Victorian Water Accounts 2007-2008

A statement of Victorian water resources

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, January 2010

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Printed by Stream Solutions

Printed on 100% Recycled paper.

ISBN 978-1-74242-296-1 (print)
ISBN 978-1-74242-297-8 (online)

ISSN 1837-591X (print)
ISSN 1837-5928 (online)

For more information contact the Department of Sustainability and Environment's Customer Service Centre 136 186.

Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

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

Editor: Ann White

Foreword

In 2007/08, Victoria received minimal relief from the low rainfall which has been the prevailing weather pattern for the twelfth straight year.

The continuing drought highlights the need to annually record and report on Victoria's water availability and use.

The *Victorian Water Accounts 2007-2008* is the fifth consecutive publication to provide a State-wide overview of Victoria's water resource availability and use at bulk supply level.

It was another year of low inflows and storages. Basic human needs for water were met through a range of contingencies and drought response plans implemented by Victoria's water businesses.

One exception to the drought was a major flood in Gippsland's Thomson and Mitchell basins early in 2007/08, following heavy rain in June.

The flood was responsible for significant damage to stock, farm lands and natural assets within the two basins, and created significant challenges for the managers of water assets in that region.

Infrastructure works associated with *The Next Stage of the Government's Water Plan* commenced in 2007/08 as Victoria aims to secure its future water supplies. Details regarding the supply impact of projects under the Water Plan are reported herein.

I commend this document as a critical account of water availability, entitlement, use and related drought response measures for 2007/08.

Tim Holding MP

Minister for Water

Alphabetical listing of Victoria's river basins

Contents

Introduction

Overview of the Victorian Water Accounts 2007-2008

The *Victorian Water Accounts 2007-2008* documents the key water resource management issues for Victoria and is the fifth in a series of reports[1] providing an overview of water availability and use across Victoria at bulk supply level. It 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 and environmental releases and initiatives. The *Victorian Water Accounts 2007-2008* is an important component of Victoria's obligations.

The *Victorian Water Accounts 2007-2008* examines the entire state's water allocation and use for the 2007/08 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 2007-2008* has two parts:

- Part 1 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 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 2007/08 was the eleventh straight year of drought.

The drought and its impacts are key themes of the *Victorian Water Accounts 2007-2008*, 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.

Drought impacts in 2007/08

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

- Rainfall was below average across all of Victoria in 2007/08 – 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 south and west Gippsland.
- Victoria experienced a very dry August to October period in 2007/08. Apart from south Gippsland and the southwest coast, most of southern Victoria experienced rainfall of 40% to 60% of the long term August to October average. Rainfall in northern and central Victoria was 20% to 40% of the average.
- Despite most river basins recording higher inflows than the extreme lows experienced in 2006/07, continuing below average rainfall combined with dry catchment conditions meant that streamflows across Victoria remained well below average in 2007/08.
- The driest river basins in 2007/08, relative to their long term averages, were the Broken, Loddon, Wimmera, Avoca and Corangamite basins.
- The total volume of water stored in Victoria's major rural reservoirs started the year at 2,003,510 ML (20.5% of capacity), increased marginally throughout 2007/08 and ended the year at 1,598,958 ML (16.4% of capacity). Levels peaked in October and declined over summer and autumn as inflows receded and water was released from the reservoirs for irrigation.
- The continuing dry conditions also impacted groundwater supplies, with 20 groundwater management units showing a long term trend of declining water level trends.

---

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

2 Water businesses include water authorities, Melbourne Water Corporation and metropolitan retailers. The *Water (Governance) Act 2006* amended the *Water Act 1989* to establish water authorities as corporations from 1 July 2007.

Actions taken to address drought

The duration and severity of the low flows of the last 11 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.

To reduce the impacts of the water shortages, the government requested each business to review and update its contingency plans based on the experiences of managing water supplies in 2006/07. It also continued to work closely with the businesses throughout the year, monitoring the water supply situation and facilitating emergency response measures when required.

Scarce water resources meant that different types of users each had to curtail their water consumption. For irrigators, the lack of availability in some parts of the state was unprecedented.

All irrigation systems in Northern Victoria started with 0% (zero) allocation for the first time ever. For the Wimmera it was the sixth consecutive year of 0% (zero) water allocation, while four irrigation districts ended 2007/08 with zero allocation.

In 2007/08, the emergency water supply system was expanded with the upgrade or addition of 157 emergency water supply points. The aim of the emergency water supply points program was to ensure that landholders did not have to travel more than 20 kilometres to access emergency water in the most drought affected areas.

Securing future water supply

Continuing population growth coupled with diminishing rainfall called for significant changes to how water is managed and used.

