

Rosslynne Reservoir, with a capacity of 25,368 ML, is the only storage greater than 1,000 ML located within the basin. The storage volume reduced from 900 ML in July 2008 to 800 ML in June 2009, or around 3% of total capacity.

Figure 25-1 All major storages and catchment inflows in the Maribyrnong basin



25.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Maribyrnong basin are shown in Table 25-2.

An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

Table 25-2 Summary of total water resources and water use in the Maribyrnong basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	20,900	6,800
Groundwater[2]	1,700	600
Recycled water	2,480	1,760

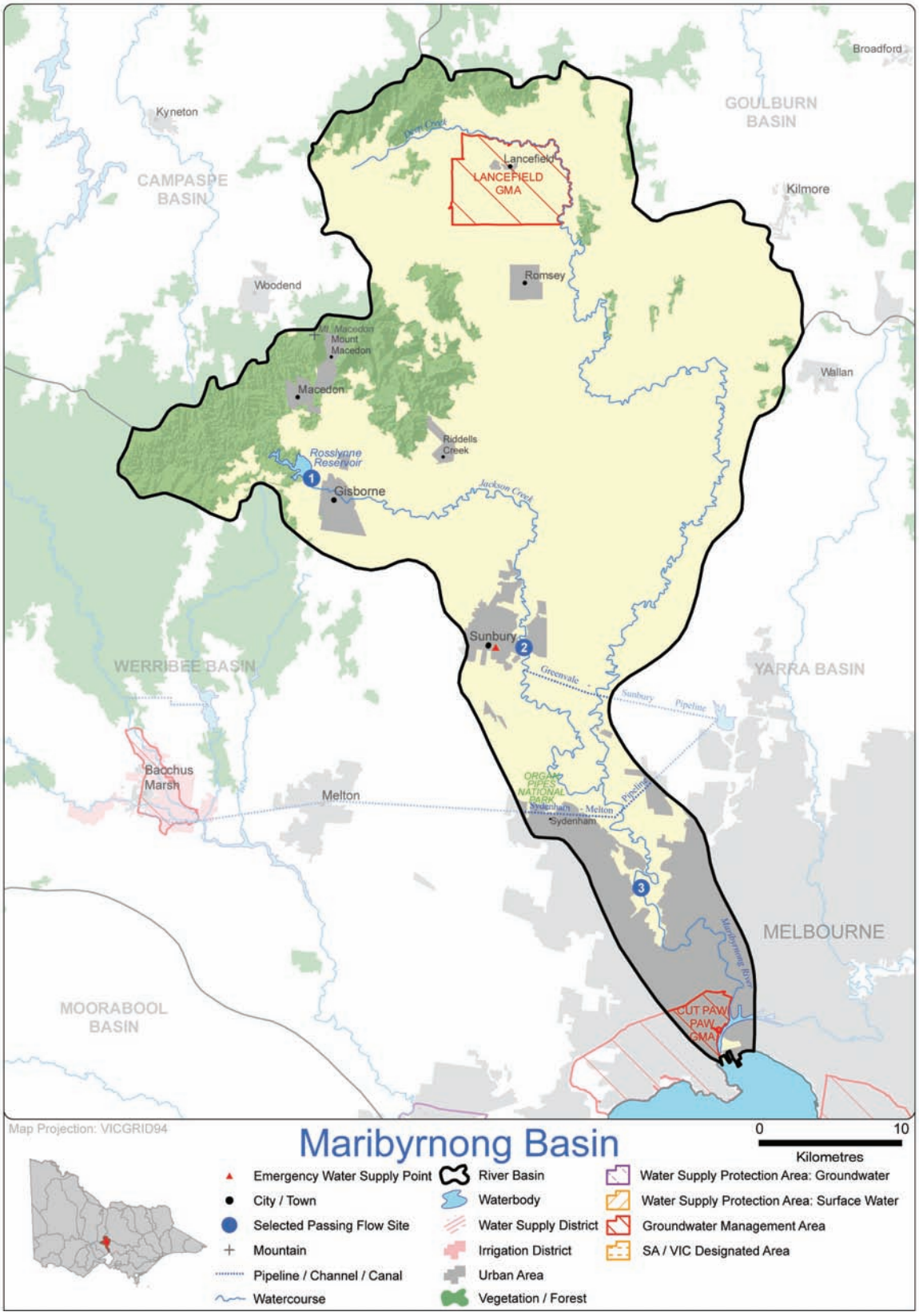
Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 25-6 and the estimated domestic and stock use presented in Table 25-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

25.5 Location of water resources

Figure 25-2 Map of the Maribyrnong basin



25.6 Surface water resources

25.6.1 Water balance

A surface water balance for the Maribyrnong basin is shown in Table 25-3.

Urban areas within the Maribyrnong basin do not rely heavily on the water resources of the basin. The area of the basin within the Melbourne metropolitan area receives its water supply from the Melbourne headworks system located in the Yarra, Thomson and Bunyip basins. Because the basin's local sources of water (e.g. Rosslynne Reservoir) have not received high inflows in recent years, Western Water almost totally relies on sourcing its water from the Melbourne system to supply its towns. The largest diversion of water in the Maribyrnong basin in 2008/09 was by small catchment dams.

Table 25-3 Balance of surface water in the Maribyrnong basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	900	1,100
Volume in storage at end of year	800	900
Change in storage	**-100**	**-200**
Inflows		
Catchment inflow(1)	20,000	25,900
Transfers from other basins(2)	220	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	720	970
Sub-total	**20,900**	**26,900**
Usage		
Urban diversions	560	920
Licensed diversions from regulated streams	200	200
Licensed diversions from unregulated streams	400	500
Small catchment dams(4)	5,600	7,800
Sub-total	**6,800**	**9,400**
Losses		
Net evaporation losses from major storages(3)	300	300
Evaporation from small catchment dams(4)	6,500	4,800
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	3,400	1,600
Sub-total	**10,200**	**6,700**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	4,000	11,000

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Transfers from the Melbourne system to Rosslynne Reservoir to maintain a buffer of emergency storage.

(3) Net evaporation estimate calculated.

(4) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(5) Losses estimated using loss functions from the Maribyrnong REALM.

25.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 25-4 are based on the estimates from the Department of Sustainability and Environment as per Chapter 5.

Table 25-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,800	2,100	n/a
Registered commercial and irrigation	5,800	3,500	n/a
Total	**11,600**	**5,600**	**12,100**

n/a: Information not available.

25.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

25.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 25-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

Similar to 2007/08, almost no water was taken for irrigation from the regulated part of the Maribyrnong River during the year. Western Water sourced the majority of its water from its Yarra bulk entitlement. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 25-5 Volume of water diverted under surface water entitlements in the Maribyrnong basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance? (2)
Western Water					
Gisborne – Barringo Creek	1	320	0	6	Yes
Lancefield	1	315	0	33	Yes
Macedon and Mt Macedon(3)	1	645	0	239	Yes
Riddells Creek	1	300	0	40	Yes
Romsey	1	460	0	151	Yes
Maribyrnong (Rosslynne Reservoir)	1	6,100	0	89	Yes
Melbourne Water					
Maribyrnong(4)	5	1,396	0	179	Yes
Southern Rural Water					
Maribyrnong	1	382	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**9,918**	**0**	**737**	
Total annual volume of bulk entitlements 2007/08		**9,918**	**0**	**1,161**	
Licensed diversions from unregulated streams 2008/09		*1,905*	*0*	*359*	
Licensed diversions from unregulated streams 2007/08		*2,022*	*0*	*499*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Average bulk entitlement is 645 ML/yr, but up to 873 ML can be diverted in any one year.

(4) Increase in bulk entitlement volume from 5,800 ML to 6,980 ML over 5 year period.

25.7 Groundwater resources

The Maribyrnong basin contains the whole Lancefield GMA and part of the Cut Paw Paw GMA. Licensed groundwater entitlements and use for these GMAs in the Maribyrnong basin, excluding domestic and stock use, are presented in Table 25-6. Groundwater levels in the Lancefield GMA are declining, however insufficient observation bores are available to determine a trend for the Cut Paw Paw GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Maribyrnong basin was higher in 2008/09 compared with 2007/08. This is largely as a result of increased extractions from the Lancefield GMA during 2008/09.

Table 25-6 Licensed groundwater volumes, Maribyrnong basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit (ML/year[3]	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[6]	Total licensed groundwater use (ML) 2007/08	Total licensed groundwater use (ML) 2006/07
Cut Paw Paw GMA (23%)	>50	848	165	16	0	16	56
Lancefield GMA (100%)	All depths	1,485	1,390	429	2	431	363
Total[5]		**2,333**	**1,555**	445	2	447	**419**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(5) Total volumes are based on the sum of management unit data prior to rounding.
(6) Non-metered use includes dairy wash and low consumption commercial use.

An estimate of domestic and stock groundwater use is provided in Table 25-7.

Table 25-7 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cut Paw Paw GMA (23%)	1	3
Lancefield GMA (100%)	80	160
Total	**81**	**163**

Note:
(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 25-6.
(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Total volumes are based on the sum of management unit data prior to rounding.

Within the Maribyrnong basin, groundwater is used as an urban water supply for the township of Lancefield. The licensed entitlements and metered use for this supply is provided in Table 25-8.

Table 25-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Lancefield	585	133	150

25.8 Drought contingency measures

A number of drought contingency measures were implemented in the Maribyrnong basin in 2008/09. These include:

- restricting urban and rural water use (discussed below)
- transferring entitlement
- a temporary qualification of rights as detailed in Table 25-9.

Western Water transferred 218 ML of its Yarra bulk entitlement to Rosslynne Reservoir to maintain a buffer volume for emergency storage.

Table 25-9 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights to water in the Maribyrnong River 2008	1 December 2008 to 30 June 2009	Reduced passing flow requirements	Reduces passing flow obligations to maintain levels in Rosslynne Reservoir for emergency supplies

25.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 25-10.

Licensed diverters on the regulated Maribyrnong River were again denied an allocation. The majority of Western Water's urban customers were supplied from the Melbourne system all year and were subsequently kept on Stage 3a restrictions.

Groundwater use was unrestricted in the Maribyrnong basin during 2008/09.

Table 25-10 Seasonal allocations and restrictions on water use in Maribyrnong basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	City West Water customers and Western Water customers (except in Lancefield)	Stage 3a restrictions from July 2008 to June 2009
	Sunbury and Bulla	Stage 3a restrictions from July 2008 to June 2009
	Romsey, Macedon, Mt Macedon, Riddells Creek and Gisborne	Stage 3a restrictions from July 2008 to June 2009
	Lancefield	Stage 2 restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Barringo Creek, Bolinda Creek, Deep Creek	Irrigation ban July 2008 to June 2009
	Riddells Creek	Irrigation ban July 2008 to June 2009
	Witch Creek	Irrigation ban July 2008 to June 2009
	Jacksons Creek	0% of licensed volume July 2008 to April 2009, irrigation ban from May to June 2009
	Maribyrnong River	Irrigation ban on winter fill licences in July to September 2008 Irrigation ban in October 2008 to June 2009
Irrigation and regulated diversions (Southern Rural Water)	Jacksons Creek	0% of licensed volume July 2008 to April 2009, irrigation ban from May to June 2009
Irrigation and regulated diversions (Melbourne Water)	Maribyrnong River	No releases from Rosslynne reservoir were made for entitlement holders on the Maribyrnong River in 2008/09

25.10 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall, 55% of the wastewater was reused in 2008/09, an increase of 4% on the proportion reused in 2007/08. The increase is largely due to an increase in reuse for urban and industrial purposes.

Table 25-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Gisborne	455	331	57%	261	0	0	70	124	0
Riddells Creek	125	125	100%	0	125	0	0	0	0
Romsey	209	209	100%	50	159	0	0	0	0
Sunbury	1,691	1,100	46%	370	410	0	320	591	0
Total 2008/09	**2,480**	**1,765**	**55%**	**681**	**694**	**0**	**390**	**715**	**0**
Total 2007/08	2,337	1,365	51%	419	772	0	174	972	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

25.11 Water for the environment

25.11.1 Environmental Water Reserve (EWR)

Important environmental assets such as the Australian Grayling and native grassland are dependent on the Maribyrnong EWR.

In 2008/09 the Maribyrnong basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Western Water and Southern Rural Water
- water set aside for the environment through the operation of licensed diversions with passing flow conditions (regulated and unregulated waterways)
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

25.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Melbourne Water reported that 40 ML was released from Rosslynne Reservoir in May 2009 to improve water quality in key refuge habitat areas downstream of Rosslynne Reservoir.

Western Water reported that it complied with the requirements of its bulk entitlements, while Southern Rural Water met the qualified requirements.

Table 25-12 shows the passing flow requirements in the Maribyrnong basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

Table 25-12 Selected passing flow requirements in the Maribyrnong basin

River	Passing flow	
Maribyrnong River, Jacksons Creek	Instrument where passing flows are specified	Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000, amended 2004
	Responsible authority	Southern Rural Water
	Compliance point	Gisborne gauging station (shown as 1 in Figure 25-2)
	Passing flow compliance	The lesser of 3 ML/day or natural flow was passed
	Compliance point	Sunbury gauging station (shown as 2 in Figure 25-2)
	Passing flow compliance	The lesser of 10 ML/day or natural flow was passed
	Compliance point	Keilor gauging station (shown as 3 in Figure 25-2)
	Passing flow compliance	The lesser of 5 ML/day or natural flow was passed

25.11.3 Streamflow management plans (SFMPs)

Work continued in preparation for the development of an SFMP for the upper Maribyrnong River.

26 Werribee basin

This chapter sets out the accounts for the Werribee basin. For detailed information about how they have been compiled, refer to Chapter 5.

26.1 Werribee basin summary

Inflows in the Werribee basin in 2008/09 were extremely low at 14% of the long term average, less than those experienced in 2006/07. As a consequence, levels in the basin's storage reservoirs continued to decline and by the end of the year were holding 6% of capacity.

The lack of water reserves and system recovery meant that water users within the Werribee basin were again severely restricted. Irrigators in the Bacchus Marsh and Werribee irrigation districts received a 5% allocation, while Western Water relied completely on Melbourne's supplies for its towns such as Melton and Bacchus Marsh. These towns were subject to Stage 3a restrictions throughout the year, in line with Melbourne. Towns supplied by Central Highlands Water were also placed on severe restrictions over the year.

In the Werribee Irrigation District, rural customers continued to rely heavily on the Werribee recycled water scheme, while Southern Rural Water again implemented a number of drought contingency measures to help supplement rural supplies in the Bacchus Marsh Irrigation District. This included pumping dead storage from Pykes Creek reservoir and continuing to access unallocated water in Lake Merrimu through a qualification of rights. Southern Rural Water also transferred 2,000 ML from its drought reserve stored in the Thomson Reservoir to the basin for use in both Werribee and Bacchus Marsh Irrigation Districts.

Entitlements in the Deutgam Water Supply Protection Area were qualified during the year, restricting groundwater access around Werribee. Licensed diverters on the Lerderderg River and Kororoit Creek were banned the entire year.

26.2 Responsibilities for management of water resources

Table 26-1 shows the responsibilities of various authorities within the Werribee basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 26-1 Responsibilities for water resources management within the Werribee basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages Werribee and Bacchus Marsh irrigation districts	Manages groundwater and surface water licensed diversions		Operates Pykes Creek Reservoir, Melton Reservoir and Merrimu Reservoir Obliged to meet passing flow requirements
Western Water			Supplies towns in the north of the basin including Melton and Bacchus Marsh	Operates Djerriwarrh Reservoir Obliged to meet passing flow requirements
Melbourne Water		Manages surface water licensed diversions for lower reaches of Kororoit Creek	Provides bulk water to City West Water and Western Water from the Thomson/Yarra system Operates the Western Treatment Plant and supplies recycled water to Southern Rural Water	Manages waterways, drainage and floodplains in all of the Werribee basin
City West Water			Supplies towns and manages wastewater in metropolitan Melbourne	
Central Highlands Water			Supplies Blackwood and Ballan	Obliged to meet passing flow requirements

26.3 Rainfall, flows and storages in 2008/09

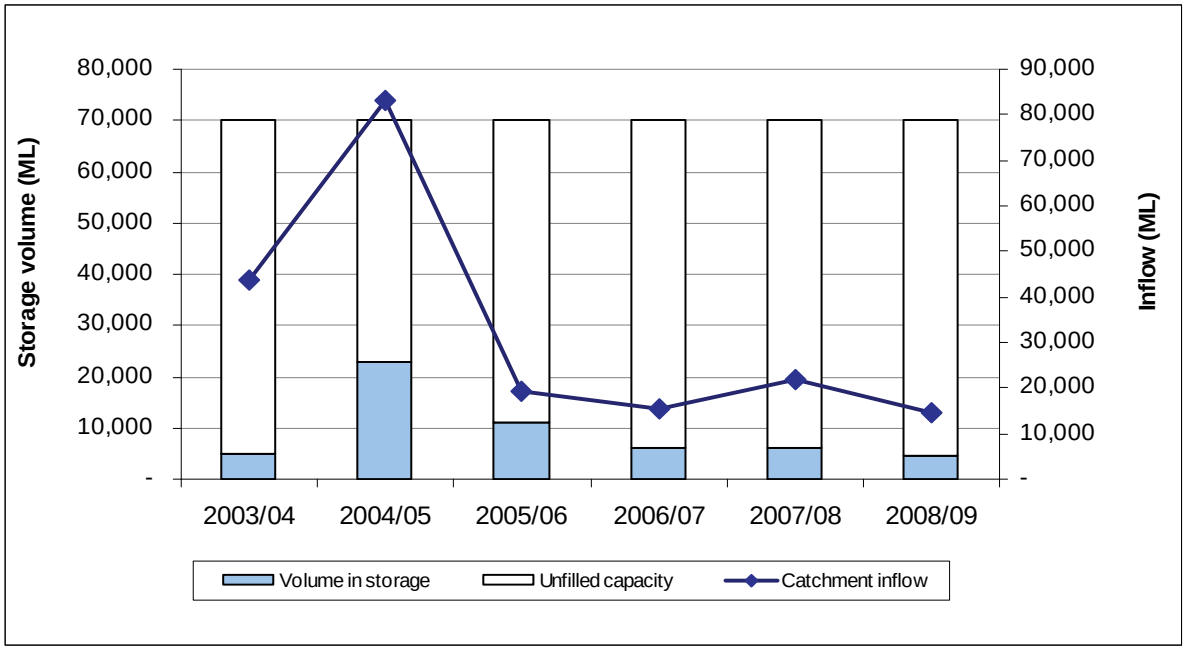
In 2008/09, rainfall in the Werribee basin ranged between 60% and 80% of the long term average. Inflows into the Werribee basin were extremely low at 14% of the long term average (of 102,000 ML).

In 2008/09 300 ML of water flowed from the Werribee basin into Port Phillip Bay. This represents 2% of the catchment inflows into the basin. About 500 ML flowed into Port Phillip Bay in 2007/08.

Storage levels for all major storages in the basin decreased from 6,000 ML in July 2008 to 4,400 ML by June 2009, or 6% of the total storage capacity of 69,980 ML. Major storages are defined as those greater than 1,000 ML capacity, with the exception of Djerriwarrh Reservoir, which has a capacity of 983 ML and is included in the total storage capacity in the Werribee basin.

Only volumes for major on-stream storages have been included in the water balance. In the Werribee basin this includes the Melton, Merrimu and Pykes Creek Reservoir, as well as Djerriwarrh Reservoir.

Figure 26-1 All major storages and catchment inflows in the Werribee basin



26.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Werribee basin are shown in Table 26-2.

Table 26-2 Summary of total water resources and water use, Werribee basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	14,600	8,600
Groundwater[2]	6,100	400
Recycled water	146,690	58,380

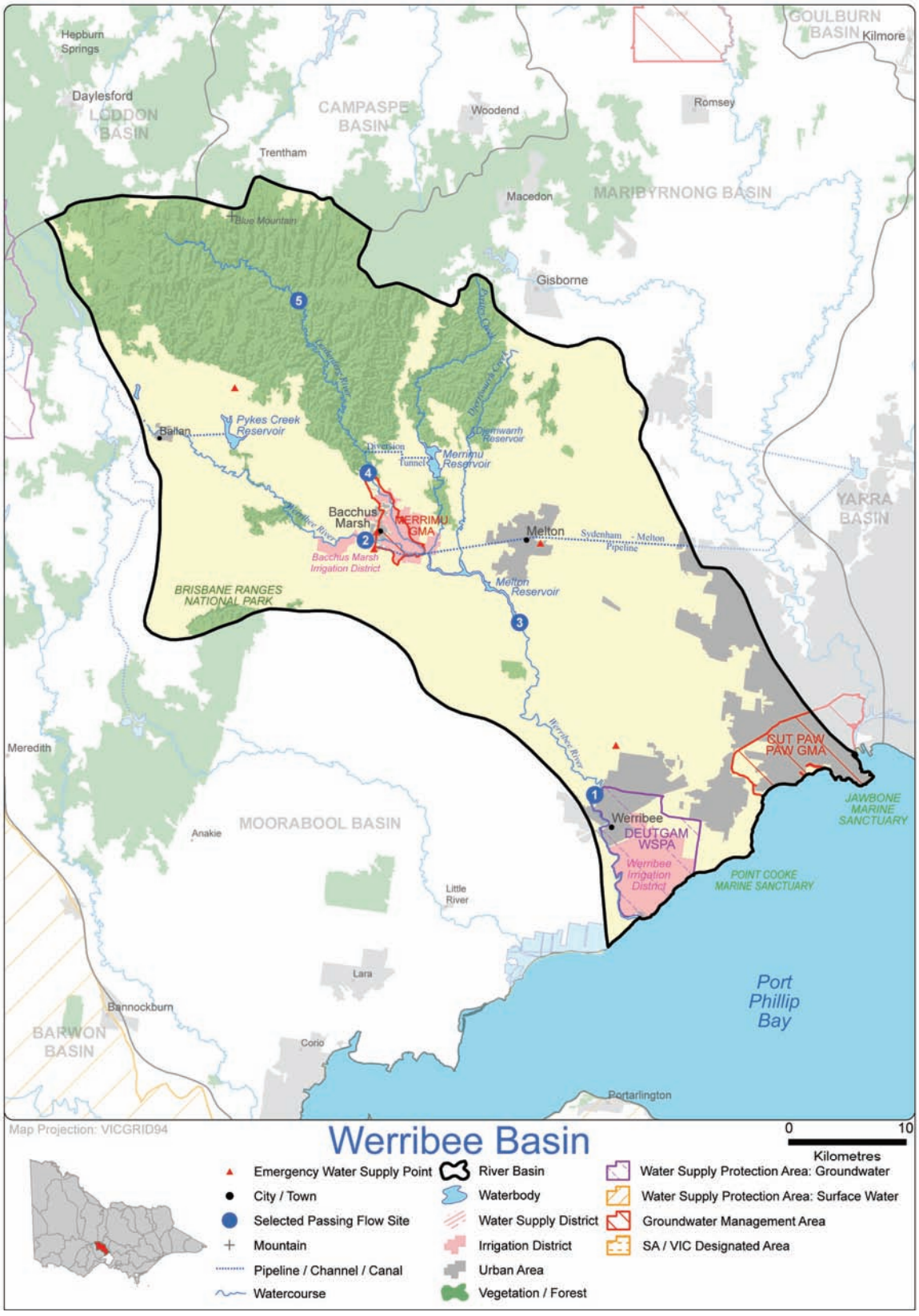
Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 26-8 and the estimated domestic and stock use presented in Table 26-9.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

26.5 Location of water resources

Figure 26-2 Map of the Werribee basin



26.6 Surface water resources

26.6.1 Water balance

A surface water balance for the Werribee basin is shown in Table 26-3. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance, with the exception of Djerriwarrh Reservoir. In the Werribee basin, this includes Melton Reservoir, Merrimu Reservoir and Pykes Creek Reservoir.