Launched in the first half of 2007, The Next Stage of the Government's Water 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 2007/08 the most significant project completed under the Next Stage of the Government's Water Plan was the 132.5 kilometre Goldfields Superpipe, which connected the major rural centres of Bendigo and Ballarat to the Goulburn system.

Conclusion

Sustainable management of our water resources cannot be achieved without adequate monitoring, accounting and reporting. The *Victorian Water Accounts 2007-2008* 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 2007/08

Part 1 of the *Victorian Water Accounts 2007-2008* 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

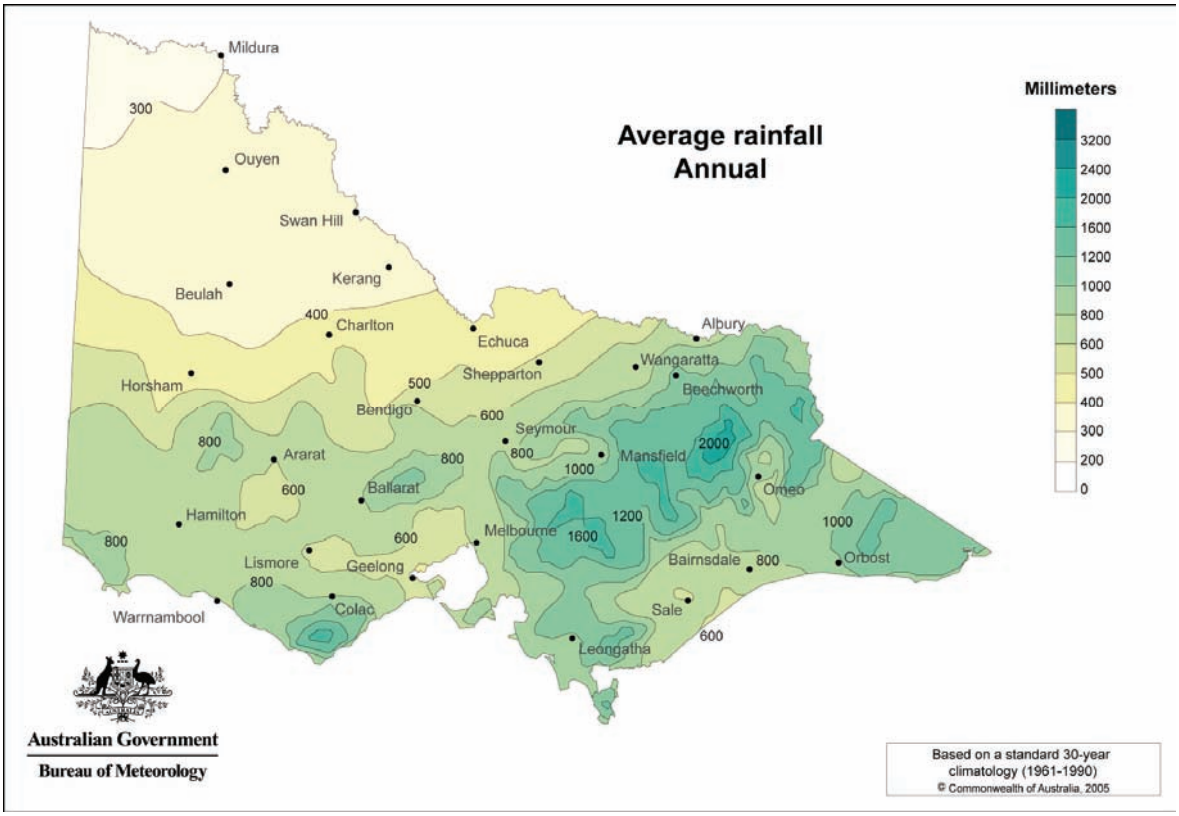
This chapter presents a description and analysis of surface water and groundwater in Victoria during 2007/08. It examines how much surface water was available in Victoria during the year compared with previous years and reports rainfall, streamflow and reservoir levels. A high level synopsis of Victoria's groundwater resources during 2007/08 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.

Most of Victoria's rainfall cannot be diverted for consumptive use. Of the total rain and snow falling across the state, around 84% evaporates or is transpired by vegetation (evapotranspiration), around 15% becomes surface run-off and streamflow and around 1% recharges groundwater aquifers.

Figure 1-1 Victorian average annual rainfall



Victoria's rainfall during 2007/08 is shown in Figure 1-2, and is compared to the long term average rainfall in Figure 1-3.

Rainfall was below average across all of Victoria in 2007/08. 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 south and west Gippsland. Totals in these areas were boosted by good rainfalls in July, November and December.