Table 26-3 Balance of surface water in the Werribee basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	6,000	6,000
Volume in storage at end of year	4,400	6,000
Change in storage	**-1,600**	**0**
Inflows		
Catchment inflow(1)	14,500	23,600
Transfers from other basins(2)	0	1,000
Return flow from irrigation	100	0
Treated wastewater discharged back to river	0	0
Sub-total	**14,600**	**24,600**
Usage		
Urban diversions	100	500
Irrigation district diversions	3,400	2,800
Licensed diversions from unregulated streams	200	300
Small catchment dams(3)	4,900	9,300
Sub-total	**8,600**	**12,900**
Losses		
Net evaporation losses from major storages(4)	1,200	100
Evaporation from small catchment dams(3)	2,500	5,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	3,600	5,700
Sub-total	**7,300**	**11,200**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	300	500

Notes:

(1) Inflows have been calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Qualification of rights approved transfer of water to the Werribee and Bacchus Marsh irrigation districts under Southern Rural Water's Irrigation Districts Diversion bulk entitlement. A transfer of 2,000 ML is accounted for in Table 20-8 as part of the volume of water diverted under the Thomson/Macalister bulk entitlement.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) No estimates provided for Melton, Merrimu and Pykes Creek reservoirs for 2007/08.

(5) Losses estimated using loss functions from the Werribee REALM.

26.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 26-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 26-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,900	1,500	n/a
Registered commercial and irrigation	7,600	3,400	n/a
Total	**13,500**	**4,900**	**7,400**

n/a: Information not available.

26.6.3 Water entitlement transfers

Due to the unbundling of water entitlements in the regulated systems of southern Victoria on 1 July 2008, some water rights within the Werribee system were unbundled for this first time in this water year.

Surface water was moved into, out of and within the Werribee basin during 2008/09 through water share transfers and variations and allocation trade. There was no trade of temporary or permanent trade of bundled entitlements within the basin in this year. During 2008/09 there was no net movement of water into the Werribee basin.

Table 26-5 summarises the movement of water shares into and out of the Werribee basin delivery systems during 2008/09.

Table 26-5 Transfers and variations of water shares in the Werribee basin, 2008/09[(1)(2)]

Delivery system	High reliability water shares			Low and spill reliability water shares		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Bacchus Marsh Irrigation District	37	37	0	17	17	0
Werribee Irrigation District	178	178	0	47	47	0
Werribee River	59	59	0	29	29	0
Total	**274**	**274**	**0**	**93**	**93**	**0**

Notes:

(1) This table summarises all recorded water share transfers and variations in the Werribee basin delivery systems during 2008/09. Some other trades were in progress at the end of the year and will be finalised in 2009/10.

(2) Transfer applications result in a change of ownership. In some cases the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water/land sale are also included in this table.

Table 26-6 summarises the trade of allocation in Victoria's share of the Werribee basin during 2008/09. The only trade in allocation that occurred in this year was within the Werribee basin.

Table 26-6 Allocation trade in the Werribee basin, 2008/09[(1)(2)]

Allocation trade type	Volume traded (ML)
Trade within Werribee basin	53
Trade from other Victorian basins	0
Trade to other Victorian basins	0
Interstate trade - inbound	0
Interstate trade - outbound	0
Total trade into the Werribee basin	**53**
Net trade into the Werribee basin	**0**

(1) This table summarises allocation trades approved into, out of and within the Victorian Werribee basin trading zones (Zone 31AD Bacchus Marsh District, Zone 31 BR Lower Werribee Diverters and Zone 31 BD Werribee District) compared with trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) This table includes trades into and out of the trading 'pool'. This means for example that when someone sold 10 ML of allocation to the pool, and another person bought that 10 ML from the pool, it is reported as a total of 20 ML traded.

26.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 26-7. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 26-7 Volume of water diverted under surface water entitlements in the Werribee basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
Central Highlands Water					
Ballan	1	451	0	0	Yes
Blackwood and Barry's Reef	1	140	0	33	Yes
Western Water					
Myrniong	1	58	0	32	Yes
Werribee system – urban	1	8,500	0	32	Yes
Southern Rural Water					
Werribee system	1	27,040	0	3,445	Yes
Total annual volume of bulk entitlements 2008/09		**36,189**	**0**	**3,542**	
Total annual volume of bulk entitlements 2007/08		**36,189**		**3,277**	
Licensed diversions from unregulated streams 2008/09[2]		*1,221*		*224*	
Licensed diversions from unregulated streams 2007/08		*1,616*		*261*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) Reduction in licensed volume for diversion from unregulated stream due to reduction in irrigation license volume.

26.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Werribee basin, excluding domestic and stock use, is presented in Table 26-8.

The Werribee basin contains the whole Deutgam WSPA and Merrimu GMA as well as part of the Cut Paw Paw GMA. Groundwater levels in the Deutgam WSPA and Merrimu GMA are respectively stable and declining. Insufficeint observation bores were available to determine a water levels trends for the Cut Paw Paw GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

The volume extracted from the Cut Paw Paw GMA and Deutgam WSPA decreased in 2008/09 compared with 2007/08. The volume extracted from the Merrimu GMA increased in 2008/09 compared with 2007/08, resulting in an increase in licensed groundwater use across the basin of 36% compared with 2007/08.

Use from the Deutgam WSPA reduced further during 2008/09 as a result of restrictions imposed on extractions, based on the continuing threat to the quality and quantity of groundwater within the WSPA.

Table 26-8 Licensed groundwater volumes, Werribee basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Cut Paw Paw GMA (77%)	>50	2,802	545	52	0	52	185
Merrimu GMA (100%)	≤30	451	400	264	2	266	13
Deutgam WSPA (100%)	≤30	5,090	5,100	24	25	49	72
Total[6]		**8,343**	**6,045**	**340**	**27**	**366**	**270**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 26-9. The estimated domestic and stock use in 2008/09 is considerably less than 2007/08 due to the ban on extractions from the Deutgam WSPA during 2008/09.

Table 26-9 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cut Paw Paw GMA (77%)	5	10
Merrimu GMA (100%)	16	32
Deutgam WSPA (100%)[4]	222	0
Total	**243**	**42**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the Table 26-8.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

(4) Rights on extractions from Deutgam WSPA qualified during 2008/09, including for domestic and stock use.

Groundwater is not used to supplement urban supplies in the Werribee basin.

26.8 Drought contingency measures

A number of drought contingency measures were implemented in the Werribee basin in 2008/09. These included:

- restricting urban and rural water use (discussed below)
- water carting
- pumping dead storage
- accessing unallocated water
- transferring entitlement
- supplementing supplies with recycled water
- the continuation of temporary qualifications of rights as detailed in Table 26-10.

Western Water and Central Highlands Water supplemented urban supplies through water carting in 2008/09. Western Water carted 1.8 ML from Bacchus Marsh to Myrniong, while Central Highlands Water carted water to Blackwood from Ballarat.

In the Werribee Irrigation District, rural customers continued to rely heavily on the Werribee Recycled Water Scheme, while Southern Rural Water again implemented a number of drought contingency measures to help supplement rural supplies in the Bacchus Marsh Irrigation District. These included pumping dead storage from Pykes Creek Reservoir and continuing to access unallocated water in Lake Merrimu through a qualification of rights.

Southern Rural Water also transferred 2,000 ML from its drought reserve stored in the Thomson Reservoir to the basin for use in both Werribee and Bacchus Marsh irrigation districts.

The Minister for Water declared two qualifications of rights in the Werribee basin in 2008/09. Details of these qualifications are presented in Table 26-10.

Table 26-10 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Temporary Qualification of Rights in the Werribee Water System October 2007	1 July 2008 to 30 June 2009 (continued from 20 October 2007)	Access to unallocated water provided	Allows Southern Rural Water access to the remaining 490 ML of the 1,200 ML of unallocated water in Lake Merrimu (not used in 2007 qualification) as well as a further 310 ML to maintain the viability of critical businesses relying on water from the Bacchus Marsh irrigation system
Temporary Qualification of Rights in the Deutgam Water Supply Protection Area June 2008	1 July 2008 to 30 June 2009	Differential access by priority entitlements	Due to continuing risk of saline intrusion, all groundwater irrigation and domestic and stock rights suspended except for four cases: chicken fogging, underpass dewatering, school grounds, aquaculture facility. These cases had reductions instead of suspensions, except for underpass where no change to entitlement

26.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions on unregulated streams and groundwater extractions are shown in Table 26-11.

The lack of water reserves and system recovery meant that water users within the Werribee basin were again severely restricted. Irrigators in the Bacchus Marsh and Werribee irrigation districts received a 5% allocation, while Western Water relied completely on Melbourne's supplies to supply its towns, such as Melton and Bacchus Marsh. These towns were subject to Stage 3a restrictions throughout the year in line with Melbourne. Towns supplied by Central Highlands Water were also placed on severe restrictions over the year.

Groundwater entitlements in the Deutgam Water Supply Protection Area were qualified during the year, restricting groundwater access around Werribee.

Licensed diverters on the Lerderderg River and Kororoit Creek were banned the entire year.

Table 26-11 Seasonal allocations and restrictions on water use in Werribee basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Ballan	Stage 4 restrictions from July 2008 to June 2009
	Barry's Reef and Blackwood	Stage 3 restrictions from July 2008 to June 2009
	Toolern and Diggers Rest	Stage 3a restrictions from July 2008 to April 2009
	Myrniong, Bacchus Marsh and Melton	Stage 3a restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Lerderderg River	Irrigation ban from July 2008 to June 2009
	Kororoit Creek	Irrigation ban from July 2008 to June 2009
Irrigation and regulated diversions	Werribee system (Werribee Irrigation District and Bacchus Marsh Irrigation District)	Opening allocation of 2% of high reliability water shares in August 2008 Final allocation of 5% of high reliability water shares
Groundwater	Deutgam WSPA	Access to groundwater restricted throughout 2008/09. Exemptions applied

26.10 Recycled water

Five wastewater treatment plants operate within the Werribee basin. The volume of wastewater produced during 2008/09 was 146,685 ML, an increase of 2,057 ML compared with 2007/08. Around 40% of wastewater was reused in 2008/09.

The majority of water recycling in the basin occurs at Melbourne Water's Western Treatment Plant, which reused 40% of wastewater, including 23,888 ML for on-site irrigation and environmental management and 16,825 ML for habitat management at Ramsar-listed wetlands.

Table 26-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				To retailers	Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Altona	4,383	71	0%	0	0	0	0	71	0	4,312
Ballan	38	38	100%	0	0	38	0	0	0	0
Melton	2,874	2,874	91%	0	800	1,815	0	259	0	0
Parwan (Bacchus Marsh)	554	554	100%	0	0	554	0	0	0	0
Western Treatment Plant	138,836	54,847	40%	13,876	258	23,888	16,825	0	0	83,989
Total 2008/09	**146,685**	**58,384**	**40%**	**13,876**	**1,058**	**26,295**	**16,825**	**330**	**0**	**88,301**
Total 2007/08	**144,628**	**60,657**	**42%**	**12,814**	**1,092**	**30,552**	**15,930**	**270**	**0**	**83,971**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

26.11 Water for the environment

26.11.1 Environmental Water Reserve (EWR)

Important environmental assets such as the Australian Grayling, Tupong and Red Gums are dependent on the Werribee basin EWR.

In 2008/09 the Werribee basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water, Western Water and Southern Rural Water
- water set aside for the environment through the operation of licensed diversions with passing flow conditions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive use.

26.11.2 Passing flow compliance

Bulk entitlements require passing flows to be met at a number of points in the basin.

Western Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Werribee basin.

Southern Rural Water did not report any incidences of non-compliance of its passing flow obligations.

Table 26-13 shows the passing flow compliance in the Werribee basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

Table 26-13 Selected passing flow compliance in the Werribee basin

River	Passing flow	
Werribee River and tributaries	Instrument where passing flows are specified	Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997 (amended 2005)
	Responsible authority	Southern Rural Water
	Compliance point	Upper Werribee Diversion Weir (shown as 1 in Figure 26-2)
	Passing flow compliance	• The lesser of 5 ML/day or the natural inflow were passed downstream of the Upper Werribee diversion weir
	Compliance point	Bacchus Marsh Diversion Weir (gauging station) (shown as 2 in Figure 26-2)
	Passing flow compliance	The following passing flow rules were applied: • The lesser of 12 ML/day continuous flow (averaged over any 7 day period) or the natural inflow, or • The sum of the lesser of at least 5 ML/day continuous flow or the natural inflow AND other intermittent flows from deliberate releases or spills Passing flow requirements were met during 2008/09
	Compliance point	Melton Reservoir (shown as 3 in Figure 26-2)
	Passing flow compliance	Passing flows were based on the following rules for May to August (inclusive): • The lesser of 15 ML/day continuous flow or the natural inflow if the reservoir is above target for that month, or • The lesser of 15 ML/day (averaged over any 7 day period) or the natural inflow averaged over the same period if the level is at or below the following target for that month: • Targets in May, June and July are 6,500 ML, target in August is 9,000 ML • If the natural flow here is less than 15 ML/day, the passing flow is to be shared between all authorities having a share of Lake Merrimu capacity and their volume of storage will be adjusted accordingly Passing flow requirements were met during 2008/09
	Compliance point	Below the Lerderderg Diversion Weir (shown as 4 in Figure 26-2)

	Passing flow compliance	The storage operator had to release passing flow according to the following passing flow rules:
		• A low flow equal to the lesser of 30 ML/day and the natural inflow
		• A fresh flow during the months of June to December inclusive of:
		  • 150 ML/day up to 5 times a year, and
		  • 1,500 ML/day for 24 hours in 3 out of 4 years if the instantaneous flow at this location exceeds 1,500 ML/day
		Passing flow requirements were met during 2008/09

	Compliance point	Below Werribee Diversion Weir (shown as 5 in Figure 26-2)
	Passing flow compliance	Passing flows were determined according to the following operational tolerances: • 10 ML/day if the declared seasonal allocation for the Werribee Irrigation District exceeds 130% of water right • 1 ML/day averaged over any 30 day period, if the declared seasonal allocation for the Werribee Irrigation District is equal to or less than 130% of water right Passing flow requirements were met during 2008/09

27 Moorabool basin

This chapter sets out the accounts for the Moorabool basin. For detailed information about how they have been compiled, refer to Chapter 5.

27.1 Moorabool basin summary

The Moorabool basin experienced yet another year of extremely dry conditions in 2008/09. At the end of the year, storages were holding 5% of capacity after the basin received 28,700 ML of inflows.

Although water use was down on previous years, evaporation rates remained high. As a consequence, only 1,000 ML of water left the basin.

Ballarat and Geelong are both partly supplied from the Moorabool basin. The lack of water available in the basin contributed to these cities being subject to severe water restrictions the entire year. Smaller townships supplied by local sources were also subject to severe restrictions, as were licensed diverters on the Moorabool River.

In addition to applying severe water restrictions, two temporary qualifications continued during the year. These retained environmental water in Lal Lal and Upper Western Moorabool reservoirs for emergency supplies to Ballarat, and enabled emergency water supplies to be delivered to Meredith.

The dry conditions also contributed to a near 50% increase in groundwater use in the basin. The increase can be largely attributed to Central Highlands Water's heavy reliance on groundwater to supplement Ballarat's supplies.

27.2 Responsibilities for management of water resources

Table 27-1 shows the responsibilities of various authorities within the Moorabool basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 27-1 Responsibilities for water resources management within the Moorabool basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water diversions		
Barwon Water			Supplies water to Greater Geelong area(1)	Manages reservoirs on the East Moorabool River and has a third of the share of Lal Lal Reservoir on the West Moorabool River Manages Stony Creek Reservoir on Stony Creek Obliged to meet passing flow requirements
Central Highlands Water			Supplies a number of towns in the Upper Moorabool basin including Gordon, Mt Egerton, Wallace, and the outskirts of Ballarat(2)	Manages reservoirs on the West Moorabool River and has a two-thirds of the share of Lal Lal Reservoir Obliged to meet passing flow requirements
Corangamite Catchment Management Authority				Responsible for waterway management in Moorabool basin

Note:

(1) Greater Geelong district's water supply is sourced from both the Barwon and Moorabool basins.

(2) The vast majority of Ballarat is outside the boundary of the Moorabool basin.

27.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Moorabool basin was generally between 40% and 80% of the long term average. This was lower than rainfall in 2007/08, which was between 60% to 100% of the long term average.

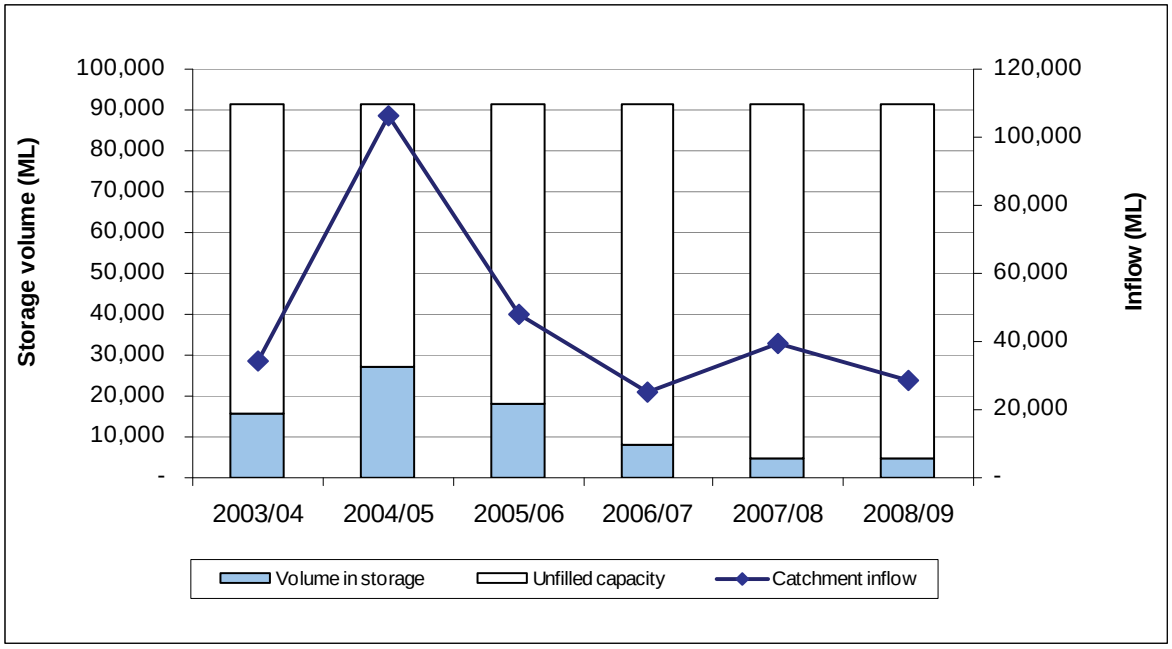
Catchment inflows in 2008/09 were 30% of the long term average of 97,000 ML. This is well below the inflows recorded in 2007/08.

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 1,000 ML in 2008/09, or 3% of the catchment inflows into the basin. This is around 300 ML lower than the outflow in 2007/08.

The Moorabool basin has six main storages: the Bostock, Upper Stony Creek, Korweinguboora, Lal Lal, Wilsons and Moorabool reservoirs. Lal Lal Reservoir accounts for about two thirds of total storage capacity in the basin. Storage levels for all major storages (greater than 1,000 ML) in the basin increased 2,950 ML in July 2008 to 4,800 ML by the end of June 2009, or about 5% of the total capacity of 31,320 ML.

Only volumes for major on-stream storages have been included in the water balance, and as such, Upper Stony Creek Reservoir has not been included. The volume of water in the major on-stream storages in the basin increased by 300 ML in 2008/09, from 3,100 ML to 3,400 ML.

Figure 27-1 All major storages and catchment inflows in the Moorabool basin



27.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Moorabool basin are shown in Table 27-2.

Table 27-2 Summary of total water resources and water use in the Moorabool basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	28,700	19,600
Groundwater[2]	3,900	3,300
Recycled water	0	0

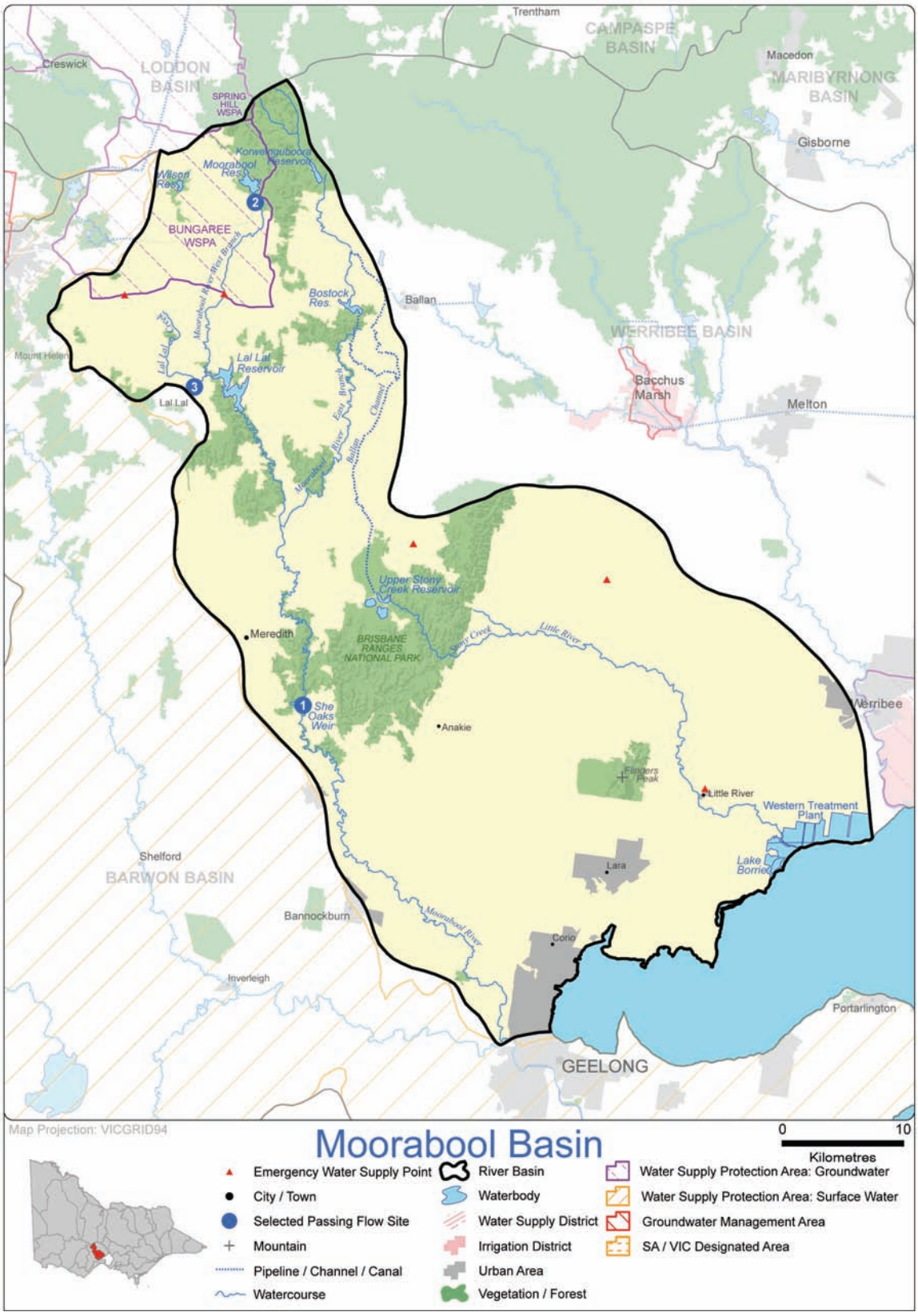
Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 27-7 and estimated domestic and stock use presented in Table 27-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

27.5 Location of water resources

Figure 27-2 Map of the Moorabool basin



27.6 Surface water resources

27.6.1 Water balance

A surface water balance for the Moorabool basin is shown in Table 27-3.

The majority of water used for consumptive purposes in the basin is sourced from small catchment dams.

Table 27-3 Balance of surface water in the Moorabool basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	3,100	3,800
Volume in storage at end of year	3,400	3,100
Change in storage	**300**	**-700**
Inflows		
Catchment inflow(1)	28,700	39,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**28,700**	**39,200**
Usage		
Urban diversions(2)	980	4,120
Transfers to Barwon basin (White Swan Reservoir)(2)	1,820	2,140
Licensed diversions from unregulated streams	1,500	1,100
Small catchment dams(3)	15,300	22,200
Sub-total	**19,600**	**29,600**
Losses		
Net evaporation losses from major storages	1,200	1,100
Evaporation from small catchment dams(3)	5,700	7,300
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	900	600
Sub-total	**7,800**	**9,000**
Water passed at outlet of basin		
River outflows to Port Phillip Bay (Little River)	600	900
River outflows to the Barwon River (Moorabool River)	400	400

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) The urban diversions figure of 980 ML represents water diverted from the Moorabool basin to directly supply urban customers in the Ballarat area (which falls in both the Moorabool basin and the Barwon basin), as well as urban customers in the Barwon basin. The transfer of 1,820 ML to the Barwon basin (to White Swan Reservoir) was also used to supply urban customers in the Ballarat area.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Losses estimated using loss functions from the Lower Barwon REALM and Moorabool REALM. The losses accounted for in the water balance do not include losses occurring between the point of water diversion from the Moorabool basin and the point of use.

27.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 27-4 below are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 27-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	6,100	2,100	n/a
Registered commercial and irrigation	22,800	13,200	n/a
Total	**28,900**	**15,300**	**21,000**

n/a - Information not available.

27.6.3 Water entitlement transfers

Surface water movement in the Moorabool basin was limited to transfers of bundled entitlement within the basin. In 2008/09, only 2 ML was traded on a temporary basis. There was no net movement of water into the Moorabool basin in this water year.

Table 27-5 summarises the movement of bundled entitlements in the Moorabool basin during 2008/09.

Table 27-5 Transfers of surface water bundled entitlements in the Moorabool basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Moorabool unregulated	0	0	0	2	2	0
Total 2008/09	**0**	**0**	**0**	**2**	**2**	**0**
Total 2007/08(1)	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

27.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 27-6.

Compliance with individual bulk entitlement volumes is deemed if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 27-6 Volume of water diverted under surface water entitlements in the Moorabool basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(2)
Barwon Water					
Lal Lal	3	7,000	0	80	Yes
Meredith	1	600	0	0	Yes
Upper East Moorabool System	1	9,000	0	0	Yes
She Oaks	3	2,000	0	364	Yes
Central Highlands Water					
Lal Lal	3	14,000	0	538	Yes
Upper West Moorabool System	1	10,500	0	1,822	Yes
Total annual volume of bulk entitlements 2008/09		**43,100**		**2,804**	
Total annual volume of bulk entitlements 2007/08		**43,100**	**0**	**6,280**	
Licensed diversions from unregulated streams 2008/09		*2,047*		*1,507*	
Licensed diversions from unregulated streams 2007/08		*2,047*		*1,121*	

Notes:
(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.
(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

27.7 Groundwater resources

A summary of the licensed entitlements and use for the Bungaree WSPA in the Moorabool basin, excluding domestic and stock use, is presented in Table 27-7. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

During 2008/09 usage within the Bungaree WSPA increased by almost 50% compared with 2007/08. This is as a result of the ongoing use of the aquifer as a supplementary supply for Ballarat.

Table 27-7 Licensed groundwater volumes, Moorabool basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[5]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Bungaree WSPA (67%)	All depths	3,544	3,544	2,919	10	2,929	1,968
Total[6]		**3,544**	**3,544**	**2,919**	**10**	**2,929**	**1,968**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(5) Non-metered use includes dairy wash and low consumption commercial use.
(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 27-8.

Table 27-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Bungaree WSPA (67%)	181	362
Total	**181**	**362**

Note:
(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the Table 27-7.
(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is generally not used to supplement urban supplies in the Moorabool basin. However, during 2008/09 an interim licence (175 ML entitlement) was in place to supplement Ballarat's urban supplies from the Bungaree WSPA. The interim licence expired on 30 June 2009, with 108 ML extracted during 20008/09.

27.8 Drought contingency measures

A number of drought contingency measures were undertaken in the Moorabool basin in 2008/09. These include:

- restricting urban and rural water use (discussed in section 27.9)
- water carting
- continuation of a temporary qualifications of rights as detailed in Table 27-9.

Barwon Water carted between 0.2 and 0.6 ML of water per day from Lethbridge to Meredith due to insufficient inflows and poor water quality in the Moorabool River.

The Minister for Water declared two qualifications of rights in the Moorabool basin in 2007/08 that were still in place during 2008/09. Details of these qualifications are presented in Table 27-9.

Table 27-9 Qualifications of rights

Legal instruments	Dates	Qualification type	Qualification description
Declaration of Temporary Qualification of Rights in the Moorabool White Swan Water Supply System July 2007	1 July 2008 to 30 June 2009 (continued from 1 July 2007)	Access to unallocated water provided	Ceases passing flows from the Upper West Moorabool Reservoir, Lal Lal Reservoir and White Swan Reservoir (located in the Barwon basin), as short term emergency relief for the Ballarat water supply system

27.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 27-10.

Ballarat and Geelong are both partly supplied from the Moorabool basin. The lack of water available in the basin contributed to these cities being subject to severe water restrictions the entire year. Smaller townships supplied by local sources were also subject to severe restrictions, as were licensed diverters on the Moorabool River.

Groundwater use was unrestricted in the Moorabool basin during 2008/09.

Table 27-10 Seasonal allocations and restrictions on water use in Moorabool basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Greater Geelong and other towns served by Barwon Water in the Moorabool basin including Meredith, Lethbridge, Anakie, Bannockburn, Little River	Stage 4 restrictions with general exemptions from July 2008 to June 2009
	Towns served by Central Highlands Water located in the Moorabool basin but part of the Ballarat system, including Bungaree, Wallace, Gordon and Mt Egerton	Stage 4 restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Moorabool River	Irrigation ban from June 2008 to July 2009

27.10 Recycled water

There are no wastewater treatment plants within the Moorabool basin.

27.11 Water for the environment

27.11.1 Environmental Water Reserve (EWR)

Important environmental assets such as River Blackfish and Australian Grayling depend on the Moorabool basin EWR, as does Hovells Creek Estuary, which is part of Port Phillip Bay.

In 2008/09 the Moorabool basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Central Highlands Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

27.11.2 Passing flow compliance

Barwon Water reported overall compliance with minimum passing flow requirements for 2008/09, however minor instances of non-compliance with daily passing flows occurred at some sites due to streamflow variations and difficulty in determining daily extraction rates, as well as storages being close to empty and off-line.

Central Highlands Water's passing flow obligations in the Moorabool basin, under both the Upper West Moorabool bulk entitlement and the Lal Lal bulk entitlement, were ceased following temporary qualification of rights (July 2007 to June 2009). However, four pulsed releases of 80 ML each from the environmental release were made in accordance with the catchment management authority's requirements, with a total of 320 ML released from Lal Lal Reservoir between November 2008 and April 2009.

Table 27-11 shows the passing flow compliance in the Moorabool basin for selected bulk entitlement compliance points. While there are other compliance points in the basin, the points below have been chosen as they were judged to be of community interest.

Table 27-11 Selected passing flow compliance in the Moorabool basin

River	Passing flow	
Moorabool River	Instrument where passing flows are specified	Bulk Entitlement (She Oaks) Conversion Order 1995
	Responsible authority	Barwon Water
	Compliance point	She Oaks diversion weir (shown as 1 in Figure 27-2)
	Passing flow compliance	• Qualification of rights in place for 2008/09, hence no flows were passed • Requirement is the lesser of 40 ML/day or natural flow
West Moorabool River	Instrument where passing flows are specified	Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995
	Responsible authority	Central Highlands Water
	Compliance point	Moorabool reservoir (shown as 2 in Figure 27-2)
	Passing flow compliance	Qualification of rights in place for 2008/09, hence no flows were passed
West Branch Moorabool River	Instrument where passing flows are specified	Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995
	Responsible authority	Central Highlands Water
	Compliance point	Lal Lal Reservoir (shown as 3 in Figure 27-2)
	Passing flow compliance	Qualification of rights in place for 2008/09, hence no flows were passed

28 Barwon basin

This chapter sets out the accounts for the Barwon basin. For detailed information about how they have been compiled, refer to Chapter 5.

28.1 Barwon basin summary

Inflows in the Barwon basin were low at 23% of the long term average, however low surface water use meant that storage levels ended the year slightly higher than where they began,

Barwon Water reduced its demands on surface water by maintaining severe restrictions for Geelong and supplementing its supplies with groundwater from the Barwon Downs borefield. The Barwon Downs borefield has been a vital resource for Geelong over the past three years, supplying around 45% of its demand during this period.

Central Highlands Water maintained severe restrictions for Ballarat, which is partly supplied from the northern part of the basin via White Swan Reservoir. Inflows to this reservoir were supplemented by retaining environmental flows under a qualification of rights and by transfers from the Goldfields Superpipe, which transferred 11,420 ML from the Campaspe system. The Superpipe was crucial for Ballarat in 2008/09, as without it Central Highlands Water would have been unable to maintain its supplies for the entire year.

Licensed diverters from the Barwon and Leigh rivers and Boundary Creek were again placed on severe restrictions or banned for periods throughout 2008/09.

28.2 Responsibilities for management of water resources

Table 28-1 shows the responsibilities of various authorities within the Barwon basin.

Table 28-1 Responsibilities for water resources management within the Barwon basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
Barwon Water			Supplies water to Greater Geelong area(1)	Operates reservoirs in the West Barwon system Obliged to meet passing flow requirements
Central Highlands Water			Supplies water to the Ballarat district	Operates reservoirs in the Ballarat supply system Obliged to meet passing flow requirements
Corangamite Catchment Authority				Manages waterways for the whole of the Barwon basin

Note:

(1) Geelong's water supply is sourced from both the Barwon and Moorabool basins.

28.3 Rainfall, flows and storages in 2008/09

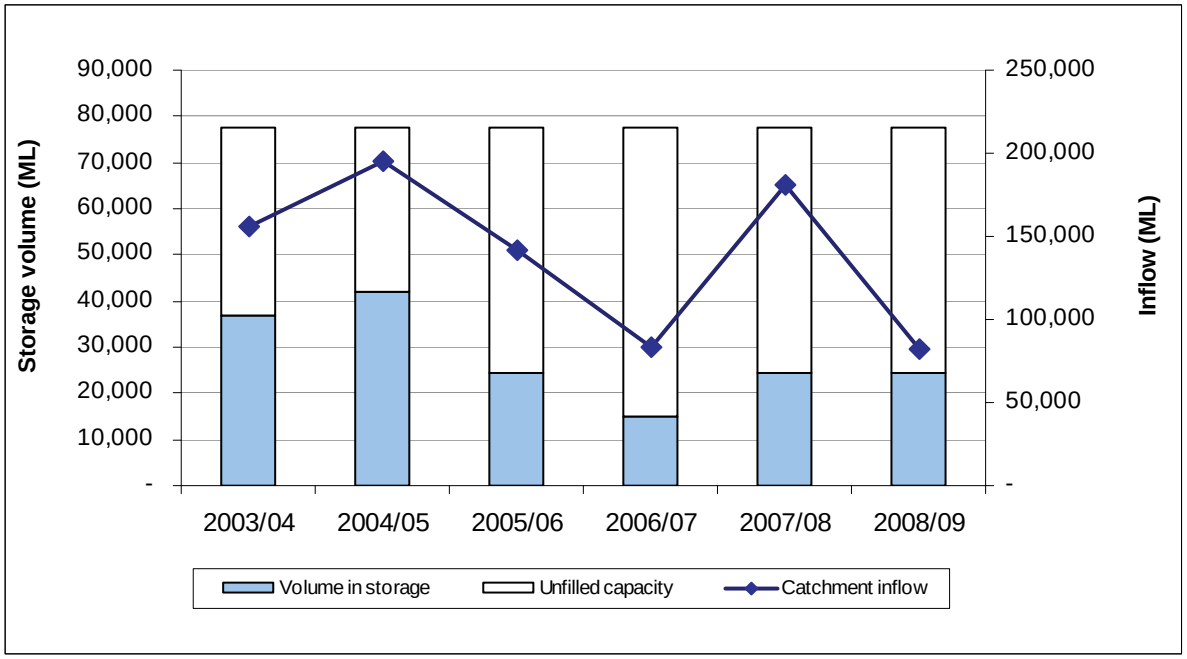
In 2008/09, rainfall in the Barwon basin ranged between 40% and 80% of the long term average, compared with 60% and 80% experienced in 2007/08. Inflows in 2008/09 were low at 23% of the long term average of 360,000 ML.

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 41,100 ML in 2008/09. This represents 50% of the catchment inflows into the basin.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin decreased from 24,400 ML in July 2008 to 24,300 ML by June 2009, or 31% of the total storage capacityof 77,440 ML.

Only volumes for major on-stream storages have been included in the water balance, and as such, Wurdee Boluc Reservoir has not been included. The volume of water in the major on-stream storages in the basin - West Barwon, White Swan and Gong Gong Reservoir – increased by 2,900 ML in 2008/09, from 8,200 ML to 11,100 ML.

Figure 28-1 All major storages and catchment inflows in the Barwon basin



28.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Barwon basin are summarised in Table 28-2.

The Greater Geelong area, serviced by Barwon Water, is a major water user in the Barwon basin. Water supplied to Geelong is also sourced from the Moorabool basin.

Table 28-2 Summary of total water resources and water use in the Barwon basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	117,100	56,800
Groundwater[2]	21,900	13,900
Recycled water	23,370	3,510

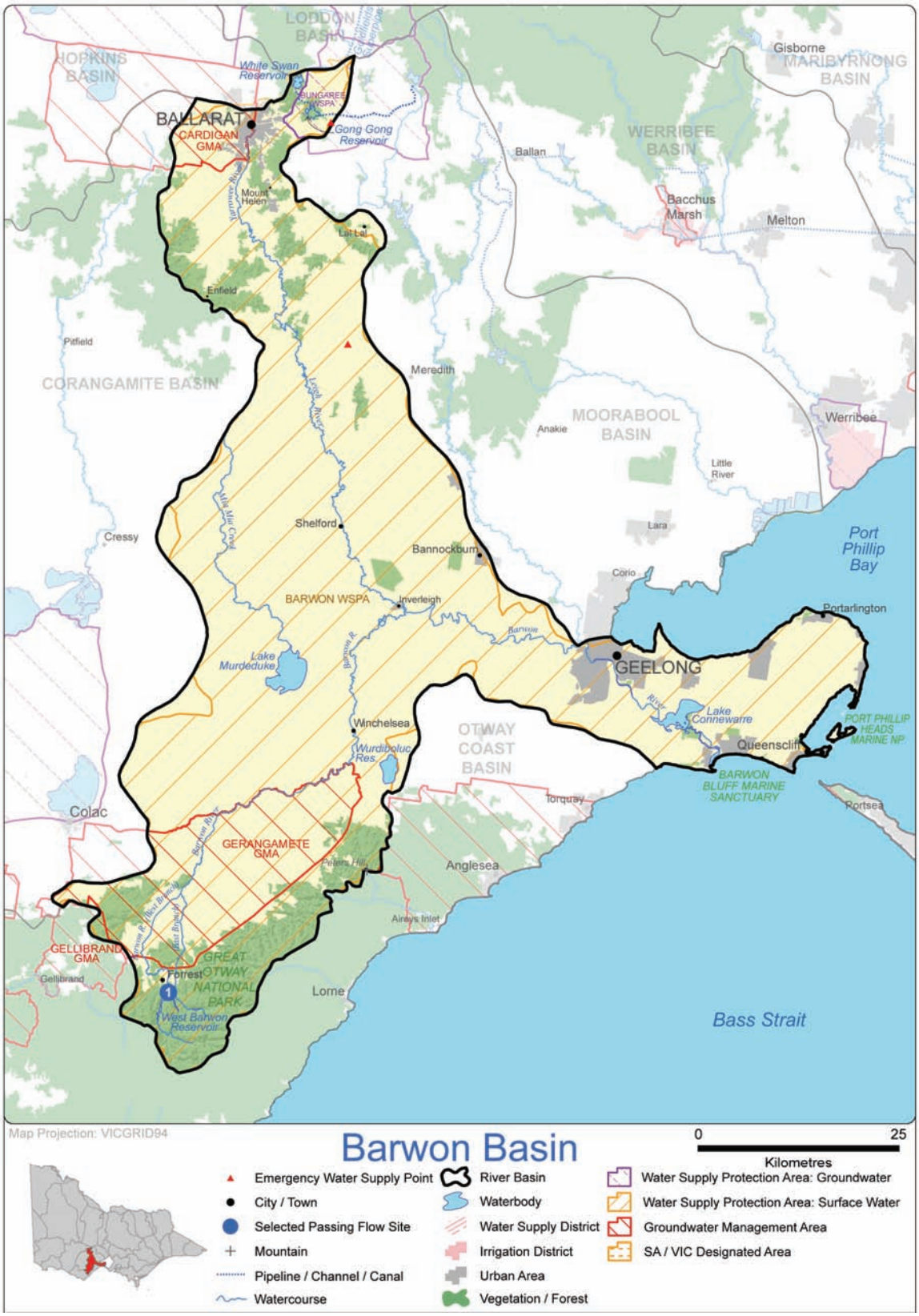
Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 28-7 and estimated domestic and stock use presented in Table 28-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. The Gerangamete GMA is one exception in the Barwon basin and this is discussed in note 7 beneath Table 28-7.

28.5 Location of water resources

Figure 28-2 Map of the Barwon basin



28.6 Surface water resources

28.6.1 Water balance

A surface water balance for the Barwon basin is shown in Table 28-3. Note that only on-stream storages with capacity greater than 1,000 ML have been included in the water balance. The major on-stream storages in the Barwon basin are the West Barwon reservoir operated by Barwon Water and the White Swan and Gong Gong reservoirs operated by Central Highlands Water.

Transfers from the Moorabool basin to the Barwon basin decreased by 15% in 2008/09 compared to the previous year. The water was transferred to White Swan reservoir and used to supply the Ballarat system. The Goldfields Superpipe was used to transfer 11,420 ML from the Campaspe basin to White Swan Reservoir to further augment the Ballarat supply.

Table 28-3 Balance of surface water in the Barwon basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	8,200	5,200
Volume in storage at end of year	11,100	8,200
Change in storage	**2,900**	**3,000**
Inflows		
Catchment inflow(1)	82,700	182,300
Inflows from the Moorabool River	400	400
Transfers from Moorabool basin to White Swan Reservoir	1,820	2,140
Transfers from Campaspe basin to White Swan Reservoir(2)	11,420	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	20,730	16,460
Sub-total	**117,100**	**201,300**
Usage		
Urban diversions	24,230	28,880
Licensed diversions from unregulated streams	1,700	2,000
Small catchment dams(2)	30,900	30,900
Sub-total	**56,800**	**61,800**
Losses		
Net evaporation losses from major storages	1,300	1,000
Evaporation from small catchment dams(3)	12,500	12,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	2,500	10,700
Sub-total	**16,300**	**24,200**
Water passed at outlet of basin		
River outflows to the ocean	41,100	112,300

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Reflected in Campaspe basin water balance.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Losses estimated using loss functions from the Lower Barwon Simulation Model (REALM). Reduced loss estimates reflect corrections to loss estimate calculation and reduced streamflows in 2008/09.

28.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 28-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 28-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,400	5,200	n/a
Registered commercial and irrigation	30,600	25,700	n/a
Total	**41,000**	**30,900**	**43,400**

n/a - Information not available.

28.6.3 Water entitlement transfers

Surface water movement in the Barwon basin was limited to transfers of bundled entitlement within the basin. In 2008/09, some 543 ML of bundled entitlement were traded on a temporary basis. There was no net movement of water into the basin during the water year.

Table 28-5 summarises the movement of bundled entitlements in the Barwon basin during 2008/09.

Table 28-5 Transfers of surface water bundled entitlements in the Barwon basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Barwon unregulated	0	0	0	543	543	0
Total 2008/09	**0**	**0**	**0**	**543**	**543**	**0**
Total 2007/08[1]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

28.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 28-6.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume but still be compliant.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

The bulk entitlement volumes within the Barwon basin refer to the total volume that can be extracted over any consecutive three-year period. The Yarrowee-White Swan bulk entitlement includes up to 10,500 ML extracted from the Upper West Moorabool system as specified in the Upper West Moorabool bulk entitlement in the Moorabool basin.

Table 28-6 Volume of water diverted under surface water entitlements in the Barwon basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?[2]
Barwon Water					
Upper Barwon system	3	43,467	0	17,405	Yes
Central Highlands Water					
Yarrowee-White Swan system[3]	3	12,267	0	6,827	Yes
Total annual volume of bulk entitlements 2008/09		**55,733**	**0**	**24,232**	
Total annual volume of bulk entitlements 2007/08		**55,733**	**0**	**28,882**	
Licensed diversions from unregulated streams 2008/09		*4,871*		*1,675*	
Licensed diversions from unregulated streams 2007/08		*4,412*		*1,971*	

Notes:
(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.
(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.
(3) This bulk entitlement overlaps with Central Highlands Water's Upper West Moorabool system bulk entitlement in the Moorabool basin.

28.7 Groundwater resources

A summary of licensed entitlements and use for groundwater management units that overlap the Barwon basin, excluding domestic and stock use, is presented in Table 28-7.

The Barwon basin contains parts of the Cardigan GMA, Gellibrand GMA, Gerangamete GMA and Bungaree WSPA. Groundwater levels in the Cardigan and Gerangamete GMAs are declining, while levels in the Gellibrand GMA and Bungaree WSPA are stable. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Compared to 2007/08, groundwater extractions in the Barwon basin increased marginally (2.4%) in 2008/09. The Gerangamete GMA is a key supply for Geelong and continued reliance on groundwater to supplement urban supplies in Geelong means that additional groundwater supplies may need to be considered in the future. The Gellibrand GMA's permissive consumptive volume (PCV) was temporarily set to 625 ML as it was considered a potential resource for augmenting urban water supplies. However, no groundwater was extracted during this time.

Table 28-7 Licensed groundwater volumes, Barwon basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[9]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Cardigan GMA (20%)	All depths	449	433	190	0	191	46
Gellibrand GMA (10%)[5]	All depths	60	-	0	0	0	0
Gerangamete GMA (86%)[6][7]	>60	20,000	20,000	12,438	2	12,440	12,605
Bungaree WSPA (24%)	All depths	1,258	1,258	1,036	4	1,039	698
Total[8]		**21,767**	**21,691**	**13,664**	**6**	**13,670**	**13,349**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage (with the exception of Gerangamete GMA – see note 6). Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. In Cardigan, out of 3,887 ML of licensed entitlement, 1,700 ML is from urban use, of which 1,689 ML is extracted from the Cardigan GMA within the Hopkins basin. The remaining 961 ML of metered use is shared on a proportional basis between Cardigan, Barwon and Corangamite basins. Cardigan GMA has 60.7% of its service area in the Hopkins basin, 19.5% in the Corangamite basin and 19.8% in the Barwon basin. Only the non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) A temporary PCV of 625 ML was issued for Gellibrand GMA which commenced on 10 July 2008 for a period of 13 months. No groundwater was extracted during this period.

(6) The PCV for the Gerangamete GMA has the following limits: 20,000 ML in one year, 80,000 ML over 10 years and 400,000 ML over 100 years. The entitlement limit in Table 28-7 represents the single year limit, however compliance would also need to be assessed at the 10 year and 100 year level.

(7) Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply (see Table 28-9). As all of this groundwater would be used in the Barwon basin, all volumes have been 100% allocated to the Barwon basin despite the Gerangamete GMA having 14% of its surface area in the Corangamite basin.

(8) Total volumes are based on the sum of management unit data prior to rounding.

(9) Non-metered use includes dairy wash and low consumption commercial use.

An estimate of domestic and stock groundwater use is provided in Table 28-8.

Table 28-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cardigan GMA (20%)	20	40
Gellibrand GMA (10%)	0	0
Gerangamete GMA (86%)	8	16
Bungaree WSPA (24%)	64	129
Total	**92**	**185**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 28-7.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater was again a significant part of the urban water supply for Geelong in 2008/09. The licensed entitlements and metered use for this supply is provided in Table 28-9.

Table 28-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Greater Geelong area	20,000	12,438	12,605

28.8 Drought contingency measures

A number of drought contingency measures were undertaken in the Barwon basin in 2008/09. These include:

- restricting urban and rural water use (discussed in section Table 28-9)
- transferring water to supplement supplies
- supplementing supplies from groundwater
- the continuation of qualification of rights, which is detailed in Table 27-9 in the Moorabool basin chapter.