Figure 1-2 Victorian rainfall in 2007/08 (millimetres)

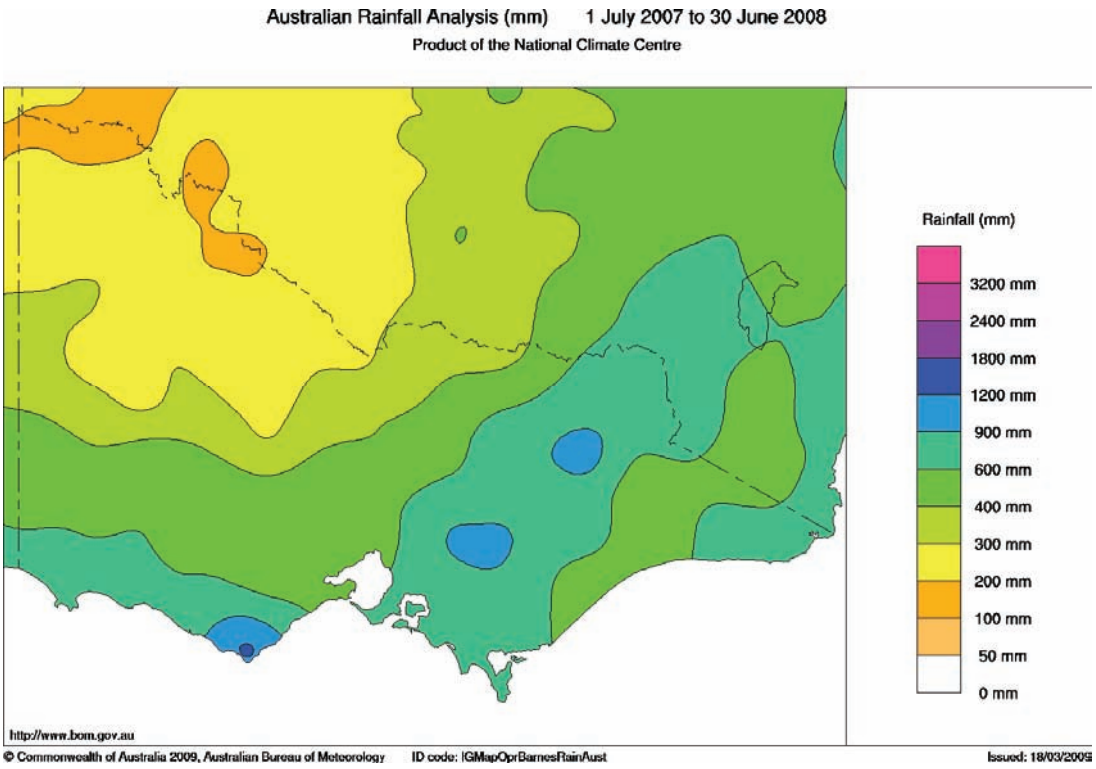
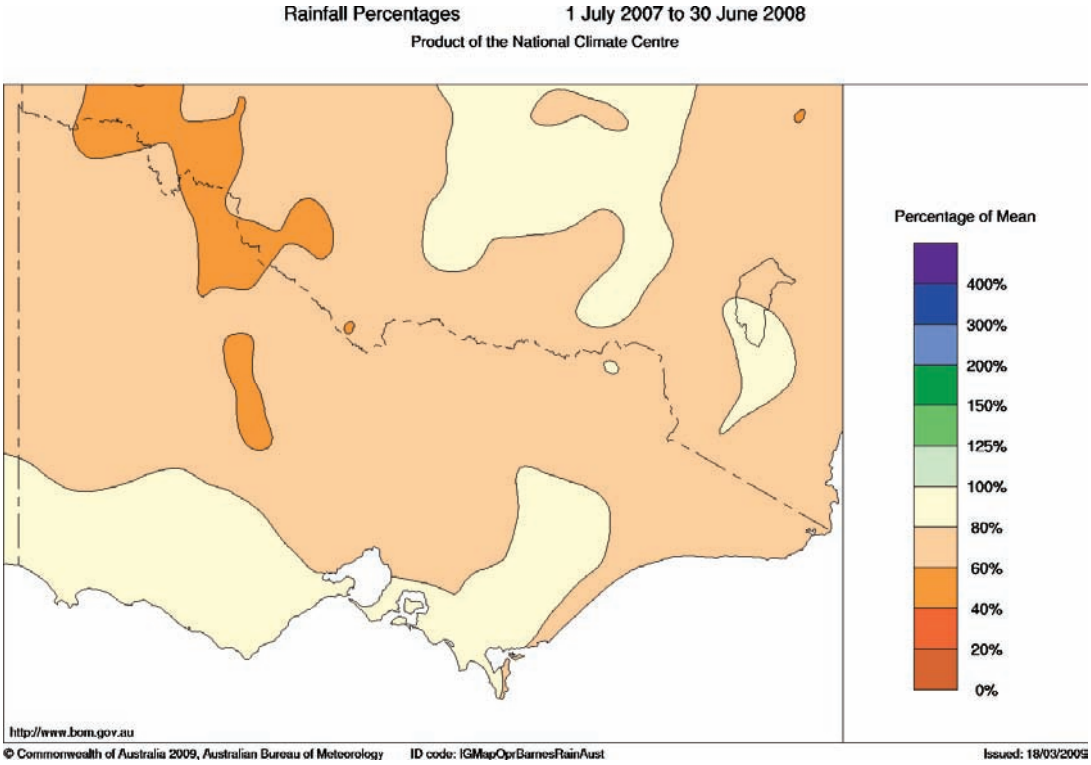
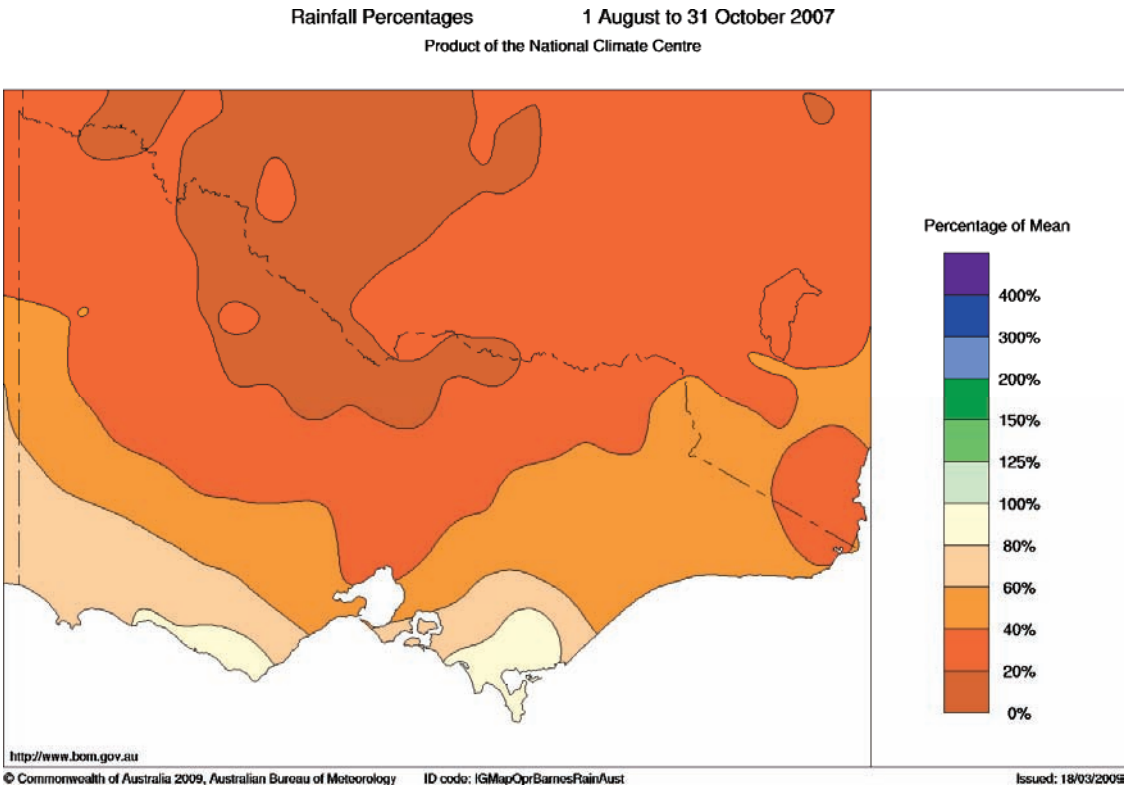