Central Highlands Water supplemented supplies in White Swan Reservoir, which is part of the Ballarat water system, by transferring 11,240 ML from the Goulburn system via the Goldfields Superpipe and retaining environmental flows under a qualification of rights. The Goldfields Superpipe was crucial for Ballarat in 2008/09, as without it Central Highlands Water would have been unable to maintain its supplies for the entire year.

Central Highlands Water also accessed groundwater for Ballarat from the Ballarat West groundwater project and from Bungaree groundwater resources, which are located on the boundary between Moorabool and Barwon basins.

Barwon Water supplemented Geelong's supplies with groundwater from the Barwon Downs borefield. The Barwon Downs borefield has been a vital resource for Geelong over the past three years, supplying around 45% of its demand during this period.

28.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions in 2008/09 are shown in Table 28-10.

Barwon Water maintained severe restrictions for Geelong the entire year to reduce demands on its surface water systems. Ballarat, which is partly supplied from the northern part of the Moorabool basin via White Swan Reservoir, was also kept on severe water restrictions by Central Highlands Water.

Licensed diverters from the Barwon and Leigh rivers and Boundary Creek were again placed on severe restrictions or banned for periods throughout 2008/09.

Groundwater use was unrestricted in the Barwon basin during 2008/09.

Table 28-10 Seasonal allocations and restrictions on water use in Barwon basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Greater Geelong and other towns in the Barwon basin serviced by Barwon Water, such as towns in the Bellarine Peninsula	Stage 4 restrictions with general exemptions from July 2008 to June 2009
	Towns within the greater Ballarat area serviced by Central Highlands Water	Stage 4 restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Boundary Creek	Irrigation ban in July 2008, from January to June 2009
	Barwon River	Stage 3 restrictions in November and December 2008 Irrigation ban from January to June 2009
	Leigh River	Stage 3 restrictions in November and December 2008, May and June 2009 Irrigation ban from January to April 2009

28.10 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin.

In 2008/09, some 9% or 3,512 ML of wastewater in the Barwon basin was recycled, mostly for agricultural purposes. This is an increase from 5% in 2007/08. The increase was primarily due to an increase in reuse at Black Rock.

Table 28-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Ballarat North	2,080	537	0%	10	0	0	528	1,542	1
Ballarat South	4,910	75	0%	14	0	0	60	4,835	0
Bannockburn	41	41	100%	0	41	0	0	0	0
Black Rock	16,073	2,621	11%	0	1,756	0	865	14,349	-897
Portarlington	240	209	87%	0	209	0	0	0	31
Winchelsea	29	29	100%	0	29	0	0	0	0
Total 2008/09	**23,373**	**3,512**	**9%**	**24**	**2,035**	**0**	**1,453**	**20,726**	**-865**
Total 2007/08	25,033	2,754	5%	0	1,349	0	1,405	16,459	5,820

Notes:
(1) Volume used to deliver specific environmental flow benefits.
(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.
(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

28.11 Water for the environment

28.11.1 Environmental Water Reserve (EWR)

The Bellarine Peninsula contains internationally significant wetlands listed under the Ramsar convention which rely on the freshwater inputs from the Barwon basin to ecologically function. Other important environmental assets include the Australian Grayling, Australian Mudfish and Australian Smelt.

In 2008/09 the Barwon basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Central Highlands Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

28.11.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Barwon Water and Central Highlands Water reported that all passing flow requirements in the Barwon basin were met.

Table 28-12 shows the passing flow compliance in the Barwon basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this point is presented in Figure 28-2.

Table 28-12 Selected passing flow requirements in the Barwon basin

River	Passing flow	
West Barwon River, East Barwon River, Callahan Creek, Dewing Creek, Matthews Creek and Pennyroyal Creek	Instrument where passing flows are specified	Bulk Entitlement (Upper Barwon System) Conversion Order 2002
	Responsible authority	Barwon Water
	Compliance point	West Barwon diversion weir (West Barwon Dam) (shown as 1 in Figure 28-2)
	Passing flow compliance	Passing flows were based on the storage volume in the West Barwon diversion weir • During April to December inclusive, a minimum flow of 4 ML/day was passed if the storage volume was less than 40,000 ML, or 5 ML/day if volume was greater than 40,000 ML • A minimum flow of 4 ML/day was passed in January, February and March

28.11.3 Streamflow management plans (SFMPs)

Work continued in preparation for the development of an SFMP for the Barwon River.

29 Corangamite basin

This chapter sets out the accounts for the Corangamite basin. For detailed information about how they have been compiled, refer to Chapter 5.

29.1 Corangamite basin summary

Inflows in the Corangamite basin in 2008/09 were again low at 17% of the long term average.

Groundwater licence holders are the largest authorised users of water in the Corangamite basin and were therefore not directly affected by the low inflows. Groundwater extractions, however, almost halved in 2008/09 compared to 2007/08 as licence holders in the basin used over 25% of their licensed entitlement.

Urban users were also not directly affected by the low inflows because towns within the Corangamite basin are supplied by other basins. However, severe restrictions did remain in place for the towns located in the north of the basin connected to Ballarat's water supply system.

Licensed diverters from the unregulated streams were also relatively unaffected by the low inflows, with the exception of diverters from Lake Tooliorook who were banned from taking water the entire year.

The amount of water flowing from the Corangamite basin into the Ramsar-listed Western District Lakes was 43,600 ML in 2008/09. This volume is similar to the flows experienced in 2007/08.

29.2 Responsibilities for management of water resources

Table 29-1 shows the responsibilities of various authorities within the Corangamite basin.

Table 29-1 Responsibilities for water resources management within the Corangamite basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
Barwon Water			Provides urban water supply to Colac (from the Otway Coast basin)	
Central Highlands Water			Provides urban water supply to Linton, Rokewood and Smythesdale (from Ballarat system)	
Wannon Water			Provides urban water supply to Camperdown, Lismore and Derrinallum (from the Otway Coast basin)	
Corangamite Catchment Management Authority				Manages waterways for the whole of the Corangamite basin

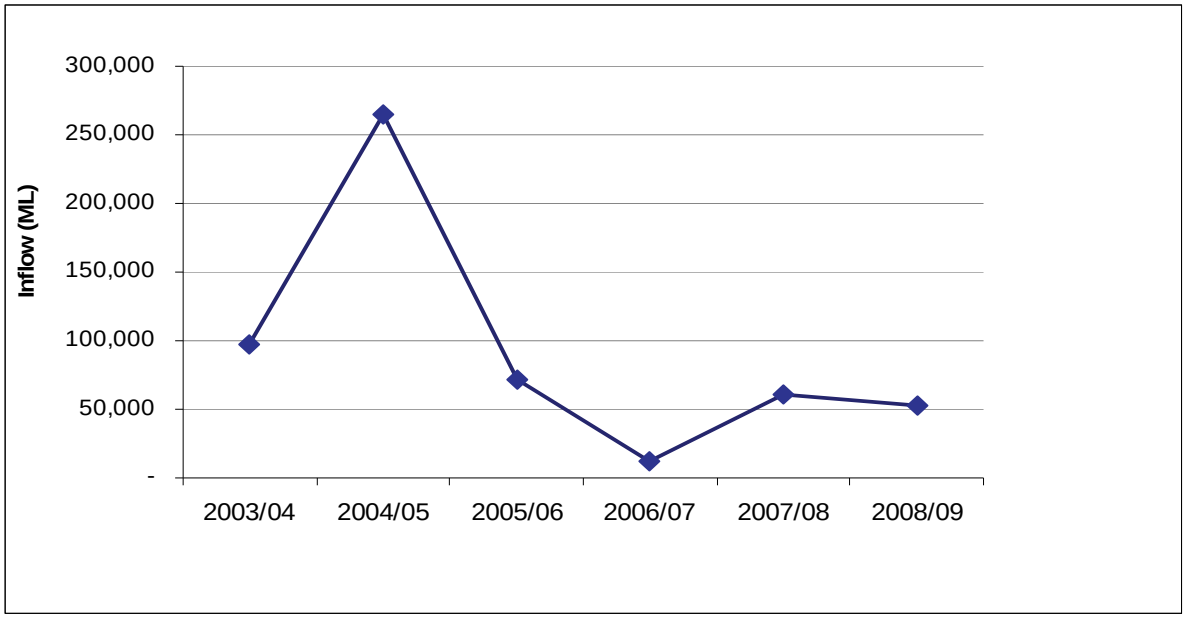
29.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Corangamite basin ranged between 60% and 80% of the long term average. Inflows across the basin were again low at 17% of the long term average of 316,000 ML. This is slightly less than the volume recorded in 2007/08.

Similar to 2007/08, some 43,600 ML of water flowed from the Corangamite basin into the Western District Lakes in 2008/09. This represented 82% of catchment inflows into the basin, compared to 71% in 2007/08.

There are no major water supply storages in the Corangamite basin.

Figure 29-1 Catchment inflows in the Corangamite basin



29.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Corangamite basin are shown in Table 29-2.

Water supplied to Colac, Camperdown, Lismore and Derrinallum is sourced from and accounted for within the Otway Coast basin.

Table 29-2 Summary of total water resources and water use in the Corangamite basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	54,500	6,900
Groundwater[2]	17,100	5,500
Recycled water	1,620	430

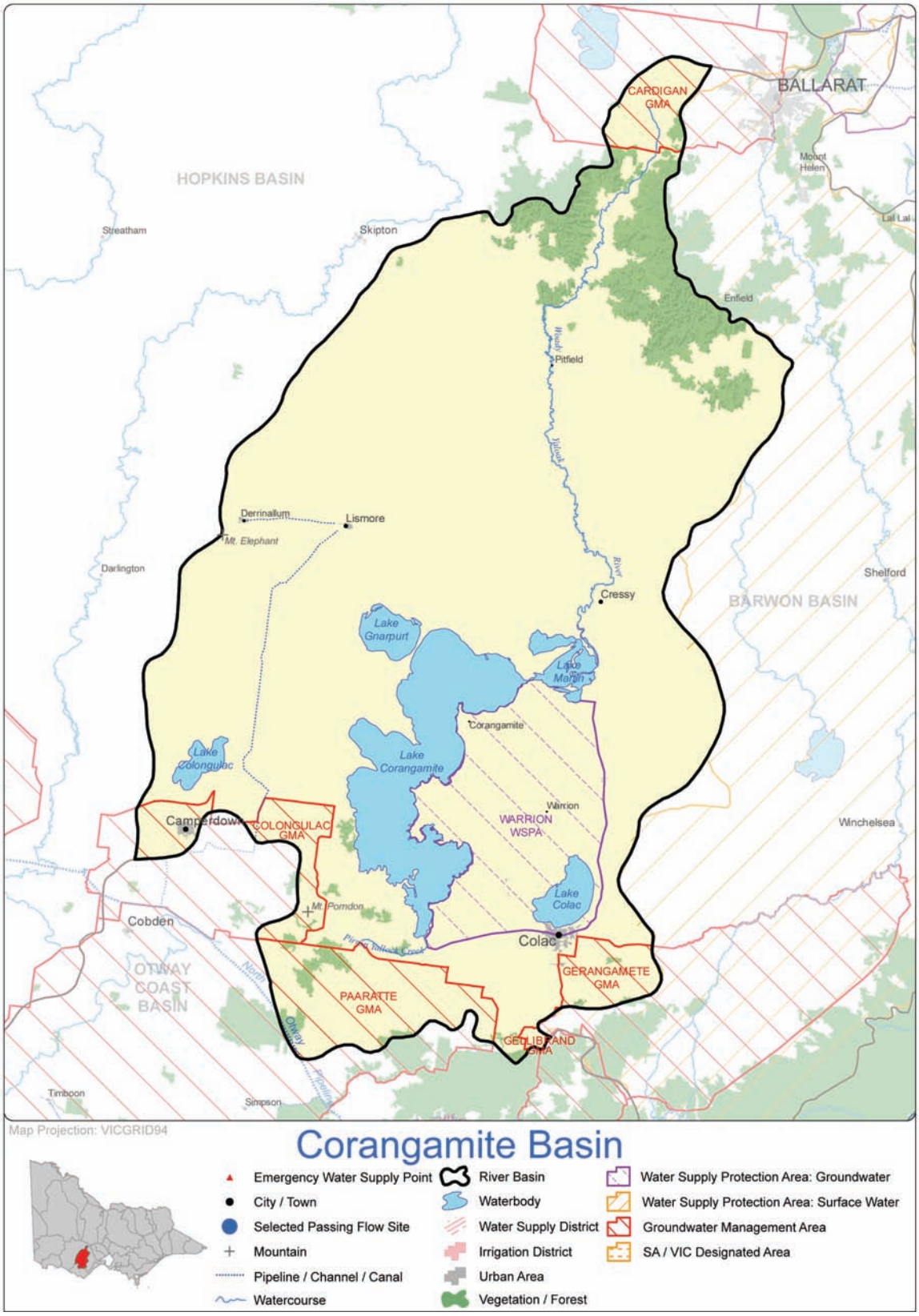
Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 29-5 and the estimated domestic and stock use as presented in Table 29-6.

(2) The total groundwater available for consumption and total groundwater use have been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. The Gerangamete GMA is one exception in the Corangamite basin and this is discussed in Note 6 beneath Table 29-5.

29.5 Location of water resources

Figure 29-2 Map of the Corangamite basin



29.6 Surface water resources

29.6.1 Water balance

A surface water balance for the Corangamite basin is shown in Table 29-3.

Urban water use within the Corangamite basin is supplied from the Otway Coast basin due to the better quality of water available.

Table 29-3 Balance of surface water in the Corangamite basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	53,200	61,400
Transfers from other basins	0	
Return flow from irrigation	0	
Treated wastewater discharged back to river	1,290	1,500
Sub-total	**54,500**	**62,900**
Usage		
Urban diversions	0	
Licensed diversions from unregulated streams	100	100
Small catchment dams(2)	6,800	12,300
Sub-total	**6,900**	**12,400**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	4,000	6,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**4,000**	**6,600**
Water passed at outlet of basin		
River outflows to the Corangamite Lakes	43,600	43,900

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Losses estimated to be zero because data is not readily available.

29.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 29-4 have been provided by the Department of Sustainability and Environment, as outlined in Chapter 5.

Table 29-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,100	2,200	n/a
Registered commercial and irrigation	9,900	4,600	n/a
Total	**18,000**	**6,800**	**10,800**

n/a: Information not available.

29.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

29.6.4 Volume diverted

The only surface water entitlements in the Corangamite basin are licences on unregulated streams. In 2008/09, the licensed volume totalled 992 ML and use was estimated to be 67 ML, which was similar to the 2007/08 licensed volume and use.

29.7 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Corangamite basin, excluding domestic and stock use, is shown in Table 29-5.

The Corangamite basin contains the whole Warrion WSPA as well as part of the Colongulac GMA, Cardigan GMA, Gerangamete GMA and Paaratte GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater extractions from the Warrion WSPA, which has the largest volume of entitlements within the basin, almost halved in 2008/09 compared to 2007/08. This resulted in an overall decrease in groundwater use from the Corangamite basin in 2008/09. Extractions from the Cardigan GMA increased in 2008/09 compared with 2007/08, while extractions from the Paaratte GMA were the same as 2007/08, with no recorded extractions. Extractions from the Gerangamete GMA are included in the Barwon basin. Groundwater levels in the Warrion WSPA and Cardigan GMA are declining, while levels in the Paaratte GMA are generally stable.

Table 29-5 Licensed groundwater volumes, Corangamite basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Cardigan GMA (19%)	All depths	442	426	187	0	187	45
Colongulac GMA (36%)	≤60	1,703	1,392	287	2	289	389
Gerangamete GMA (14%)[6]	>60	-	-	0	0	0	0
Paaratte GMA (15%)	>120	674	467	0	0	0	0
Warrion WSPA (100%)	All depths	13,836	13,835	3,943	25	3,968	6,715
Total [7]		**16,655**	**16,120**	**4,417**	**27**	**4,444**	**7,149**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. GMAs/WSPAs with less than 5% surface area within the basin have not been included. In Cardigan, out of 3,887 ML of licensed entitlement, 1,700 ML is from urban use, of which 1,689 ML is extracted from the Cardigan GMA within the Hopkins basin. The remaining 961 ML of metered use is shared on a proportional basis between Cardigan, Barwon and Corangamite basins. Cardigan GMA has 60.7% of its service area in the Hopkins basin, 19.5% in the Corangamite basin and 19.8% in the Barwon basin. Only the non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply. As all of this groundwater would be used in the Barwon basin, all volumes have been 100% allocated to the Barwon basin despite the Gerangamete GMA having 14% of its surface area in the Corangamite basin. See Table 28-7 in the Barwon basin chapter for Gerangamete GMA volumes.

(7) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 29-6. Groundwater is not used to supply towns within the Corangamite basin.

Table 29-6 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cardigan GMA (19%)	20	40
Colongulac GMA (36%)	53	106
Gerangamete GMA (14%)	1	2
Paaratte GMA (15%)	18	36
Warrion WSPA (100%)	416	832
Total	**508**	**1,016**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the Table 29-5.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

29.8 Drought contingency measures

The main drought contingency measure in place in the Corangamite basin was restrictions on urban and rural water use (discussed in section 29.9).

29.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 29-7.

Water resources in the Corangamite basin are not used to supply towns, so urban water restrictions reflected the conditions of the respective supply systems outside the basin. With this being the case, severe restrictions remained in place for the towns located in the north of the basin connected to Ballarat's water supply system.

Licensed diverters from the unregulated streams were relatively unaffected by the low inflows, with the exception of diverters from Lake Tooliorook who were banned from taking water the entire year.

Groundwater use was unrestricted in the Corangamite basin during 2008/09.

Table 29-7 Seasonal allocations and restrictions on water use in Corangamite basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Linton, Rokewood, Smythesdale	Stage 4 restrictions from June 2008 to June 2009
	Beeac, Colac, Cressy, Alvie, Coragulac, Cororooke, Elliminyt, Irrewarra, Ondit, Warrion	Stage 2 in July 2008
Licensed diversions from unregulated streams	Lake Tooliorook	Irrigation ban July 2008 to June 2009

29.10 Recycled water

A wastewater treatment plant at Colac is operated by Barwon Water and a treatment plant at Camperdown is operated by Wannon Water. Recycled water was used for agricultural purposes. Compared to 2007/08 the volume and percentage of recycled water reused increased in 2008/09, with around 24% recycled.

Table 29-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Camperdown industrial[4]	0	28	0%	0	28	0	0	0	-28
Camperdown municipal[4]	299	370	124%	20	350	0	0	0	-71
Colac	1,325	35	0%	0	0	0	35	1,290	0
Total 2008/09	**1,624**	**433**	**24%**	**20**	**378**	0	**35**	**1,290**	**-99**
Total 2007/08	**1,946**	**284**	**13%**	**18**	**236**	0	**29**	**1,499**	**164**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) Volume of water recycled at Camperdown exceeded volume produced, as water stored on site during the winter is used for irrigation water use in summer.

29.11 Water for the environment

29.11.1 Environmental Water Reserve (EWR)

The Western District Lakes are internationally significant wetlands listed under the Ramsar convention and rely on the freshwater inputs from the Corangamite basin to ecologically function. Wetlands of national importance include the Kooraweera Lakes, Lough Calvert, Lake Thurrumbong and Cundare Pool.

In 2008/09 the Corangamite basin EWR comprised:

- the component of water in the basin not allocated for consumptive use, i.e. water above cap
- water set aside for the environment through the operation of licensed diversions in passing flow conditions.

29.11.2 Compliance with passing flow requirements

There are currently no bulk entitlements in operation in the Corangamite basin.

30 Otway Coast basin

This chapter sets out the accounts for the Otway Coast basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

30.1 Otway Coast basin summary

Inflows in the Otway Coast basin in 2008/09 were 54% of the long term average, well below inflows experienced in 2007/08.

Consumptive use is only a small proportion of total available surface water resources, however many urban and rural supplies need reliable flows throughout the entire year.

The dry conditions resulted in Apollo Bay residents being placed on Stage 2 restrictions for about eight months and licensed diverters from Lake Purumbete being banned from taking water the entire year. Towns in the Bellarine Peninsula are supplied from the Geelong system and were therefore on Stage 4 restrictions, with exceptions, the entire year.

The total volume of surface water and groundwater taken under entitlements in the basin was very similar to 2007/08.

30.2 Responsibilities for management of water resources

Table 30-1 shows the responsibilities of various authorities within the Otway Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 30-1 Responsibilities for water resources management within the Otway Coast basin, 2007/08

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
Wannon Water	Provides domestic and stock supplies to farms across parts of the Otway Coast, Corangamite, Hopkins and Portland Coast basins(1)		Provides urban water supply to towns in the west of the basin including Cobden, Timboon, Peterborough and Port Campbell(1)	Obliged to meet passing flow requirements
Barwon Water			Provides urban water supply to the majority of towns in the basin including Torquay, Anglesea, Lorne and Apollo Bay. Also transfers to Colac	Operates West Gellibrand Reservoir Obliged to meet passing flow requirements
Corangamite Catchment Management Authority				Manages waterways for the whole of the Otway Coast basin

Note:

(1) The Otway water supply system extends westward to Warrnambool and Koroit and north to Lismore and Derrinallum, supplying Cobden, Camperdown, Terang and Allansford on the way. Port Campbell, Timboon and Peterborough are supplied via a separate linked system drawing on the Dilwyn aquifer at Port Campbell.

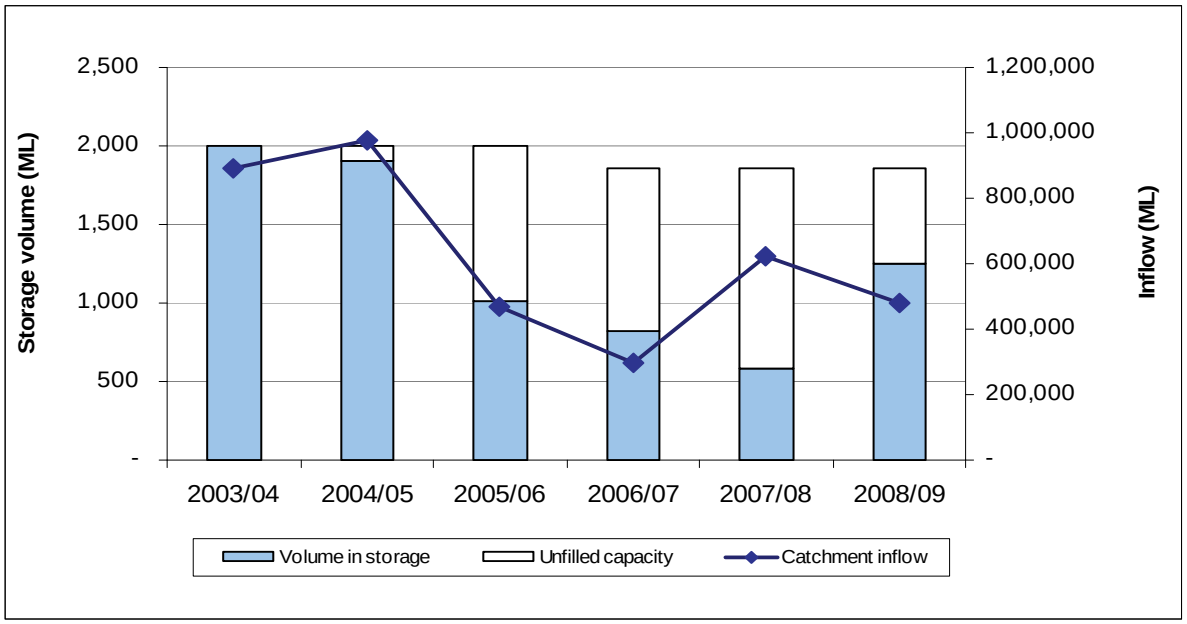
30.3 Rainfall, flows and storages in 2008/09

In 2008/09 rainfall in the Otway Coast basin ranged between 60% and 100% of the long term average. Inflows in 2008/09, at 54% of the long term average of 884,000 ML, were well below the inflows in 2007/08.

The amount of water flowing from the Otway basin into Bass Strait reduced to 446,100 ML in 2008/09. This represented 93% of the catchment inflows into the basin, compared with 95% in 2007/08.

The only major storage in the basin is the West Gellibrand Reservoir, starting at 580 ML in July 2008 and increasing to 1,250 ML in June 2009 or 67% of the total storage capacity of 1,900 ML.