Figure 1-3 Victorian rainfall in 2007/08 relative to average rainfall



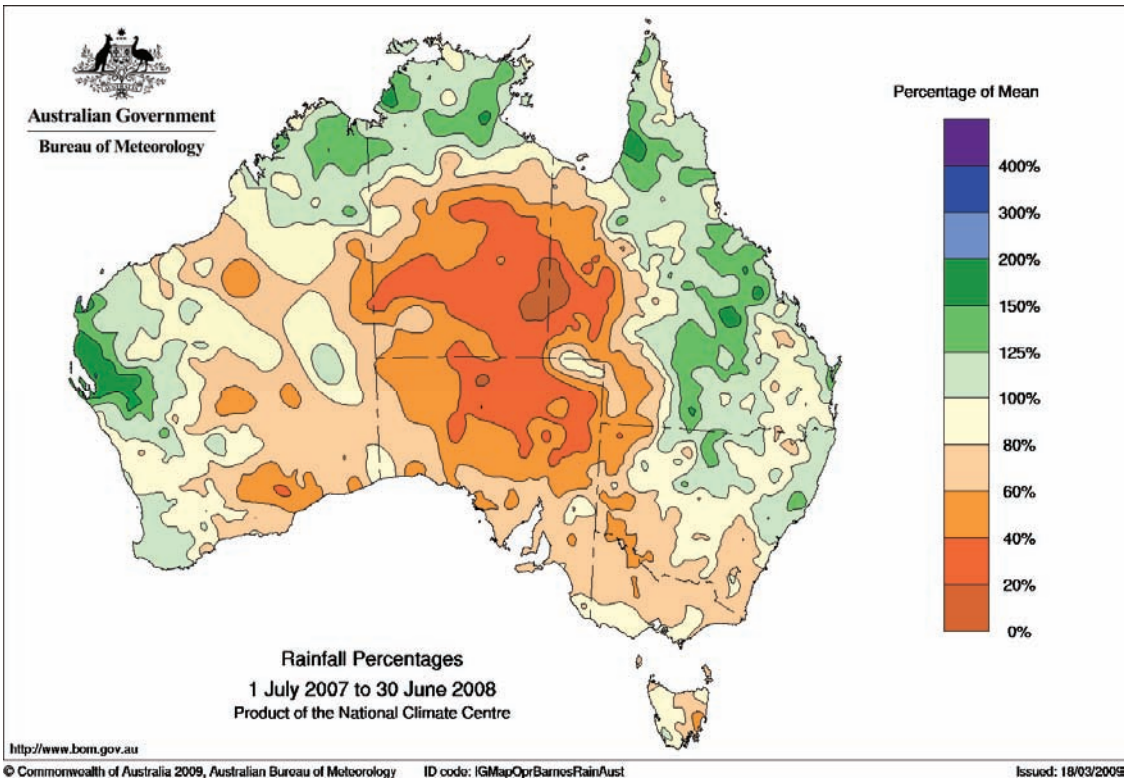
The August to October period historically produces the highest rainfall and streamflows of the year. However, as Figure 1-4 demonstrates, Victoria experienced a very dry August to October period in 2007/08. Apart from south Gippsland and the south west coast, most of southern Victoria experienced rainfall of 40% to 60% of the long term August to October average. Rainfall in northern and central Victoria was 20% to 40% of the average.

Figure 1-4 Victorian rainfall from 1 August to 31 October 2007 relative to average rainfall



The pattern of below average rainfall across Victoria for 2007/08 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, southeast South Australia and inland Western Australia were similar to Victoria, while deficiencies in central Australia were even more severe. In contrast, eastern Queensland, northern New South Wales and coastal western and northern Australia received above long term average rainfall (Figure 1-5).

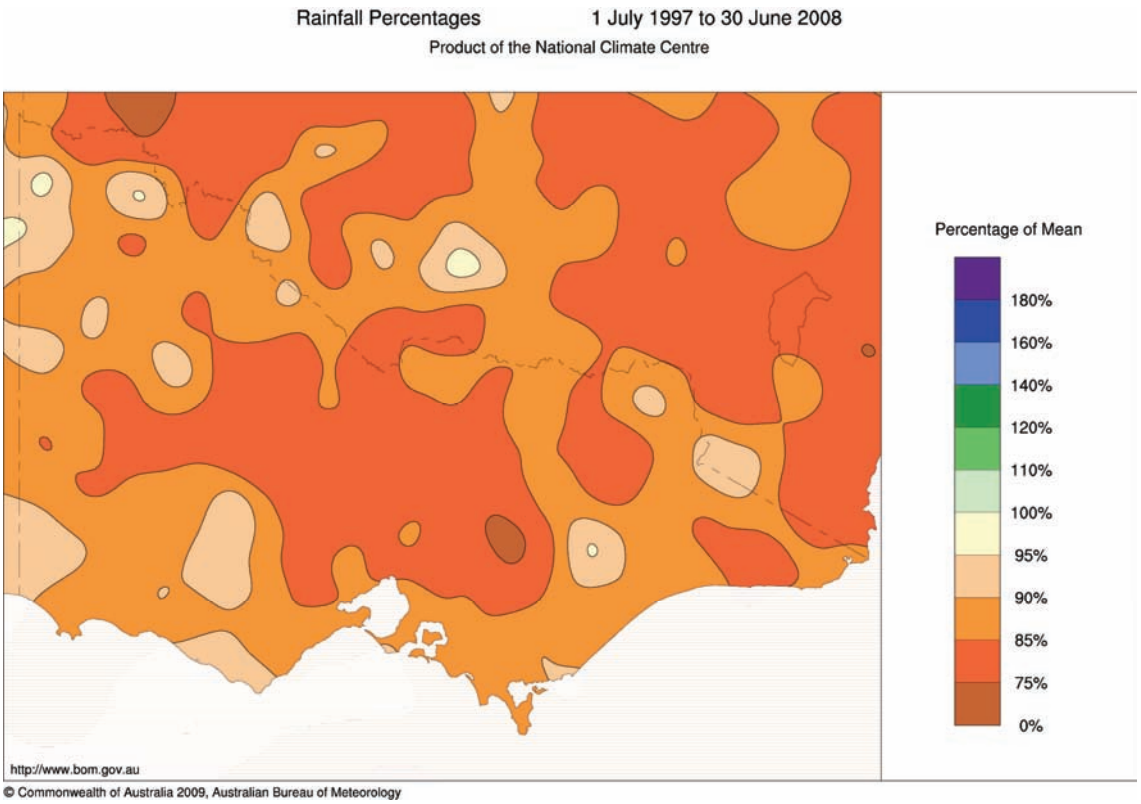
Figure 1-5 Australian rainfall, percentage of average, 1 July 2007 to 30 June 2008



The dry conditions experienced in Victoria in 2007/08 extended the period of lower than average rainfall and inflows to eleven years. Figure 1-6 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 eleven years across most of the state have been 75% to 90% of the long term average. Central Victoria, which includes Melbourne's catchment areas, and extensive parts of western Victoria have experienced the driest conditions with rainfall totals between 75% to 85% of the average.

Figure 1-6 Average annual rainfall percentage 11 years ending June 2008



Data from the Bureau of Meteorology indicates that evaporation was generally above historical long term averages for the majority of the state in 2007/08.

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 2007/08, 2006/07 and over the long term.

Despite most river basins recording higher inflows than the extreme lows experienced in 2006/07, continuing below average rainfall, combined with dry catchment conditions, meant that streamflows across Victoria remained well below average in 2007/08.

The driest river basins in 2007/08, relative to their long term averages, were the Broken, Loddon, Wimmera, Avoca and Corangamite basins. Inflows in the Wimmera basin were 8% of the long term average and less than half those experienced in 2006/07. Streamflows in East Gippsland, Broken and Yarra basins were also less than 2006/07 levels.

Only seven of the state's river basins – Snowy, Thomson, Latrobe, Bunyip, Barwon, Otway Coast and Portland Coast - recorded streamflows of more than 50% of the long term average. All these basins are located in southern Victoria and received above average winter and early summer rainfall, including the significant rainfall event in Gippsland in late June 2007. Outlined in Section 1.2.2, this event helped boost total streamflow volumes in 2007/08.

Table 1-1 Streamflow compared with long term average

Basin	Average annual streamflow (ML) [1]	2007/08 streamflow [2]		2006/07 streamflow [2]	
		(ML)	(% of average)	(ML)	(% of average)
Murray	7,000,000	1,632,800	23%	1,140,900	16%
Kiewa	679,000	325,100	48%	169,800	25%
Ovens	1,692,000	589,700	35%	190,400	11%
Broken	326,000	66,000	20%	71,700	22%
Goulburn	3,366,000	1,260,800	37%	777,700	23%
Campaspe	305,000	93,400	31%	34,500	11%
Loddon	415,000	57,900	14%	39,900	10%
Avoca	136,200	26,900	20%	16,500	12%
Mallee[3]	0	0	Not applicable	0	Not applicable
Wimmera[6]	316,400	25,700	8%	62,400	20%
East Gippsland	1,122,000	466,700	42%	788,600	70%
Snowy [4]	1,447,300	893,900	62%	780,800	54%
Tambo	570,000	146,700	26%	115,600	20%
Mitchell	1,355,000	609,400	45%	353,800	26%
Thomson	1,414,000	1,188,000	84%	665,200	47%
Latrobe [1]	875,000	575,200	66%	306,500	35%
South Gippsland	1,157,000	538,300	47%	191,100	17%
Bunyip	541,000	398,300	74%	265,900	49%
Yarra [1]	1,054,000	386,900	37%	388,200	37%
Maribyrnong [1]	113,000	25,900	23%	19,600	17%
Werribee [1]	102,000	23,600	23%	15,400	15%
Moorabool [1]	97,000	39,200	40%	25,100	26%
Barwon [1]	360,000	182,300	51%	83,400	23%
Corangamite	316,000	61,400	19%	11,700	4%
Otway Coast	884,000	622,600	70%	297,000	34%
Hopkins	635,000	210,400	33%	82,100	13%
Portland Coast	361,000	315,400	87%	57,100	16%
Glenelg	964,000	308,100	32%	140,200	15%
Millicent Coast [5]	0	0	Not applicable	0	Not applicable
Total[6]	27,602,900	**11,070,600**	**40%**	**7,091,100**	**26%**

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) and 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.