Figure 30-1 All major storages and catchment inflows in the Otway Coast basin



30.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Otway Coast basin are shown in Table 30-2.

Table 30-2 Summary of total water resources and water use in the Otway Coast basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	479,900	29,600
Groundwater[2]	48,900	6,400
Recycled water	1,260	380

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 30-6 and the estimated domestic and stock use presented in Table 30-7.

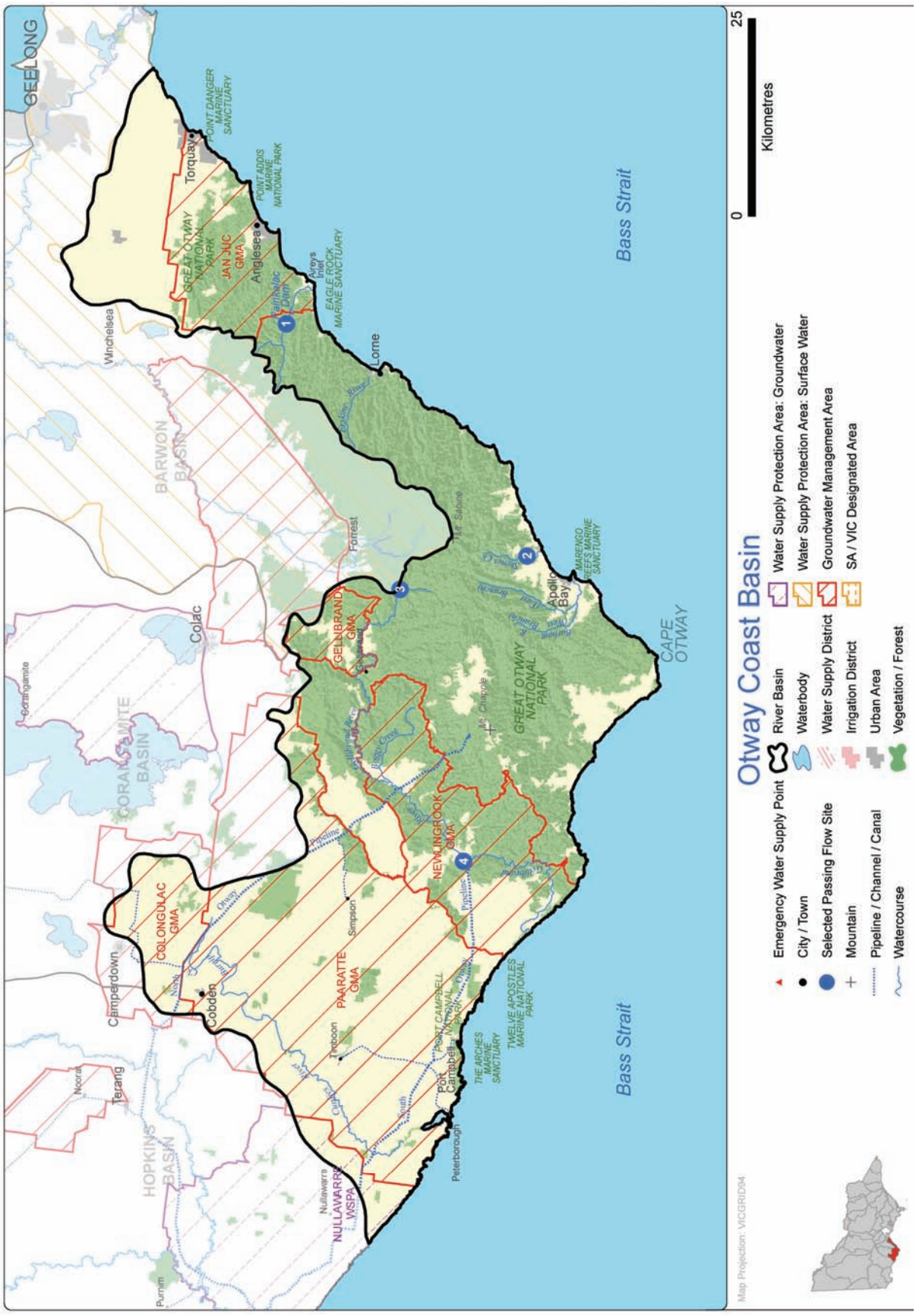
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. The Jan Juc bulk entitlement is based on a 5-year total of 35,000 ML.

30.4.1 Infrastructure projects to improve water availability

Barwon Water continued construction of groundwater bores, a pre-treatment plant, pump stations and transfer mains for the Anglesea borefield project in 2008/09. By the end of the year, three production bores and 29 kilometres of transfer/collection mains had been completed. The project is due for completion in March 2010.

30.5 Location of water resources

Figure 30-2 Map of the Otway Coast basin



30.6 Surface water resources

30.6.1 Water balance

A surface water balance for the Otway Coast basin is shown in Table 30-3.

Table 30-3 Balance of surface water in the Otway Coast basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	600	800
Volume in storage at end of year	1,200	600
Change in storage	**600**	**-200**
Inflows		
Catchment inflow(1)	479,100	622,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	840	920
Sub-total	**479,900**	**623,500**
Usage		
Urban diversions	14,100	14,130
Licensed diversions from unregulated streams	2,700	2,200
Small catchment dams(2)	12,800	12,800
Sub-total	**29,600**	**29,100**
Losses		
Net evaporation losses from major storages	200	200
Evaporation from small catchment dams(2)	3,400	3,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**3,600**	**3,600**
Water passed at outlet of basin		
River outflows to the ocean	446,100	591,000

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.
(3) Assumed to be zero because data is not readily available.

30.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 30-4 below are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 30-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,700	5,400	n/a
Registered commercial and irrigation	8,800	7,400	n/a
Total	**19,500**	**12,800**	**16,200**

n/a: Information not available.

30.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

30.6.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 30-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 30-5 Volume of water diverted under surface water entitlements in the Otway Coast basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
Barwon Water					
Aireys Inlet	1	317	0	183	Yes
Apollo Bay and Skenes Creek	1	365	0	319	Yes
Colac	1	5,400	0	4,246	Yes
Gellibrand	1	60	0	21	Yes
Lorne	1	510	0	370	Yes
Wannon Water					
Otway system	1	12,580	0	8,957	Yes
Total annual volume of bulk entitlements 2008/09		**19,232**	**0**	**14,096**	
Total annual volume of bulk entitlements 2007/08		**19,232**	**0**	**14,131**	
Licensed diversions from unregulated streams 2008/09[(1)]		*8,942*		*2,671*	
Licensed diversions from unregulated streams 2007/08		*11,599*		*2,246*	

Notes:

(1) The decrease in the bulk entitlement volume in 2008/09 is largely due to a decrease in irrigation water entitlements during 2008/09.

30.7 Groundwater resources

A summary of licensed entitlements and use from groundwater management units within the Otway Coast basin, excluding domestic and stock use, is presented in Table 30-6.

The Otway Coast basin contains all of the Jan Juc GMA and Newlingrook GMA as well as part of the Colongulac GMA, Gellibrand GMA, Paaratte GMA and Nullawarre WSPA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Total groundwater use in the Otway Coast basin was similar to the volume extracted in 2007/08. Decreases in extractions from Colongulac GMA and Jan Juc GMA were balanced by increases in Nullawarre WSPA and especially Newlingrook GMA, where extractions increased from 32 ML in 2007/08 to 559 ML in 2008/09.

The first groundwater bulk entitlement was granted to Barwon Water on 30 June 2009. The entitlement allows Barwon Water to extract an average of 7,000 ML of groundwater over any five year period. The bulk entitlement will supply homes and businesses in the Greater Geelong region. No groundwater was extracted from the bulk entitlement in 2008/09.

Table 30-6 Licensed groundwater volumes, Otway Coast basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Colongulac GMA (55%)	≤60	2,577	2,108	435	3	437	588
Gellibrand GMA (90%)[6]	All depths	565	0	0	0	0	0
Jan Juc GMA (100%)[7]	All depths	39,250	39,250	3,359	2	3,361	3,641
Newlingrook GMA (100%)	All depths	1,977	1,947	558	1	559	32
Paaratte GMA (85%)	>120	3,932	2,726	0	0	0	1
Nullawarre WSPA (11%)	≤250	2,248	2,248	1,430	3	1,432	1,266
Total[8]		**50,549**	**48,279**	**5,782**	**8**	**5,789**	**5,528**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use..

(6) A temporary PCV of 625 ML was issued for Gellibrand GMA which commenced on 10 July 2008 for a period of 13 months. No groundwater was extracted during this period.

(7) The PCV for Jan Juc GMA is as follows: Zone 1 (all formations) at 250 ML/yr, Zone 2 (Upper Easter View Formation) at 4,000 ML/yr, Zone 2 (Lower Eastern View Formation (35,000 ML in total in any five year period) and Zone 2 (all formations other than Upper Eastern View and Lower Eastern View) at 0 ML/yr.

(8) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 30-7.

Table 30-7 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Colongulac GMA (55%)	80	160
Gellibrand GMA (90%)	2	4
Jan Juc GMA (100%)	5	10
Newlingrook GMA (100%)	10	20
Paaratte GMA (85%)	105	210
Nullawarre WSPA (11%)	112	224
Total	**314**	**628**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 30-6.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

In the Otway Coast basin, groundwater is used for urban water supply in the townships of Port Campbell, Timboon, Peterborough and Koroit as well as the areas around Carlisle and Curdie Vale. The licensed entitlements and metered use for these groundwater supplies is provided in Table 30-8.

Table 30-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Otway system (Carlisle)	1,800	437	70
Port Campbell, Timboon, Peterborough and Curdie Vale	3,159	334	336
Total	**4,959**	**771**	**406**

30.8 Drought contingency measures

The main drought contingency measure implemented in the Otway Coast basin in 2008/09 involved restricting urban and rural water use (discussed in section 30.9).

30.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 30-9.

Towns in the east of the basin faced higher restrictions than those in the south. Stage 4 restrictions were enforced in Torquay, Mt Duneed, Jan Juc and Anglesea, however these towns are supplied by the Geelong water system. Apollo Bay residents were placed on Stage 2 restrictions for about eight months. Towns in the west of the basin are supplied by groundwater, which was unrestricted in the basin during 2008/09.

Licensed diverters from Lake Purumbete were banned from taking water the entire year.

Table 30-9 Seasonal allocations and restrictions on water use in Otway Coast basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Skenes Creek, Apollo Bay, Marengo	Stage 2 restrictions from July 2008 to March 2009, permanent water savings rules from April 2009
	Torquay, Mt Duneed, Jan Juc, Anglesea	Stage 4 restrictions with general exemptions from July 2008 to June 2009
Licensed diversions from unregulated streams	Lake Purumbete	Irrigation ban July 2008 to June 2009

30.10 Recycled water

Wastewater treatment plants within the Otway Coast basin are operated by Barwon Water and Wannon Water, with the largest plants located at Lorne and Apollo Bay. In 2008/09, some 26% of the volume of treated wastewater was used within the Otway Coast basin (Table 30-10), which represents a small increase in the percentage of recycled water used in 2007/08.

Table 30-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Aireys Inlet	77	77	100%	0	77	0	0	0	0
Anglesea	248	117	35%	0	87	0	30	161	-30
Apollo Bay	391	15	0%	0	0	0	15	391	-15
Cobden	171	55	32%	0	55	0	0	11	105
Lorne	275	15	0%	0	0	0	15	275	-15
Port Campbell	39	30	78%	0	30	0	0	0	9
Simpson	16	0	0%	0	0	0	0	1	15
Timboon[4]	41	72	176%	0	72	0	0	0	-31
Total 2008/09	**1,258**	**381**	**26%**	**0**	**321**	**0**	**60**	**839**	**38**
Total 2007/08	**1,281**	**383**	**25%**	**0**	**325**	**0**	**58**	**916**	**-18**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) Volume recycled is greater than the volume produced due to water stored on-site carried over from the previous year.

30.11 Water for the environment

30.11.1 Environmental Water Reserve (EWR)

Important environmental assets such as River Blackfish, remnant riparian vegetation and the Australian Grayling depend on the Otway Coast basin EWR. The Lower Aire wetlands are of national significance and Aire River estuary of state significance.

In 2008/09 the Otway Coast basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Wannon Water
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use.

30.11.2 Passing flow compliance

Wannon Water reported that all passing flow requirements under their bulk entitlements in the Otway Coast basin were met in 2008/09.

Barwon Water met all of its passing flow requirements except during pipeline repairs at the West Gellibrand and Olangolah Reservoirs.

Table 30-11 shows the passing flow requirements in the Otway Coast basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

Table 30-11 Selected passing flow compliance in the Otway Coast basin

River	Passing flow	
Painkalac Creek	Instrument where passing flows are specified	Bulk Entitlement (Aireys Inlet) Conversion Order 1997
	Responsible authority	Barwon Water
	Compliance point	Painkalac Creek Reservoir (shown as 1 in Figure 30-2)
	Passing flow compliance	• From December to February inclusive natural inflows were passed downstream of the reservoir • From March to November inclusive the lesser of 0.5 ML/day or natural flows were passed downstream of the reservoir
Barham River, Skenes Creek	Instrument where passing flows are specified	Bulk Entitlement (Apollo Bay and Skenes Creek) Conversion Order 1997
	Responsible authority	Barwon Water
	Compliance point	Skenes Creek diversion weir (shown as 2 in Figure 30-2)
	Passing flow compliance	• The lesser of 1.5 ML/day or natural flows were passed below the weir • 1.5 ML/day were passed when flows were between 1.5 and 1.93 ML/day • When flows were greater than 1.93 ML/day, flows equal to the entire flow, less 0.43 ML/day, were passed • Note the minimum passing flow was 1.5 ML/day
Arkins Creek West, Arkins Creek East, First Creek, Gellibrand River	Instrument where passing flows are specified	Bulk Entitlement (Otway System) Conversion Order 1998
	Responsible authority	Wannon Water
	Compliance point	Gellibrand River – North Otway pump station (shown as 3 in Figure 30-2)
	Passing flow compliance	• When flows were equal to or less than 12 ML/day, no passing flows were made • When flows were between 12 and 22.5 ML/day, 12 ML/day were passed below the pump station • When flows were between 22.5 and 44.9 ML/day, 17.5 ML/day were passed below the pump station • When flows were between 44.9 and 54.9 ML/day, 20 ML/day were passed below the pump station • When flows were 54.9 ML/day or greater, 22.5 ML/day were passed below the pump station
	Compliance point	Gellibrand River – South Otway pump station (shown as 4 in Figure 30-2)
	Passing flow compliance	• When flows were equal to or less than 12 ML/day, no passing flows were made • When flows were between 12 and 22 ML/day, 12 ML/day were passed below the pump station • When flows were between 22 and 32.7 ML/day, 17 ML/day were passed below the pump station • When flows were between 32.7 and 41.2 ML/day, 19 ML/day were passed below the pump station • When flows were 41.2 ML/day or greater, 21.5 ML/day were passed below the pump station

30.11.3 Streamflow management plans (SFMPs)

Work continued in preparation for the development of an SFMP for the Gelibrand River.

31 Hopkins basin

This chapter sets out the accounts for the Hopkins basin. For detailed information about how they have been compiled, refer to Chapter 5.

31.1 Hopkins basin summary

Inflows in the Hopkins basin were 26% of the long term average in 2008/09.

Groundwater is a significant resource in the Hopkins basin and usage increased by approximately 15% during the year compared to 2007/08. The largest increases occurred in the Nullawarre and Yangery WSPAs. Groundwater from the Cardigan GMA remained an important supplement for Ballarat's supplies as Central Highlands Water continued to utilise the Ballarat West borefield at near capacity.

A number of towns located within the Hopkins basin were subject to Stage 4 water restrictions the entire year. However, some of these are supplied from systems that source water from outside the basin, such as the Grampians and Ballarat headworks.

Licensed diverters on a number of unregulated rivers were restricted at various times during the year, with restrictions generally being more severe over the summer months.

31.2 Responsibilities for management of water resources

Table 31-1 shows the responsibilities of various authorities within the Hopkins basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 31-1 Responsibilities for water resources management within the Hopkins basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
Wannon Water			Supplies towns in the south of the basin including Warrnambool	
GWMWater			Supplies towns in the north of the basin including Ararat	
Central Highlands Water			Supplies towns in the north-east of the basin including Beaufort and Skipton	Obliged to meet passing flow requirements
Glenelg Hopkins Catchment Management Authority				Manages waterways in the whole of the Hopkins basin

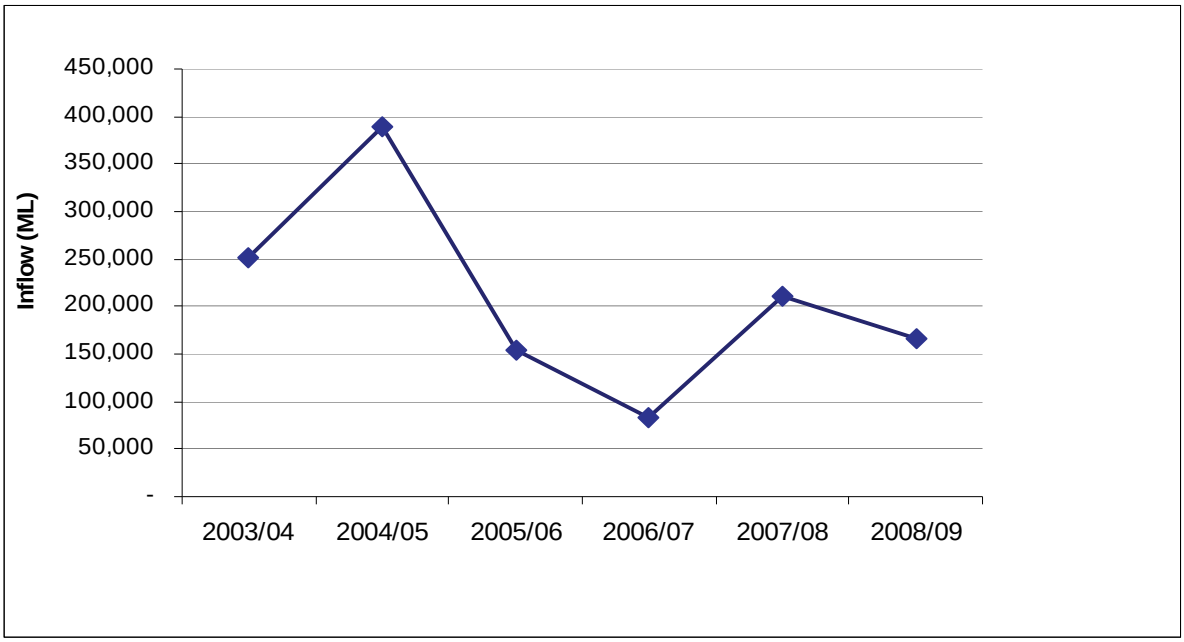
31.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Hopkins basin ranged between 60% and 100% of the long term average. Inflows in 2008/09 were 26% of the long term average (of 635,000 ML), which is double those recorded in 2006/07 (13%), but lower than the 33% recorded in 2007/08.

The volume of water flowing from the Hopkins basin into Bass Strait was 121,500 ML in 2008/09, a slight increase on the previous year. This represented 73% of the catchment inflows into the basin, compared with 56% in 2007/08.

There are no major water storages (greater than 1,000 ML in size) in the basin.

Figure 31-1 Catchment inflows in the Hopkins basin



31.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Hopkins basin are shown in Table 31-2.

Table 31-2 Summary of total water resources and water use in the Hopkins basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	170,300	33,500
Groundwater[2]	39,600	21,400
Recycled water	4,960	590

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 31-7 and the estimated domestic and stock use presented in Table 31-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

31.4.1 Infrastructure to improve water availability

Central Highlands Water commissioned the development the Raglan groundwater project during 2008/09. This involved the drilling and installing of a production bore and connection to the Beaufort supply system. The project was completed in June 2009.

In April 2009, Wannon Water began construction of an additional 290 ML storage to improve the security of supply to Warrnambool.

31.5 Location of water resources

Figure 31-2 Map of the Hopkins basin

31.6 Surface water resources

31.6.1 Water balance

A water balance for the Hopkins basin is shown in Table 31-3. There are no major water storages (greater than 1,000 ML in size) in the basin.

Transfers into the basin for urban water supply did not affect streamflows and are therefore not accounted for in the water balance for the Hopkins basin.

Table 31-3 Balance of surface water in the Hopkins basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	166,000	210,400
Transfers from other basins(2)	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	4,290	4,300
Sub-total	**170,300**	**214,700**
Usage		
Urban diversions	220	170
Licensed diversions from unregulated streams	2,300	1,900
Small catchment dams(3)	31,000	64,600
Sub-total	**33,500**	**66,700**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	15,300	30,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**15,300**	**30,100**
Water passed at outlet of basin		
River outflows to the ocean	121,500	117,900

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Water from other basins used to supply urban needs are not shown as they were provided directly into the relevant urban supply systems and did not affect streamflows in the Hopkins basin.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Assumed to be zero because data is not readily available.

31.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 31-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 31-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	30,900	7,400	n/a
Registered commercial and irrigation	58,400	23,600	n/a
Total	**89,300**	**31,000**	**46,300**

n/a: Information not available.

31.6.3 Water entitlement transfers

Surface water movement in the Hopkins basin was limited to transfers of bundled entitlement within the basin. During the year 1 ML of bundled entitlement in the Hopkins basin was transferred on a permanent basis and 144 ML on a temporary basis. There was no net import of water into the basin in this water year.

Table 31-5 summarises the movement of bundled entitlements in the Hopkins basin during 2008/09.

Table 31-5 Transfers of surface water bundled entitlements in the Hopkins basin, 2008/09

Trading zone	Permanent transfers			Temporary transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin (ML)	Bought (ML)	Sold (ML)	Net transfer to basin (ML)
Hopkins unregulated	1	1	0	144	144	0
Total 2008/09	**1**	**1**	**0**	**144**	**144**	**0**
Total 2007/08[1]	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:
(1) No data available for 2007/08.

31.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 31-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2007/08. No water was extracted under the Skipton bulk entitlement as the town was supplied from the Ballarat system.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 31-6 Volume of water diverted under surface water entitlements in the Hopkins basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?
Central Highlands Water					
Beaufort	1	419	0	223	Yes
Skipton	1	210	0	0	Yes
GWMWater					
Willaura, Moyston, Lake Bolac and Wickliffe[2]	1	0	0	0	Yes
Total annual volume of bulk entitlements 2008/09		**629**	**0**	**223**	
Total annual volume of bulk entitlements 2007/08		**629**	**0**	**171**	
Licensed diversions from unregulated streams 2008/09[3]		*9,607*		*2,309*	
Licensed diversions from unregulated streams 2007/08		*9,068*		*1,876*	

Note:
(1) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.
(2) These towns are supplied by the Mt William supply system and are yet to be converted to formalised bulk entitlements.
(3) The increase in the bulk entitlement volume in 2008/09 is due to an increase in irrigation water entitlements during 2008/09.

31.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Hopkins basin, excluding domestic and stock use, is presented in Table 31-7.

The Hopkins basin contains all of the Glenormiston GMA as well as parts of the Nullawarre WSPA, Upper Loddon WSPA, Yangery WSPA, Cardigan GMA and Colongulac GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A. Good quality groundwater of reasonable yields is found in the unincorporated areas around the Nullawarre and Yangery WSPAs, and use from these unincorporated areas is expected to increase in the future. Groundwater levels in the Nullawarre WSPA, Yangery WSPA and Colongulac GMA are generally stable,

with Upper Loddon WSPA and Cardigan GMA experiencing declining trends. Insufficient observation bores were available to determine a trend for the Glenormiston GMA.

Groundwater use in the Hopkins basin was increased by about 26% in 2008/09 compared with 2007/08. This was largely due to the increase in extractions in the Cardigan GMA, the Nullawarre WSPA and the Yangery WSPA.