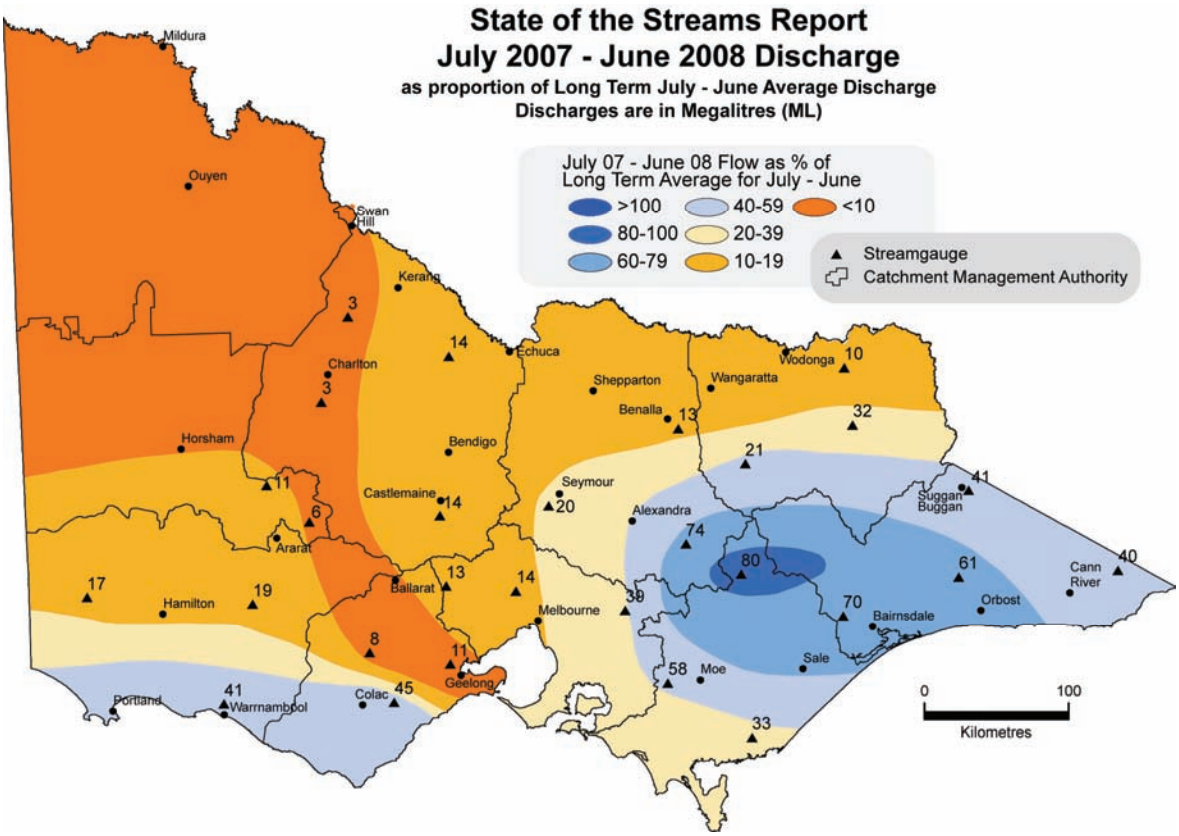
(4) Volumes shown for Snowy basin exclude catchment inflows from NSW (i.e. above Burnt Hut Crossing).

(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) This value was incorrectly reported as 43,700 in Table 1-1 but correctly reported in Table 15.3 of the *Victorian Water Accounts 2006-2007*. The correct value has been provided here.

Figure 1-7 shows Victorian streamflows in 2007/08 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 the Mallee, Wimmera, Werribee and Moorabool basins were considerably lower (<10%) than the long term average, while volumes throughout western, central and northeast Victoria were only slightly greater. Streamflows were higher as a proportion of the long term average across Gippsland and southwest Victoria, but volumes in these districts, excluding the Macalister, Latrobe and Mitchell rivers, were still low at 50% of the long term averages. The close to average inflow volumes recorded in central Gippsland can be attributed to flooding events in June/July and November 2007.