Table 31-7 Licensed groundwater volumes, Hopkins basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[5]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Cardigan GMA (61%)	All depths	3,076	3,028	2,272	1	2,273	140
Colongulac GMA (9%)	≤60	416	340	70	0	70	95
Glenormiston GMA (100%)	≤60	2,565	2,464	787	3	790	831
Nullawarre WSPA (89%)	≤250	19,032	19,032	12,106	22	12,128	10,722
Upper Loddon WSPA (24%)	All depths	3,282	3,190	1,218	0	1,218	1,149
Yangery WSPA (60%)	≤100	8,520	8,520	2,907	15	2,922	2,460
Total[6]		**36,891**	**36,574**	**19,360**	**41**	**19,401**	**15,397**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The Cardigan GMA is spread over three basins, with total licensed entitlement of 3,887 ML. As the total urban licensed entitlement of 1,700 ML is only extracted from the Hopkins basin (with usage of 1,689 ML), the remaining 961 ML of metered use is shared on a proportional basis between Cardigan, Barwon and Corangamite basins. Cardigan GMA has 60.7% of its service area in the Hopkins basin, 19.5% in the Corangamite basin and 19.8% in the Barwon basin. Only the non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV).

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 31-8.

Table 31-8 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cardigan GMA (61%)	62	124
Colongulac GMA (9%)	13	26
Glenormiston GMA (100%)	110	220
Nullawarre WSPA (89%)	951	1,902
Upper Loddon WSPA (24%)	104	208
Yangery WSPA (60%)	598	1,196
Total	**1,838**	**3,676**

Notes:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the Table 31-7.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

In the Hopkins basin, groundwater is provided to the townships of Mortlake, Warrnambool, Koroit, Allansford, Caramu, Darlington and Willaura. Additionally, groundwater from the Willaura (Mt William) bores is supplied to Glenthompson in the Glenelg basin through an agreement between Wannon Water and GWMWater. The licensed entitlements and metered use for these groundwater supplies is provided in Table 31-9.

Table 31-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Caramut	50	31	36
Darlington	10	2	5
Koroit	524	0	0
Mortlake	335	26	36
Warrnambool, Allansford and Koroit	750	434	438
Willaura, Glenthompson(1)	140	76	25
Ballarat(2)	1,700	1,689	2,199
Beaufort(3)	200	3	n/a
Streatham(3)	60	42	n/a
Total	**3,769**	**2,303**	**2,739**

Notes:

(1) The licensed volume for Willaura has incorrectly been reported as the licence for Glenthompson in the previous Victorian Water Accounts, and the Willaura supply and metered use not included. Of the 76 ML, some 44 ML was used to supply Glenthompson.

(2) The licensed volume is 1,700 ML, however up to 3,000 ML can be taken during periods of water shortage. Ballarat town supply was not reported in the 200708 Victorian Water Accounts.

(3) Not reported in 2007/08 Victorian Water Accounts.

31.8 Drought contingency measures

The main drought contingency measures in place in the Hopkins basin in 2008/09 were restrictions on urban and rural water use (discussed in section 31.9).

31.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 31-10.

A number of towns located within the Hopkins basin were subject to Stage 4 water restrictions the entire year. However, some of these are supplied from systems that source water from outside the basin, such as the Grampians and Ballarat headworks.

Licensed diverters on a number of unregulated rivers were restricted at various times during the year, with restrictions generally being more severe over the summer months.

Groundwater use was unrestricted in the Hopkins basin during 2008/09.

Table 31-10 Seasonal allocations and restrictions on water use in Hopkins basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Beaufort, Raglan	Stage 3 restrictions from July to December 2008, Stage 4 restrictions from January to July 2009
	Skipton	Stage 4 restrictions from July 2008 to June 2009
	Ararat	Stage 4 restrictions from July 2008 to June 2009
	Buangor	Stage 2 restrictions from July 2008 to June 2009
	Lake Bolac, Wickliffe and Willaura	Stage 4 restrictions from July 2008 to June 2009
	Streatham and Westmere	Stage 4 restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Merri River	Stage 1 restrictions in July 2008, November 2008, December 2008, and May and June 2009, Stage 4 restrictions in January 2009, Stage 7 from February to April 2009
	Mt Emu Creek	Stage 1 restrictions in July 2008, November and December 2008, Stage 3 restrictions in January, May and June 2009, Stage 4 restrictions in August 2008 and April 2009 and irrigation bans in February and March 2009
	Hopkins River	Stage 1 restrictions in July 2008 and January 2009, Stage 2 restrictions from April to June 2009, Stage 4 restrictions in August 2008 and irrigation bans in March and April 2009
	Lake Cartcarrong	Irrigation ban from July 2008 to June 2009

31.10 Recycled water

Three separate water authorities operate wastewater treatment plants within the Hopkins basin. Wastewater from the largest treatment plant in the basin at Warrnambool is discharged to the ocean. While the volume of recycled water reduced in 2008/09, the total percent recycled in 2008/09 remained at 12% of the total wastewater volume produced.

Table 31-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Ararat	400	400	98%	96	296	0	9	0	-1
Beaufort	42	0	0%	0	0	0	0	42	0
Cardigan Village	0	0	0%	0	0	0	0	0	0
Mortlake	61	0	1%	0	0	0	0	0	61
Terang[4]	191	194	102%	0	194	0	0	0	-3
Warrnambool	4,251	0	0%	0	0	0	0	4,251	0
Willaura	12	0	0%	0	0	0	0	0	12
Total 2008/09	**4,957**	**594**	**12%**	**96**	**490**	**0**	**9**	**4,293**	**69**
Total 2007/08	**5,137**	**648**	**12%**	**135**	**505**	**0**	**8**	**4,301**	**188**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

(4) Volume recycled greater than volume produced due to water stored on-site carried over from previous year.

31.11 Water for the environment

31.11.1 Environmental Water Reserve (EWR)

Important environmental assets, such as the coastal saltmarsh wetlands and the wetlands associated with the Merri River Estuary, depend on the Hopkins basin EWR.

In 2008/09 the Hopkins basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and GWMWater
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use.

31.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 31-12 shows the passing flow requirements in the Hopkins basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of these compliance points is presented in Figure 31-2.

Central Highlands Water did not report any non-compliance with their bulk entitlements within the Hopkins basin.

Table 31-12 Selected passing flow compliance in the Hopkins basin at selected sites

River	Passing flow	
Cave Hill Creek, Glut Creek, Side Spring Creek	Instrument where passing flows are specified	Bulk Entitlement (Beaufort) Conversion Order 2005
	Responsible authority	Central Highlands Water
	Compliance point	Cave Hill Creek Weir (shown as 1 in Figure 31-2)
	Passing flow compliance	The lesser of 0.2 ML/day or natural inflow were passed below Cave Hill Creek weir, except when there was insufficient supply to meet demand at Raglan

31.11.3 Streamflow management plans (SFMPs)

Work continued in preparation for the development of an SFMP for the Merri River.

32 Portland Coast basin

This chapter sets out the accounts for the Portland Coast basin. For detailed information about how they have been compiled, refer to Chapter 5.

32.1 Portland Coast basin summary

Despite rainfall ranging between 80% and 100% of the long term average, estimated inflows to the Portland Coast basin were 39% of the long term average. This was significantly lower than those recorded in 2007/08.

As with other river basins in western Victoria, groundwater is a significant resource in the Portland Coast basin. Although conditions were drier in 2008/09, total licensed use decreased by about 20% compared to 2007/08. The largest reduction was experienced in the Portland GMA, where usage decreased by nearly 65%.

The major towns in the basin are also supplied by groundwater, and in particular the Dilwyn aquifer. The yields from these sources were adequate to provide unrestricted supplies to these towns.

A very dry summer, however, meant that bans on licensed diversions were placed on a number of unregulated rivers in the basin in the second half of the year.

32.2 Responsibilities for management of water resources

Table 32-1 shows the responsibilities of various authorities within the Portland Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 32-1 Responsibilities for water resources management within the Portland Coast basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversion		
Wannon Water			Supplies Koroit, Port Fairy, Heywood and Portland	
Glenelg Hopkins Catchment Management Authority				Manages waterways in the whole Portland Coast basin

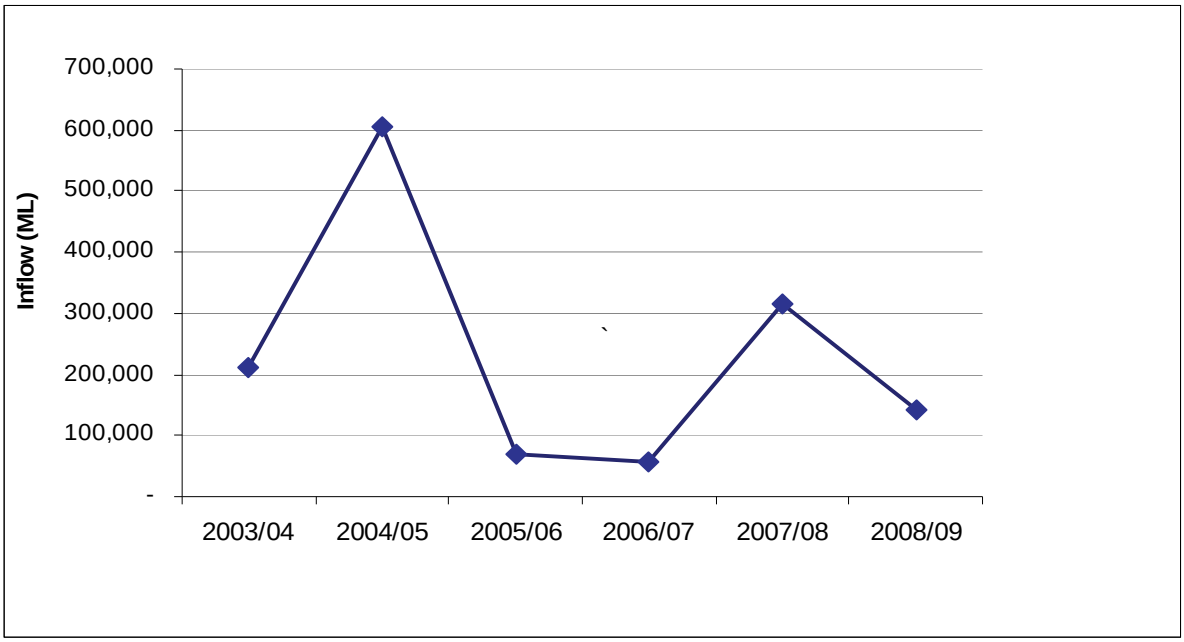
32.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall in the Portland Coast basin ranged between 80% and 100% of the long term average, which was similar to 2007/08. However, estimated inflows of 141,900 ML in 2008/09 were significantly lower than the previous year. Overall, inflows were 39% of the long term average in 2008/09, down from 87% in 2007/08.

The amount of water flowing from the Portland Coast basin into Bass Strait was 121,200 ML in 2008/09, a significant reduction from the previous year. This represents 85% of the catchment inflows into the basin.

There are no major storages (greater than 1,000 ML) in the basin.

Figure 32-1 Catchment inflows in the Portland Coast basin



32.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Portland Coast basin are shown in Table 32-2.

Table 32-2 Summary of total water resources and water use in the Portland Coast basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	141,900	16,300
Groundwater[2]	40,200	23,100
Recycled water	2,330	140

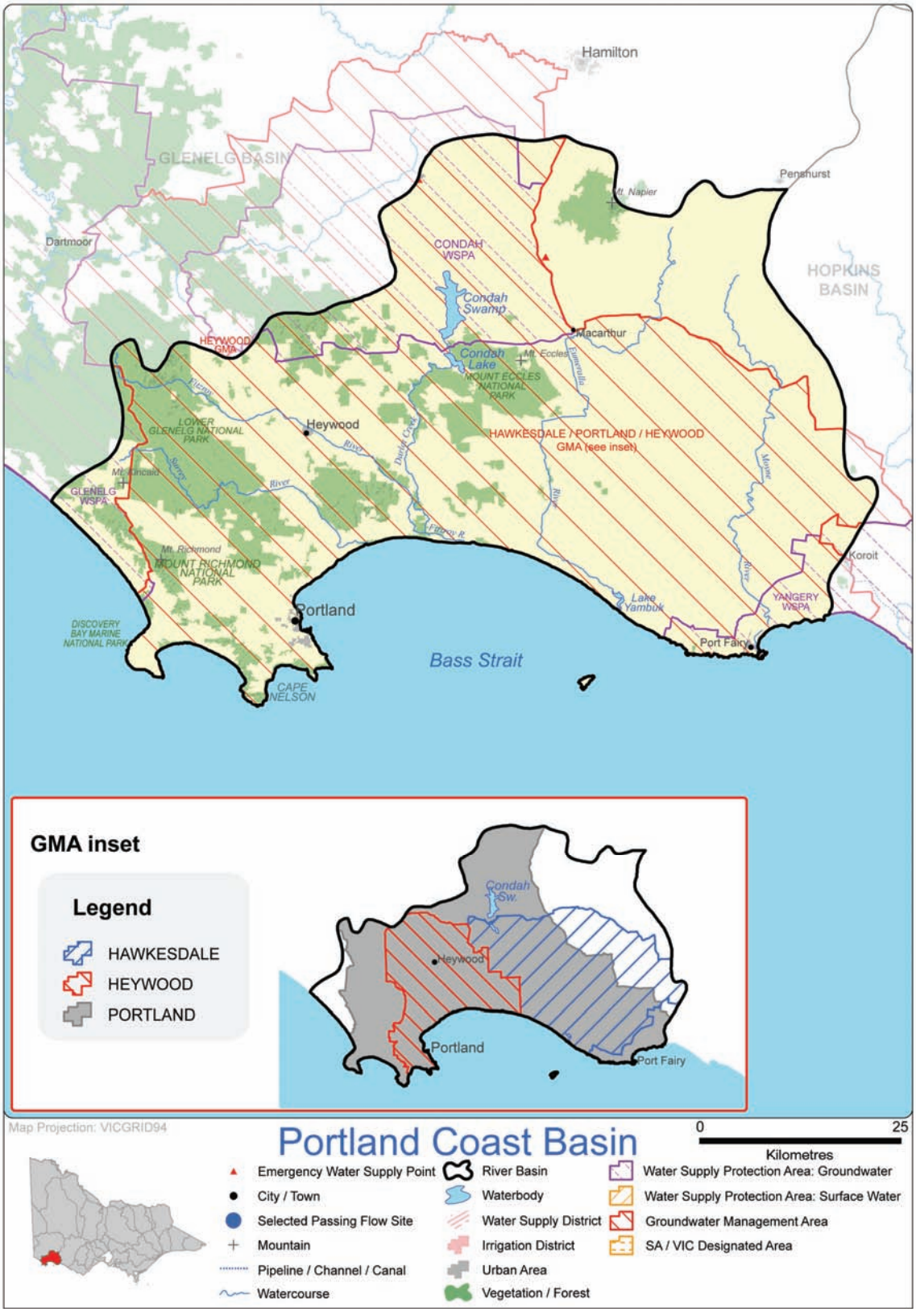
Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 32-5 and the estimated domestic and stock use presented in Table 32-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5 and Note (1) beneath Table 32-5.

32.5 Location of water resources

Figure 32-2 Map of the Portland Coast basin



32.6 Surface water resources

32.6.1 Water balance

A water balance for the Portland Coast basin is shown in Table 32-3.

Of the total inflows some 11% were diverted for consumptive use, mainly from small catchment dams. All towns serviced by Wannon Water in this basin are supplied by groundwater or from other river basins.

Table 32-3 Balance of surface water in the Portland Coast basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	141,900	315,400
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	2,690
Sub-total	**141,900**	**318,100**
Usage		
Urban diversions	0	0
Licensed diversions from unregulated streams	100	100
Small catchment dams(2)	16,200	16,200
Sub-total	**16,300**	**16,300**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	4,400	4,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)		0
Sub-total	**4,400**	**4,400**
Water passed at outlet of basin		
River outflows to the ocean	121,200	297,400

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.
(3) Assumed to be zero because data is not readily available.

32.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 32-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 32-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,500	2,300	n/a
Registered commercial and irrigation	16,500	13,900	n/a
Total	**21,000**	**16,200**	**20,600**

n/a: Information not available.

32.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

32.6.4 Volume diverted

There are no bulk entitlements to surface water in the Portland Coast basin. All water is diverted from unregulated streams under licences. In 2008/09, about 67 ML out of a total licence volume of 2,085 ML was diverted for use in the basin. This compares with 82 ML out of a total licence volume of 2,069 ML in 2007/08.

32.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Portland Coast basin, excluding domestic and stock use, is presented in Table 32-5.

The Portland Coast basin contains all of the Heywood GMA and Hawkesdale GMA as well as part of the Condah WSPA (52%), Yangery WSPA (40%) and Portland GMA (73%). The Hawkesdale GMA recorded an increase of 60% in groundwater use compared to 2007/08, while Portland GMA recorded a decrease of 64%. Groundwater levels in the Condah WSPA and Portland GMA are declining, while the Yangery WSPA remains stable. Insufficient observation bores were available to determine trends for the Heywood and Hawkesdale GMA. New bores were drilled in 2008/09 to improve the network coverage. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

The Portland GMA comprises the deep, geothermal waters of the Dilwyn Formation aquifer, which is recharged in its northern parts where it is closer to the ground surface. The change in land use in its recharge zones has the potential to deplete recharge to the aquifer and its impact is being considered in the management of groundwater resources.

The water level in the Condah WSPA is exhibiting a long term declining trend.

Table 32-5 Licensed groundwater volumes, Portland Coast basin 2008/09

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Hawkesdale GMA (100%)	Zone 1 All depths Zone 2 <200	16,161	11,754	5,612	10	5,622	3,423
Heywood GMA (100%)	≤70	8,500	6,695	1,350	10	1,360	1,916
Portland GMA (73%)	>200	7,736	7,736	3,114	-	3,114	8,738
Condah WSPA (52%)	70-200	3,902	3,901	1,659	5	1,664	1,498
Yangery WSPA (40%)	≤100	5,583	5,583	1,905	10	1,915	1,612
Total[6]		**41,882**	**35,669**	**13,640**	**35**	**13,675**	**17,186**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. The water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The exception in this table is Portland GMA, which is known to have 7,581 ML of urban licensed volume. In Portland, out of 7,794 ML of licensed entitlement, 7,581 ML is from urban use, all extracted from the Portland basin. The remaining 213 ML is shared on a proportional basis between Portland and Glenelg basins. Portland GMA has 73% of its service area in the Portland basin and 27% in the Glenelg. Only the entitlement limit, non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 32-6.

Table 32-6 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Hawkesdale GMA (100%)	1,288	2,576
Heywood GMA (100%)	1,406	2,812
Portland GMA (73%)	118	235
Condah WSPA (52%)	170	340
Yangery WSPA (40%)	391	783
Total	**3,373**	**6,746**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the Table 32-5.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is used as an urban water supply for the townships of Portland, Port Fairy and Heywood. The licensed entitlements and metered use for these groundwater supplies is provided in Table 32-7.

Table 32-7 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Heywood	333	186	202
Port Fairy	1,026	808	855
Portland	6,222	2,121	2,175
Total	**7,581**	**3,115**	**3,232**

32.8 Drought contingency measures

The main drought contingency measures in place in the Portland Coast basin in 2008/09 were restrictions on urban and rural water use (discussed in section 32.9).

32.9 Seasonal allocations and restrictions on water use, diversions and extractions

The major towns in the basin are also supplied by groundwater, in particular from the Dilwyn aquifer. The yields from these sources were adequate to provide unrestricted supplies to these towns.

A very dry summer however, meant that bans on licensed diversions were placed on a number of unregulated rivers in the basin in the second half of the year.

Restrictions applying to licensed diversions are shown in Table 32-8.

Table 32-8 Seasonal allocations and restrictions on water use in Portland Coast basin, 2008/09

Type of restriction	Area	Nature of restriction
Licensed diversions from unregulated streams	Surrey River	Irrigation ban from January to June 2009
	Fitzroy River, Eumarella River and Moyne River	Irrigation ban from January to June 2009

32.10 Recycled water

Wannon Water operates all treatment plants within the Portland Coast basin. In 2008/09, about 6% of the total wastewater produced in the basin was reused, including 52% from the Heywood treatment plant for wood lot irrigation (up from 37% in 2007/08). The 6% recycled water use in 2008/09 increased from the 4% in 2007/08 and was similar to the 6% recycled use in 2006/07.

Table 32-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Heywood	275	144	52%	0	144	0	0	82	49
Port Fairy	900	0	0%	0	0	0	0	900	0
Portland	1,155	0	0%	0	0	0	0	1,155	0
Total 2008/09	**2,330**	**144**	**6%**	0	**144**	0	0	**2,137**	**49**
Total 2007/08	**2,897**	**129**	**4%**	0	**129**	0	0	**2,689**	**80**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

32.11 Water for the environment

32.11.1 Environmental Water Reserve (EWR)

In 2008/09 the Portland Coast basin EWR comprised:

- water set aside for the environment through the operations of licensed diversions in passing flow conditions
- water in the basin not otherwise allocated for consumptive use, i.e. water above cap.

32.11.2 Passing flow compliance

There are currently no bulk entitlements in operation and therefore no passing flow obligations on water corporations in the Portland Coast basin.

33 Glenelg basin

This chapter sets out the accounts for the Glenelg basin. For detailed information about how they have been compiled, refer to Chapter 5.

33.1 Glenelg basin summary

Inflows in the Glenelg basin in 2008/09 were 16% of the long term average and less than half the inflows experienced in 2007/08. At the end of the year, the basin's largest water storage, Rocklands Reservoir, was holding only 1% of capacity.

The lack of water in storage meant that GWMWater were restricted to transferring only 4,700 ML to the Wimmera-Mallee system over the year. This is less than half the volume transferred in 2007/08 and well below the 60,000 ML long term average.

All Wimmera and Glenelg rivers bulk entitlements were qualified in 2008/09 to enable GWMWater to withhold water allocated for the environment, as well as carryover water, in reserve until supply conditions improve.

Towns supplied by the Grampians catchments, such as Hamilton and Balmoral, experienced severe water shortages during the year and were subsequently placed on severe water restrictions. Licensed diverters from the Wannon and the Glenelg rivers and a number of their tributaries were banned from taking water for the second half of the year.

33.2 Responsibilities for management of water resources

Table 33-1 shows the responsibilities of various authorities within the Glenelg basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 33-1 Responsibilities for water resources management within the Glenelg basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions for the entire basin except the Glenelg River north of the bridge on Casterton-Harrow Road		
GWMWater		Manages groundwater and surface water licensed diversions for the Glenelg River north of the bridge on Casterton-Harrow Road	Supplies Harrow	Operates the Wimmera Mallee supply system, which includes Rocklands and Moora Moora reservoirs, and several other small diversion weirs in the upper Glenelg and Wannon rivers
Wannon Water			Supplies all towns in the basin with the exception of Harrow	Operates reservoirs in the Hamilton supply systems Obliged to meet passing flow requirements
Environment Minister				Obliged to meet passing flow requirements
Glenelg-Hopkins Catchment Management Authority				Manages waterways in the whole of the Glenelg basin

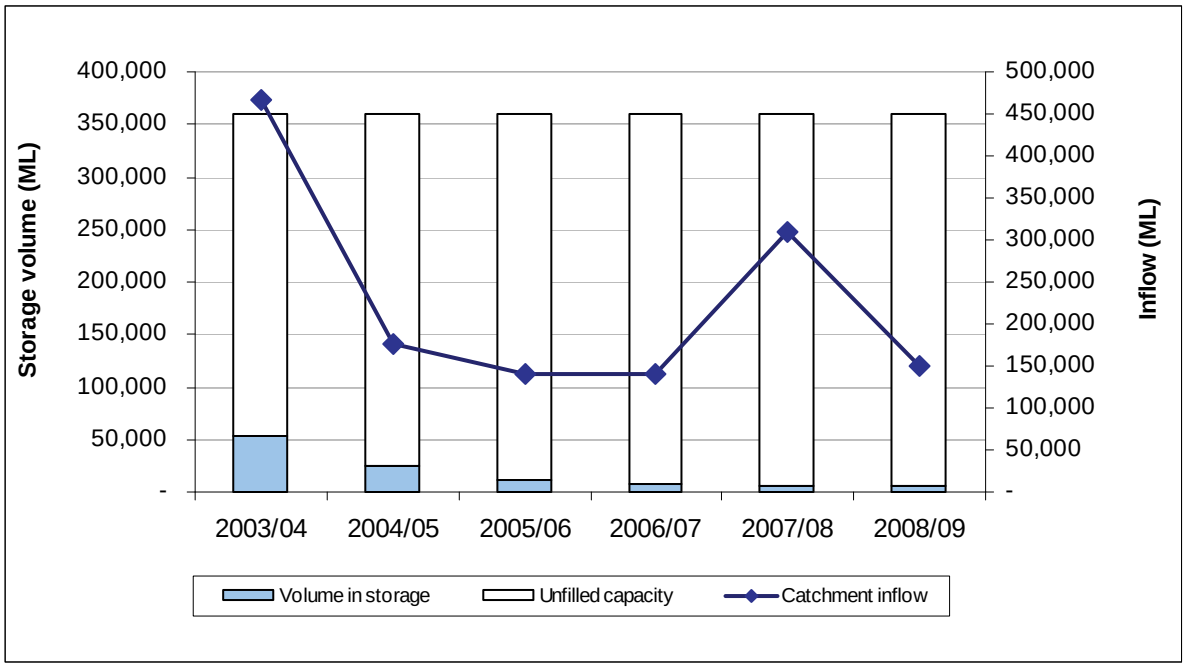
33.3 Rainfall, flows and storages in 2008/09

During 2008/09, rainfall in the Glenelg basin was mostly between 80% to 100% of the long term average, with some areas receiving between 60% to 80% of the long term average. Inflows across the basin were 149,600 ML. This was 16% of the long term average (of 964,000 ML) and less than half the inflows experienced in 2007/08.

The volume of water flowing from the Glenelg basin into Bass Strait was 49,900 ML in 2008/09, a significant reduction from the previous year. This represented 33% of the catchment inflows into the basin, compared with 62% in 2007/08.

Four major storages are located within the basin. Rocklands Reservoir, which accounts for 97% of the total capacity of Glenelg basin storages, was holding a little more than 1% of capacity at the end of 2008/09.

Figure 33-1 All major storages and catchment inflows in the Glenelg basin



33.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Glenelg basin are shown in Table 33-2.

Table 33-2 Summary of total water resources and water use in the Glenelg basin, 2008/09

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	149,800	34,700
Groundwater[2]	28,800	10,200
Recycled water	1,150	870

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 33-6 and the estimated domestic and stock use presented in Table 33-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5 and Note (1) beneath Table 33-6.

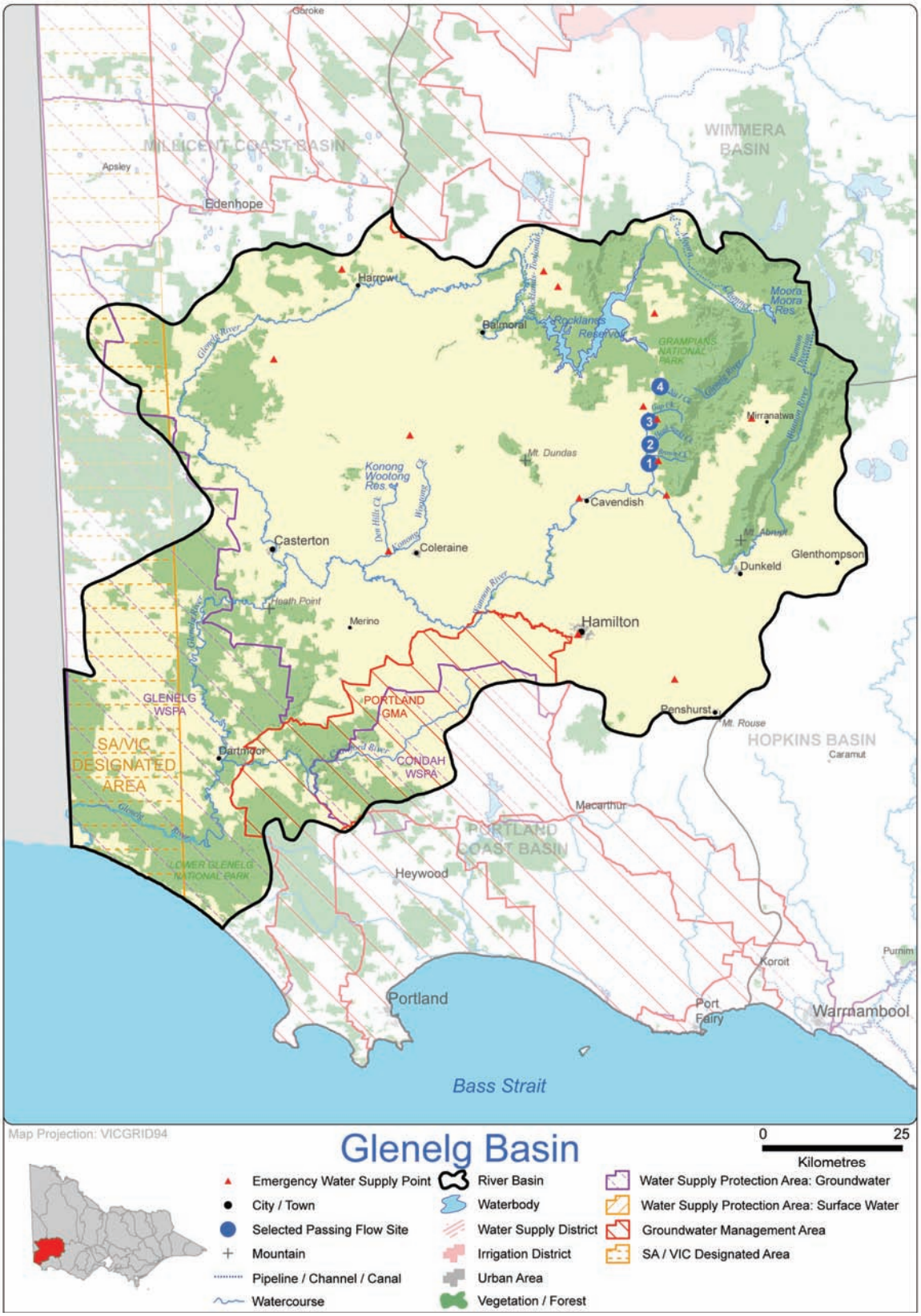
33.4.1 Infrastructure to improve water availability

Wannon Water began constructing the 53 kilometre Hamilton-Grampians pipeline in 2009. The pipeline is due for completion in 2010 and will connect Hamilton to Rocklands Reservoir in the Wimmera-Mallee system.

Wannon Water also completed construction of the 29 kilometre pipeline from Casterton to Coleraine in 2009. This pipeline will improve water quality and supply security for Coleraine.

33.5 Location of water resources

Figure 33-2 Map of the Glenelg basin



33.6 Surface water resources

33.6.1 Water balance

A water balance for the Glenelg basin is shown in Table 33-3. Diversions to the Wimmera Mallee System reduced from 14,100 ML in 2007/08 to 4,700 ML in 2008/09 due to the severe water shortage in the basin.

Table 33-3 Balance of surface water in the Glenelg basin

Water account component	2008/09 (ML)	2007/08 (ML)
Major on-stream storage		
Volume in storage at start of year	5,700	8,500
Volume in storage at end of year	6,100	5,700
Change in storage	**400**	**-2,800**
Inflows		
Catchment inflow(1)	149,600	308,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	180	240
Sub-total	**149,800**	**308,300**
Usage		
Urban diversions	1,400	1,990
Diversions to the Wimmera Mallee Water System	4,700	14,100
Licensed diversions from unregulated streams	300	300
Small catchment dams(2)	28,300	55,500
Sub-total	**34,700**	**71,900**
Losses		
Net evaporation losses from major storages	4,900	8,900
Evaporation from small catchment dams(2)	52,600	24,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	7,300	15,800
Sub-total	**64,800**	**49,300**
Water passed at outlet of basin		
River outflows to the ocean	49,900	189,900

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The estimate for 2007/08 was revised during 2008/09 and differs from the number reported in the *Victorian Water Accounts 2007-2008*. See Table 1-1, Note 7 in Part 1 of this report.

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Estimated from loss functions in the Glenelg River REALM model.

33.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2008/09 is not readily available. The values in Table 33-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 33-4 Estimated small catchment dam information, 2008/09

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	27,100	6,900	n/a
Registered commercial and irrigation	49,900	21,400	n/a
Total	**77,000**	**28,300**	**80,900**

n/a: Information not available.

33.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

33.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 33-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2008/09.

The amount diverted for the Coleraine bulk entitlement is not directly measured and was estimated based on the metered volume of water supplied to customers. Although Casterton and Sandford are included in this bulk entitlement, these towns are supplied from the Tullich bore system.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 33-5 Volume of water diverted under surface water entitlements in the Glenelg basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2008/09 (ML)	Volume diverted 2008/09 (ML)	Bulk entitlement volume compliance?(2)
Coliban Water					
Wimmera and Glenelg Rivers(3)	1	450	0	276	Yes
Wannon Water					
Coleraine, Casterton, Sandford	1	855	0	204	Yes
Dunkeld	1	170	0	0	Yes
Glenthompson	1	94	0	6	Yes
Hamilton	1	3,435	0	1,125	Yes
Wimmera and Glenelg Rivers(4)	1	80	0	67	Yes
GWMWater					
Wimmera and Glenelg Rivers – Grampians Water(3)	1	16,109	0	3,532	Yes
Wimmera and Glenelg Rivers – Wimmera Mallee Water(3)	1	149,211	0	3,112	Yes
Environment Minister					
Wimmera and Glenelg Rivers(3)	5	40,563	0	8,175	Yes
Total annual volume of bulk entitlements 2008/09		**210,967**	**0**	**16,497**	
Total annual volume of bulk entitlements 2007/08		**210,967**	**0**	**11,328**	
Licensed diversions from unregulated streams 2008/09		*1,034*		*252*	
Licensed diversions from unregulated streams 2007/08		*1,025*		*279*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Diversions under these bulk entitlements are not shown in the water balance for the Glenelg basin because diversions are taken from both the Glenelg and Wimmera river systems and cannot be disaggregated. They are shown in the water balance for the Wimmera basin.

(4) Diversions under this bulk entitlement are included in the Glenelg basin water balance.

33.7 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Glenelg basin, excluding domestic and stock use, is presented in Table 33-6.

The Glenelg basin contains part of the Condah WSPA, Glenelg WSPA and Portland GMA. Groundwater levels are generally declining in this area. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use reduced in 2008/09 compared with 2007/08, with extractions in the Portland GMA reducing from 2,075 ML in 2007/08 to zero in 2008/09. Extractions in the Glenelg WSPA, however, increased from 5,312 ML in 2007/08 to 6,432 ML in 2008/09.

Table 33-6 Licensed groundwater volumes, Glenelg basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[5]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Portland GMA (27%)	>200	59	58	0	0	0	2,075
Condah WSPA (48%)	70-200	3,535	3,535	1,503	5	1,508	1,357
Glenelg WSPA (70%)	All depths	23,017	23,017	6,418	14	6,432	5,312
Total[6]		**26,611**	**26,610**	**7,921**	**19**	**7,940**	**8,744**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. The water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included, with the exception of Portland GMA, which is known to have 7,581 ML of urban licensed volume. In Portland, out of 7,794 ML of licensed entitlement, 7,581 ML is for urban use, all extracted from the Portland basin. The remaining 213 ML is shared on a proportional basis between Portland and Glenelg basins. Portland GMA has 73% of its service area in the Portland basin and 27% in the Glenelg. Only the entitlement limit, non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established, in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 33-7.

Table 33-7 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Portland GMA (27%)	44	89
Condah WSPA (48%)	154	308
Glenelg WSPA (70%)	919	1,838
Total	**1,117**	**2,235**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in the Table 33-6.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

Groundwater is used as an urban water supply for a number of townships in the basin. Urban groundwater usage was reduced in 2008/09 largely due to the decreased reliance on the Hamilton emergency bores. The licensed entitlements and metered use for these groundwater supplies is provided in Table 33-8.

Table 33-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Casterton	1,000	294	387
Dartmoor(1)	170	22	26
Hamilton (emergency bores)(2)	668	238	314
Harrow(3)	29	46	37
Macarthur	130	25	34
Merino	100	0	0
Penshurst	250	144	149
Total	2,347	769	947

Note:

(1) The Dartmoor licence volume includes a 20 ML transfer.

(2) The Hamilton licence volume includes 120 ML of permanent licence, and 548 ML of temporary licence which expired on 30 June 2008.

(3) Harrow's groundwater licence was insufficient to supply the town's needs in 2008/09. GWMWater is considering an application for an increase in the licence volume.

33.8 Drought contingency measures

A number of drought contingency measures were implemented in the Glenelg basin in 2008/09. These include:

- restricting urban and rural water use (discussed in section 33.9)
- the continuation of a temporary qualification of rights of the Wimmera-Glenelg bulk entitlements as detailed in Chapter 15
- amending a bulk entitlement.

In addition to the temporary qualification of rights on the Wimmera-Glenelg bulk entitlements, the Minister for Water approved an amendment to the Wannon Water Bulk Entitlement (Hamilton) Conversion Order 1997. The amendment reduced passing flow requirements in Grampians headworks streams to secure Hamilton's drinking supplies during severe drought scenarios until the Hamilton-Grampians pipeline is complete.

33.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 33-9.

Towns supplied by the Grampians catchments, such as Hamilton and Balmoral, experienced severe water shortages during the year and were subsequently placed on severe water restrictions. Licensed diverters from the Wannon and the Glenelg rivers and a number of their tributaries were banned from taking water for the second half of the year.

Groundwater use was unrestricted in the Glenelg basin during 2008/09.

Table 33-9 Seasonal allocations and restrictions on water use in Glenelg basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Harrow	Stage 1 restrictions from July 2008 to June 2009
	Glenthompson	Stage 2 restrictions from July 2008 to June 2009
	Balmoral	Stage 4 restrictions from July 2008 to June 2009
	Cavendish, Dunkeld, Hamilton and Tarrington	Stage 3 restrictions from July 2008 to June 2009
Licensed diversions from unregulated streams	Wannon River, Crawford River and Grange Burn Creek	Irrigation ban from January to June 2009
	Glenelg River	Irrigation ban from January to June 2009

33.10 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. Some 76% of wastewater was recycled in 2008/09, which was similar to the 75% in 2007/08.

Table 33-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Casterton	213	46	21%	0	46	0	0	0	167
Coleraine	17	18	106%	18	0	0	0	0	-1
Dunkeld	29	32	108%	10	22	0	0	2	-5
Hamilton	888	771	87%	120	651	0	0	181	-64
Total 2008/09	**1,147**	**867**	**76%**	**148**	**719**	**0**	**0**	**183**	**97**
Total 2007/08	**1,102**	**823**	**75%**	**108**	**715**	**0**	**0**	**242**	**37**

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for, such as Wannon Water holding wastewater in storage for the next year.

33.11 Water for the environment

33.11.1 Environmental Water Reserve (EWR)

The Lower Glenelg River is a heritage river and dependent on the Glenelg basin EWR to ecologically function. Other important environmental assets such as Glenelg Spiny Crayfish and Yarra and Ewens Pigmy Perch also rely on the EWR of this basin.

In 2008/09 the Glenelg basin EWR comprised the following components:

- the Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Order 2005
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Wannon Water and GWMWater
- water set aside for the environment through the operation of licensed diversions in passing flow conditions
- all other water in the basin not allocated for consumptive use.

33.11.2 Entitlements for the environment

The Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Order 2005 was in operation in the Glenelg basin in 2008/09. The Inter Catchment Advisory Group determines the share of environmental allocations between the two catchments. The full entitlement under this bulk entitlement order is 75,299 ML, of which 40,560 ML is held in storage and 34,739 ML is rules-based water.

During 2008/09, 900 ML was released to the Glenelg River under this entitlement.

33.11.3 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 33-11 shows the passing flow compliance in the Glenelg basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. Wannon Water reported that it complied with all passing flow obligations.

Table 33-11 Selected passing flow compliance in the Glenelg basin

River	Passing flow	
Brown Creek, Headworks Creek, Gap Creek, Chimney Pot Creek, No 1 Creek, No 2 Creek, No 3 Creek	Instrument where passing flows are specified	Bulk Entitlement (Hamilton) Conversion Order 1997
	Responsible authority	Wannon Water
	Compliance point	Brown Creek (shown as 1 in Figure 33-2)
	Passing flow compliance	The lesser of 0.4 ML/day or natural flows were passed from Brown Creek
	Compliance point	Headworks Creek (shown as 2 in Figure 33-2)
	Passing flow compliance	The lesser of 0.4 ML/day or natural flow were passed from Headworks Creek
	Compliance point	Gap Creek (shown as 3 in Figure 33-2)
	Passing flow compliance	The lesser of 0.4 ML/day or natural flow were passed from Gap Creek
	Compliance point	No 1 Creek (shown as 4 in Figure 33-2)
	Passing flow compliance	The lesser of 0.4 ML/day or natural flow were passed from No 1 Creek

34 Millicent Coast basin

This chapter sets out the accounts for the Millicent Coast basin. For detailed information about how they have been compiled, refer to Chapter 5.

34.1 Millicent Coast basin summary

Rainfall across the Millicent Coast basin in 2008/09 ranged between 60% and 100% of the long term average.

Groundwater is the main source of water supply in the Millicent Coast basin. Licensed groundwater use within the basin in 2008/09 increased by nearly 10% compared to the previous year. The most significant increase in use occurred in the Apsley WSPA and Kaniva WSPA.

Edenhope was the only town to experience Stage 1 restrictions. Towns that rely solely on groundwater for supplies were not subject to restrictions. Bans were in place throughout the year for licensed diverters from Lake Charlegrark, Lake Wallace and Lake Yampitcha.

34.2 Responsibilities for management of water resources

Table 34-1 shows the responsibilities of various authorities within the Millicent Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 34-1 Responsibilities for water resources management within the Millicent Coast basin, 2008/09

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater		Manages groundwater(1) and surface water licensed diversions within the Millicent Coast basin	Supplies all towns including Kaniva and Edenhope	
Southern Rural Water		Manages groundwater licensed diversions in the Glenelg WSPA		
Wimmera Catchment Management Authority				Manages waterways in the whole of the Millicent Coast basin

Note:

(1) Groundwater management is undertaken jointly by South Australia and Victoria under the Border agreement.

34.3 Rainfall, flows and storages in 2008/09

In 2008/09, rainfall across the Millicent Coast basin ranged between 60% and 100% of the long term average. This is similar to 2007/08. No reliable stream flow data exists for the Millicent Coast basin.

As there are no stream gauges within the Millicent Coast basin in Victoria, an estimate of the volume of water leaving the basin was not made. Any surface water not diverted flows to South Australia.

34.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Millicent Coast basin are shown in Table 34-2. The volume of the surface water resource has notionally been set to the water diverted from streams in 2008/09.

Table 34-2 Summary of total water resources and water use in the Millicent Coast basin, 2008/09

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	100	100
Groundwater(2)	57,500	24,800
Recycled water	40	40

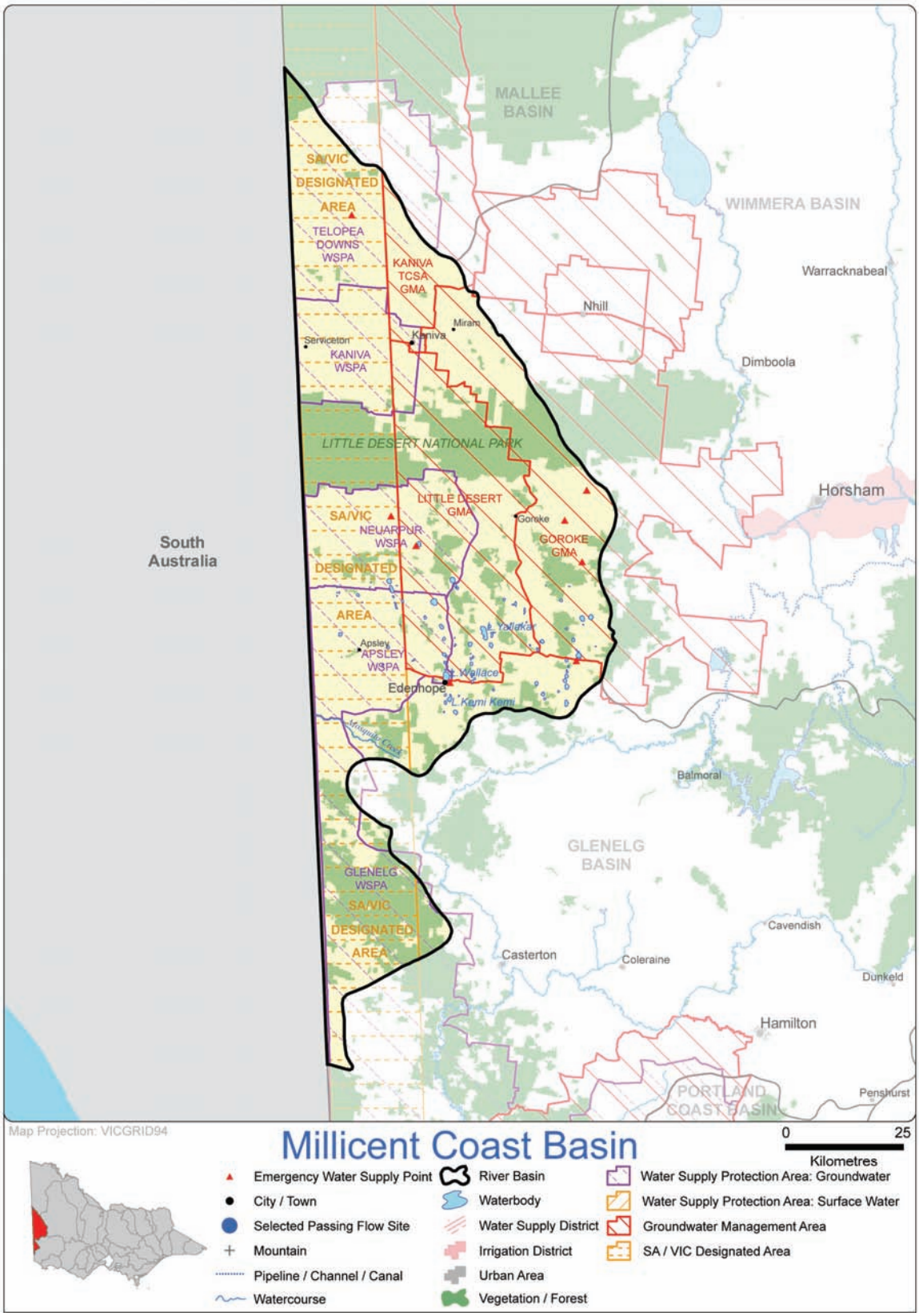
Note:

(1) For surface water and groundwater, the total water resource is the licensed entitlement volume as presented in Table 34-3 and estimate of domestic and stock use as presented in Table 34-4.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

34.5 Location of water resources

Figure 34-1 Map of the Millicent Coast basin



34.6 Surface water resources

34.6.1 Water balance

There is no reliable estimate of the average annual inflows in the Victorian Millicent Coast basin, although 4,000 ML a year was estimated for the National Land and Water Resources Audit (National Land and Water Audit, 2001). As there is no flow gauging within the Millicent Coast basin in Victoria, an estimate of 2008/09 inflows could not reliably be made.

Currently limited information is available for surface water availability and use, therefore a water balance has not been included for the Millicent Coast basin.

34.6.2 Small catchment dams

No information regarding small catchment dams is readily available within the Millicent Coast basin.

34.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2008/09.

34.6.4 Volume diverted

There are no bulk entitlements to surface water in the Millicent Coast basin. All water is diverted from unregulated streams under licences. In 2008/09, all of the total licence volume of 100 ML was diverted for use in the basin. The same volume was diverted in 2007/08.

34.7 Groundwater resources

A summary of the licensed entitlements and use from groundwater management units within the Millicent Coast basin, excluding domestic and stock use, is shown in Table 34-3.

The main water supply in the Millicent Coast basin is groundwater. The Millicent Coast basin contains the whole Kaniva WSPA, Neuarpur WSPA, Apsley WSPA and Little Desert GMA, as well as part of the Glenelg WSPA, Telopea Downs WSPA, Kaniva TCSA GMA and Goroke GMA. Groundwater levels in Kaniva, Glenelg and Telopea Downs, as well as Little Desert and Kaniva TCSA GMA are stable, with declining trends in the Goroke GMA, and Neuarpur and Apsley WSPAs.

Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in the Millicent Coast basin increased in 2008/09 compared with 2007/08. The most significant increase in groundwater use occurred in the Glenelg WSPA, where extractions increased from 2,225 ML in 2007/08 to 2,695 ML in 2008/09 and Kaninva WSPA where extractions increased from 2,087 ML in 2007/08 to 3,027 ML in 2008/09.

Table 34-3 Licensed groundwater volumes, Millicent Coast basin 2008/09

WSPA/GMA[1]	GMA/WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[5]	Total licensed groundwater use (ML) 2008/09	Total licensed groundwater use (ML) 2007/08
Goroke GMA (37%)	Tertiary confined sand aquifer	807	807	0	0	0	0
Kaniva TCSA GMA (17%)	Tertiary confined sand aquifer	187	187	0	0	0	0
Little Desert GMA (100%)	Tertiary confined sand aquifer	1,100	1,100	0	0	0	0
Apsley WSPA (100%)	All depths	5,591	5,591	1,532	0	1,532	1,451
Glenelg WSPA (30%)	All depths	9,643	9,643	2,689	6	2,695	2,225
Kaniva WSPA (100%)	25-140	7,659	7,659	3,027	0	3,027	2,087
Neuarpur WSPA (100%)	50-175	24,750	24,750	14,651	0	14,651	14,793
Telopea Downs WSPA (61%)	All depths	6,506	6,506	1,630	0	1,630	992
Total[6]		**56,243**	**56,243**	**23,529**	**6**	**23,534**	**21,548**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) The entitlement limit is represented by the permissible consumptive volume (PCV), except where a PCV has not been established (e.g. Telopea Downs WSPA, Kaniva TSCA GMA and Apsley WSPA), in which case the licensed entitlement is used.

(4) Licensed entitlement includes domestic and stock usage in those cases where this forms part of a licensed volume.

(5) Non-metered use includes dairy wash and low consumption commercial use.

(6) Total volumes are based on the sum of management unit data prior to rounding.

An estimate of domestic and stock groundwater use is provided in Table 34-4.

Table 34-4 Number of domestic and stock bores and estimated use, 2008/09

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Goroke GMA	0	0
Kaniva TCSA GMA	0	0
Little Desert GMA	0	0
Apsley WSPA	98	196
Glenelg WSPA	385	770
Kaniva WSPA	33	66
Neuarpur WSPA	111	222
Telopea Downs WSPA	19	38
Total	**646**	**1,292**

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 34-3.

(2) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data prior to rounding.

In the Millicent Coast basin, groundwater is used as an urban water supply for the townships of Apsley, Kaniva, Lillimur, Goroke, Leeor (Serviceton), Mirampiram (Miram) and Harrow, and as an emergency supply for Edenhope. The licensed entitlements and metered use for these groundwater supplies is provided in Table 34-5.

Table 34-5 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2008/09 (ML)	Metered use 2007/08 (ML)
Boikerbert (Apsley)[1]	40	48	48
Edenhope (emergency bores)[2]	n/a	134	144
Goroke	86	67	61
Kaniva	600	232	244
Leeor (Serviceton)	25	9	9
Lillimur	32	13	12
Mirampiram (Miram)	7	1	2
Total	790	504	**520**

Note:

(1) Since Apsley is in a WSPA no new licences can be considered. Compliance with licensed volume is achieved through temporary transfer of entitlements.

(2) GWMWater and the Department of Sustainability and Environment are currently working on defining a licensed volume for Edenhope's groundwater supply.

34.8 Drought contingency measures

The main drought contingency measures in place in the Portland Coast basin in 2008/09 were restrictions on urban and rural water use (discussed in section 34.9).

34.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions on water use in the Millicent Coast basin are outlined in Table 34-6.

Edenhope was the only town to experience Stage 1 restrictions. Towns that rely solely on groundwater for supplies were not subject to restrictions. Bans were in place throughout the year for licensed diverters from Lake Charlegrark, Lake Wallace and Lake Yampitcha.

Groundwater use was unrestricted in the basin during 2008/09.

Table 34-6 Seasonal allocations and restrictions on water use in Millicent Coast basin, 2008/09

Type of restriction	Area	Nature of restriction
Urban	Edenhope	Stage 1 restrictions from July 2008 to June 2009
Diversions from unregulated streams	Lake Charlegrark, Lake Wallace and Lake Yampitcha	Irrigation ban from July 2008 to June 2009

34.10 Recycled water

GWMWater operates wastewater treatment plants in three towns within the Millicent Coast basin. All wastewater from Edenhope was reused for a variety of purposes, including pasture improvement and watering recreational facilities and parks. Wastewater produced at Kaniva and Serviceton treatment plants was evaporated on-site and is not included in Table 34-7.

Table 34-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Edenhope	42	42	100%	42	0	0	0	0	0
Kaniva North	0	0	0%	0	0	0	0	0	0
Kaniva South	0	0	0%	0	0	0	0	0	0
Serviceton	0	0	0%	0	0	0	0	0	0
Total 2008/09	**42**	**42**	**100%**	**42**	**0**	**0**	**0**	**0**	**0**
Total 2007/08	35	35	100%	35	0	0	0	0	0

Notes:

(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

(3) Other refers to a change in on-site wastewater storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

34.11 Water for the environment

34.11.1 Environmental Water Reserve (EWR)

The Millicent Coast basin contains numerous wetlands dependent on the basin's EWR.

In 2008/09 the Millicent Coast basin EWR comprised all water in the basin not allocated for consumptive use.

34.11.2 Passing Flows

There are currently no bulk entitlements in operation and therefore no passing flow obligations on water corporations in the Millicent Coast basin.

Appendix A

Groundwater entitlement and use

Groundwater management unit[1]	PCV	Allocation limit as of 30/06/09 (ML)	Licensed volumes (as at 30/06/09)							Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metering program complete	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores	Estimated use (ML)[4]	
Goulburn-Murray Water												
WSPA (approved plan)												
Campaspe Deep Lead WSPA	47,252	47,252	46,096	114	115	Yes	24,107	0		228	456	24,563
Shepparton WSPA		241,033	241,033	1,445	993	Yes	57,154	0		1,865	3,730	60,884
Spring Hill WSPA	5,062	5,062	4,909	55	59	Yes	2,041	0		151	302	2,343
Katunga WSPA	59,780	59,780	59,539	190	132	Yes	32,849	0		465	930	33,779
WSPA (draft plan)												
Mid Loddon WSPA	37,200	37,200	34,014	97	99	Yes	19,422	0		348	696	20,118
Upper Loddon WSPA	13,648	13,648	13,264	115	135	Yes	5,066	0		432	864	5,930
GMA												
Alexandra GMA	1,937	1,937	1,714	10	7	Yes	182	1,028	60% of entitlement	4	8	1,219
Barnawartha GMA	2,100	2,100	635	5	0	Yes	0	381	60% of entitlement	32	64	445
Kinglake GMA	2,015	2,015	1,864	54	29	Yes	263	1,118	60% of entitlement	290	580	1,961
Mullindolingong GMA	6,980	6,980	1,532	35	13	Yes	0	613	40% of entitlement	56	112	725
Upper Ovens WSPA	4,010	4,010	3,658	102	0	Yes	0	1,463	40% of entitlement	318	636	2,099
Lower Ovens GMA	25,200	25,200	17,062	253	0	Yes	0	6,825	40% of entitlement	1,897	3,794	10,619
Mid Goulburn GMA	14,900	14,900	12,330	61	37	Yes	4,566	0		152	304	4,870
Southern Campaspe Plains GMA	8,850	8,850	8,307	24	20	Yes	3,509	0		101	302	3,811
Unincorporated areas												
Goulburn-Murray Water		40,456	40,456	719		No		16,182	40% of entitlement	1,764	3,528	19,710
GWMWater												
WSPA (approved plan)												
Murrayville WSPA	10,883	10,883	9,634	37	46	Yes	6,479	0		180	360	6,839
Neuarpur WSPA	24,750	24,750	24,691	48	141	Yes	14,651	0		111	222	14,873
WSPA (draft plan)												
Apsley WSPA		5,591	5,591	32	31	Yes	1,532	0		98	196	1,728
Kaniva WSPA		7659	7,659	23	24	No	3,027	0		33	66	3,093
Telopea Downs WSPA		10,682	10,682	16	18	Yes	2,676	0		31	62	2,738
GMA												
Balrootan (Nhill) GMA		1,522	1,522	13	26	Yes	449	0		32	64	513

Groundwater management unit[1]	PCV	Allocation limit as of 30/06/09 (ML)	Licensed volumes (as at 30/06/09)							Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metering program complete	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores	Estimated use (ML)[4]	
Goroke GMA	2,200	2,200	0	0	0	Yes	0	0		0	0	0
Kaniva TCSA GMA	1,100	1,100	0	0	0	Yes	0	0		0	0	0
Little Desert GMA	1,100	1,100	0	0	0	Yes	0	0		0	0	0
Nhill GMA	1,200	1,200	0	0	0	Yes	0	0		0	0	0
Unincorporated areas												
GWMWater		13,626	13,626	92		No	451	2,880	23% of entitlement	53	106	3,437
Southern Rural Water												
WSPA (approved plan)												
Nullawarre WSPA	21,280	21,280	21,280	212	162	Yes	13,536	25	Only includes DY licences or CO (under 2.2 ML) within GMA/WSPA[7]	1,063	2,126	15,687
Yangery WSPA	14,103	14,103	14,103	164	160	Yes	4,812	25		989	1,978	6,815
WSPA (draft plan)												
Bungaree WSPA	5,321	5,321	5,321	107	136	Yes	4,383	15	Only includes DY licences or CO (under 2.2 ML) within GMA/WSPA[7]	272	544	4,942
Condah WSPA	7,437	7,437	7,436	39	41	Yes	3,162	10		324	648	3,820
Denison WSPA	17,743	17,743	17,743	125	100	Yes	8,370	15		275	550	8,935
Deutgam WSPA	5,100	5,090	5,100	150	208	Yes	24	25		222	0	49
Glenelg WSPA	32,660	32,660	32,660	80	91	Yes	9,107	20		1,304	2,608	11,735
Koo-Wee-Rup WSPA	12,915	12,915	12,826	386	278	Yes	5,036	50		1,563	3,126	8,212
Wandin Yallock WSPA	2,924	2,924	2,939	187	206	Yes	565	35		115	230	830
Warrion WSPA	13,836	13,836	13,835	131	127	Yes	3,943	25		416	832	4,800
Wy Yung WSPA	7,463	7,463	7,462	61	72	Yes	1,009	15		70	140	1,164
Yarram WSPA	25,317	25,317	25,317	83	81	Yes	13,891	20		357	714	14,625
Sale WSPA	21,212	21,212	21,062	109	111	Yes	11,160	25		426	852	12,037
GMA												
Colongulac GMA	4,695	4,695	3,840	44	19	Yes	792	5	Only includes DY licences or CO (under 2.2 ML) within GMA/WSPA[7]	146	292	1,089
Cardigan GMA	3,967	3,967	3,897	25	19	Yes	2,650	2		102	204	2,856
Corinella GMA	2,250	2,250	146	12	6	Yes	43	2		118	236	281
Cut Paw Paw GMA	3,650	3,650	710	8	3	Yes	68	0		6	12	80
Frankston GMA	3,200	3,200	1,080	32	21	Yes	211	0		170	340	551
Gellibrand GMA	625	625	0	0	0	Yes	0	0		2	4	4
Gerangamete GMA[5]	20,000	20,000	20,000	1	6	Yes	12,438	2		9	18	12,458
Giffard GMA	5,670	5,670	5,670	16	17	Yes	3,657	5		52	104	3,766
Glenormiston GMA	2,565	2,565	2,464	33	9	Yes	787	3		110	220	1,010
Hawkesdale GMA	16,161	16,161	11,754	109	56	Yes	5,612	10		1,288	2,576	8,198
Heywood GMA	8,500	8,500	6,695	95	46	Yes	1,350	10		1,406	2,812	4,172
Jan Juc GMA[6]	39,250	39,250	39,250	3	6	Yes	3,359	2		5	10	3,371
Lancefield GMA	1,485	1,485	1,390	15	18	Yes	429	2		80	160	591

Groundwater management unit[1]	PCV	Allocation limit as of 30/06/09 (ML)	Licensed volumes (as at 30/06/09)							Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metering program complete	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores	Estimated use (ML)[4]	
Leongatha GMA	6,500	6,500	1,480	32	11	Yes	342	2		80	160	504
Merrimu GMA	451	451	400	13	15	Yes	264	2		16	32	298
		`										
Moe GMA	8,200	8,200	3,772	85	24	Yes	1,076	5		243	486	1,567
Moorabbin GMA	2,700	2,700	2,647	57	57	Yes	1,171	10		362	724	1,905
Nepean GMA	6,013	6,013	6,012	70	71	Yes	3,908	10		2,440	1,220	5,138
Newlingrook GMA	1,977	1,977	1,947	5	5	Yes	558	1		10	20	579
Orbost GMA	1,201	1,201	1,201	5	4	Yes	578	0		21	42	620
Paaratte GMA	4,606	4,606	3,193	8	0	Yes	0	0		123	246	246
Portland GMA	7,795	7,795	7,794	8	1	Yes	2,121	0		162	324	2,445
Rosedale GMA	22,313	22,313	22,232	52	43	Yes	6,891	4,649		157	314	11,854
Stratford GMA	27,645	27,645	27,645	8	6	Yes	88	26,809		51	102	26,999
Tarwin GMA	1,300	1,300	37	2	1	Yes	6	0		755	1,510	1,516
Wa De Lock GMA	30,172	30,172	28,458	242	135	Yes	9,512	5		551	1,102	10,619
Unincorporated areas												
Southern Rural Water		59,059	59,059	1,311	0	Yes		23,623	40% of entitlement	1,225	2,450	26,073
Total		**1,069,987**	**1,012,364**	**7,665**	**4,297**	**No**	**315,331**	**85,955**		**25,727**	**47,450**	**448,736**

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 40% of entitlement for Southern Rural Water, 35% of entitlement for Goulburn-Murray Water and 23% for GWMWater.

(3) The numbers of domestic and stock bores are all bores from the Groundwater Management System that are less than 30 years old and have been cross-checked with the Victorian Water Register to ensure bores are not double counted. Bore depths (where recorded) have been taken into account to ensure that the domestic and stock bore is assigned to the appropriate GMU where overlap of management units occurs. As 2008/09 is the first year this method has been applied, the numbers of domestic and stock bores differ from previous years and are based on the surface area percentage within the basin.

(4) Domestic and stock use is estimated as 2 ML/bore except in the Nepean GMA (0.5 ML/bore), which is a more accurate estimate.

(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.

(6) The Jan Juc bulk entitlement is based on a 5 year total of 35,000 ML. The total of 39,250 includes 4,250 ML and the 5 year bulk entitlement of 35,000 ML.

(7) In Southern Rural Water's region, the estimated use includes dairy licences (DY), commercial licences (CO) under 2.2 ML within a WSPA or GMA and also includes other extraction licences that are exempted from metering based on the following rule: existing licences that are greater than 20 ML are not required to be metered.

Appendix B

Storage levels

Basin	Reservoir	On-stream or off-stream?	Full storage capacity (ML)	% full at 1 July 2008	% full at 30 June 2009
East Gippsland	None	n/a	n/a	n/a	n/a
Snowy	None	n/a	n/a	n/a	n/a
Tambo	None	n/a	n/a	n/a	n/a
Mitchell	None	n/a	n/a	n/a	n/a
Thomson	Lake Glenmaggie	On-stream	190,410	55%	22%
	Thomson Reservoir	On-stream	1,068,000	18%	16%
Latrobe	Blue Rock	On-stream	208,188	70%	70%
	Lake Narracan	On-stream	8,000	61%	17%
	Moondarra Reservoir	On-stream	30,300	62%	59%
South Gippsland	Lance Creek Reservoir	On-stream	4,200	42%	66%
	Hyland Reservoir	On-stream	671	38%	71%
	Western Reservoir	On-stream	1,137	32%	41%
	Candowie Reservoir	On-stream	2,207	38%	33%
Bunyip	Tarago Reservoir	On-stream	25,000	89%	59%
Yarra	Upper Yarra Reservoir	On-stream	200,000	48%	41%
	O'Shannassy Reservoir	On-stream	3,000	82%	66%
	Maroondah Reservoir	On-stream	22,000	25%	29%
	Yan Yean Reservoir	On-stream	30,000	15%	19%
	Cardinia Reservoir	Off-stream	287,000	51%	38%
	Greenvale Reservoir	Off-stream	27,000	83%	74%
	Silvan Reservoir	Off-stream	40,000	90%	88%
	Sugarloaf Reservoir	Off-stream	96,000	16%	16%
Maribyrnong	Rosslynne Reservoir	On-stream	25,368	3%	3%
Werribee	Melton Reservoir	On-stream	14,364	4%	4%
	Merrimu Reservoir	On-stream	32,516	13%	9%
	Pykes Creek Reservoir	On-stream	22,119	4%	2%
	Djerriwarrh Reservoir	On-stream	983	34%	25%
Moorabool	Korweinguboora Reservoir	On-stream	2,100	5%	3%
	Bostock Reservoir	On-stream	7,480	1%	4%
	Lal Lal Reservoir	On-stream	64,495	5%	4%
	Wilsons Reservoir	On-stream	1,010	0%	5%
	Moorabool Reservoir	On-stream	6,738	0%	2%
	Upper Stony Creek Reservoir	Off-stream	9,494	17%	15%
Barwon	West Barwon Dam	On-stream	21,000	30%	13%
	White Swan Reservoir	On-stream	14,107	13%	58%
	Gong Gong Reservoir	On-stream	1,902	2%	7%
	Wurdee Boluc Reservoir	Off-stream	40,431	40%	35%
Corangamite	None	n/a	n/a	n/a	
Otway Coast	West Gellibrand Reservoir	On-stream	1,856	31%	67%
Hopkins	None	n/a	n/a	n/a	
Portland Coast	None	n/a	n/a	n/a	
Glenelg	Rocklands Reservoir	On-stream	348,310	1%	1%
	Moora Moora Reservoir	On-stream	6,300	20%	15%
	Konongwootong Reservoir	On-stream	1,920	27%	16%
	Hayes Reservoir	On-stream	2,700	34%	31%
Millicent Coast	None	n/a	n/a	n/a	
Murray	Lake Victoria (Victoria's share only)	On-stream	338,500	63%	44%

Basin	Reservoir	On-stream or off-stream?	Full storage capacity (ML)	% full at 1 July 2008	% full at 30 June 2009
	Menindee Lakes (Victoria's share only)[1]	On-stream	865,500	0%	0%
	Lake Hume (Victoria's share only)	On-stream	1,518,250	14%	5%
	Lake Dartmouth (Victoria's share only)	On-stream	1,953,795	23%	11%
	Lake Cullueraine	On-stream	5,270	84%	83%
Kiewa	Rocky Valley	On-stream	28,294	46%	74%
	Lake Guy	On-stream	1,416	41%	46%
	Clover Pondage	Off-stream	255	78%	59%
	Pretty Valley basin	Off-stream	500	100%	100%
Ovens	Lake William Hovell	On-stream	13,710	84%	59%
	Lake Buffalo	On-stream	23,900	49%	63%
Broken	Lake Mokoan	On-stream	362,450	4%	1%
	Lake Nillacootie	On-stream	39,950	23%	12%
	Loombah-McCall Say	On-stream	1,813	77%	53%
Goulburn	Lake Eildon	On-stream	3,334,158	14%	13%
	Goulburn Weir	On-stream	25,500	99%	99%
	Sunday Creek Reservoir	On-stream	1,700	9%	26%
	Greens' Lake	Off-stream	32,440	72%	50%
	Waranga basin	Off-stream	432,632	12%	17%
Campaspe	Upper Coliban Reservoir	On-stream	37,480	1%	0%
	Lauriston Reservoir	On-stream	19,790	39%	31%
	Malmsbury Reservoir	On-stream	17,780	2%	2%
	Lake Eppalock	On-stream	304,651	6%	6%
	Campaspe Weir	Off-stream	2,624	87%	74%
Loddon	Newlyn Reservoir	On-stream	3,215	5%	9%
	Tullaroop Reservoir	On-stream	72,950	5%	4%
	Cairn Curran Reservoir	On-stream	147,130	5%	2%
	Laanecoorie Reservoir	On-stream	7,940	13%	4%
	Hepburn Lagoon	On-stream	3,001	0%	0%
	Evansford Reservoir	Off-stream	1,351	6%	4%
	Sandhurst Reservoir	Off-stream	2,590	94%	68%
	Spring Gully Reservoir	Off-stream	1,680	35%	26%
Avoca	None	n/a	n/a	n/a	
Mallee	None	n/a	n/a	n/a	
Wimmera	Taylors Lake	On-stream	33,700	15%	11%
	Lake Lonsdale	On-stream	65,480	0%	0%
	Wartook Reservoir	On-stream	29,300	27%	35%
	Lake Bellfield	On-stream	78,560	10%	17%
	Fyans Lake	On-stream	18,460	20%	20%
	Batyo Lake	On-stream	2,250	0%	0%
	Dock Lake	On-stream	4,420	0%	0%
	Green Lake	On-stream	5,350	0%	0%
	Pine Lake	On-stream	62,000	0%	0%
	Toolondo Reservoir	On-stream	92,430	0%	0%

Note:

(1) When the volume held in storage in the Menindee Lakes drops below 480,000 ML, the entire volume is held by New South Wales. Victoria will regain its share of the water in the Menindee Lakes when the volume next exceeds 640,000 ML.

n/a: Not applicable.

Appendix C

Groundwater trades

Groundwater management unit	Permanent trade		Temporary trade	
	No. trades	Total volume (ML)	No. trades	Total volume (ML)
Goulburn Murray Water				
Campaspe Deep Lead WSPA	0	0	48	4,031
Spring Hill WSPA	0	0	13	325
Katunga WSPA	0	0	53	3,471
Mid Loddon WSPA	0	0	21	3,535
Upper Loddon WSPA	0	0	4	1,612
Barnawartha	0	0	1	150
Kinglake	0	0	3	43
Mullindolingong Zone 2	0	0	1	5
Upper Ovens GMA	0	0	2	44
Lower Ovens GMA	0	0	3	164
Southern Campaspe Plains GMA	0	0	3	500
GWMWater				
Murrayville	1	300	3	900
Neuarpur	1	600	4	880
Apsley	0	0	3	895
Kaniva	0	0	1	200
Southern Rural Water				
Nullawarre	4	313	7	433
Yangery	2	224	3	43
Bungaree	0	0	8	100
Denison	0	0	5	400
Koo-Wee-Rup	0	0	16	371
Sale	3	86	9	620
Wandin Yallock	0	0	1	6
Warrion	0	0	1	50
Yarram	0	0	4	393
Cardigan	1	10	1	18
Giffard	0	0	4	300
Hawkesdale	2	155	2	490
Merrimu	5	55	2	38
Moorabbin	2	10	2	5
Nepean	0	0	5	228
Rosedale	5	29	3	370
Stratford	0	0	2	70
Wa De Lock	0	0	3	64
Total	**26**	**1,782**	**241**	**20,751**

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
MDBA	Murray-Darling Basin Authority
MDBC	Murray-Darling Basin Commission
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 Victorian Water Accounts 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.

Carry-over: Provides the right to take unused allocations at the end of one season into the subsequent season. Carry-over is available under rules to the holders of permanent entitlements, including water shares, supplies by agreement and specified bulk and environmental entitlements, in the regulated water systems of northern Victoria.

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 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 differ 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: Groundwater is the reserve of water that is located beneath the earth's surface in pores and crevices of rocks and soil. These areas vary in size and volume throughout Victoria and are known as aquifers.

Groundwater entitlement 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.

Heritage river: A river protected in Victoria for its special features under the *Heritage River Act 1992*.

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 on the level of compliance with these requirements.

Permissible consumptive volume (PCV): The total amount of water that can be taken in a groundwater management area under a Ministerial declaration.

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.

Qualification of rights: The Minister for Water has the power (under section 33AAA of the *Water Act 1989*) to qualify rights to water to maintain essential supplies to towns and rural communities. The Minister may declare a temporary qualification of rights where a water shortage exists in an area or water system. Where the water shortage is due to a long term change to water availability, a permanent qualification of rights may be declared but only following a long term water resources assessment which finds the long term water availability will have a disproportionate effect on water allocated for consumptive purposes or the Environmental Water Reserve.

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 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 passed legislation enabling all water rights and licences to be converted into water shares, beginning 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 that 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.