Figure 1-7 Streamflow in 2007/08 expressed as a percentage of long term average flow(1)

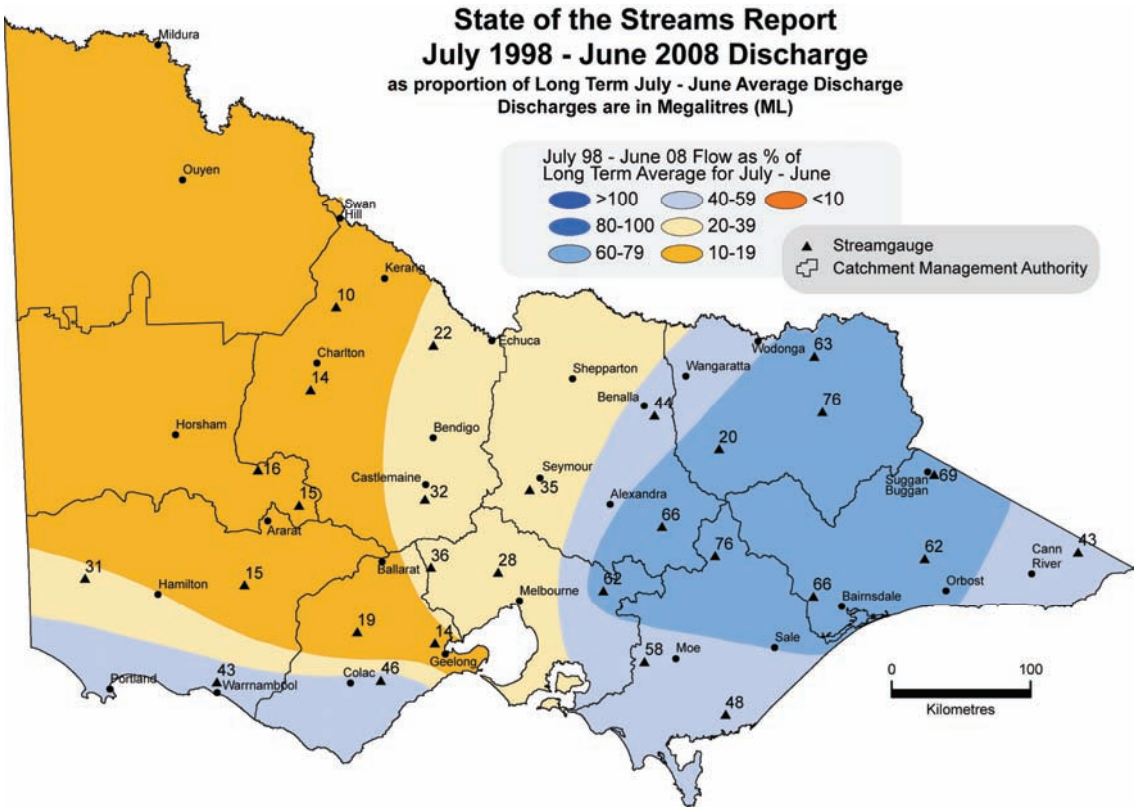


Note:

(1) Figure 1-7 shows an isoline representation of 2007/08 streamflow as a percentage of long term average streamflow (inclusive of 2007/08), 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 1-8 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, although less pronounced than in 2007/08, 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 1-7 and Figure 1-8 is the scale of the reduction experienced in northeast Victoria in 2007/08. Where streamflows in this region since 1997 have been between 60% and 80% of the long term average, flows in 2007/08 were less than 40% of the average.

Figure 1-8 Streamflow July 1998 to June 2008 expressed as a percentage of long term average flow(1)



Note:

(1) An isoline representation of 1997/98 to 2007/08 streamflow as a percentage of long term average streamflow (inclusive of 2007/08), 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 2007/08 and the volumes recorded each year since 2003/04. Although total streamflows in 2007/08 were over 50% higher than 2006/07 streamflows, they were still well below the long term average and lower than the annual volumes recorded in the three years prior.

Table 1-2 Streamflow compared with long term average of 27,602,900 ML

Year	Streamflow (ML)	% of average
2003/04	16,848,300	62%
2004/05	17,015,900	62%
2005/06	15,296,700	55%
2006/07	7,091,100	26%
2007/08	11,070,600	40%

1.2.1 Long term streamflow trends

As mentioned above, average annual streamflows in the past eleven 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 flows in the Wimmera districts having reduced to as low as 11% of the long term average.

The following graphs depict flows across a selection of Victorian waterways for the calendar year to the end of 2007. (Note that 2007/08 streamflows in Table 1-1 are for the period from 1 July 2007 to 30 June 2008). They demonstrate that streamflows across central and western Victoria in 2007, although higher than those recorded in 2006, were still below the average of the past 11 years. Streamflows in eastern Victoria were close to or above the long term average due to a series of intense rainfall events in June and November.

The persistence of below average streamflows across northern, central and western Victoria continued the recent trend of low water availability for rural and urban communities and the environment in these regions. In contrast, high streamflows compared to 2006/07 in eastern Victoria increased water availability for urban and rural water users during the year.

Figure 1-9 depicts annual flows in the Goulburn River at Doherty's, which is upstream of Lake Eildon. Annual flows here over the past 11 years have been 65% of the long term average. Flows in 2007, despite being higher than flows in 2006 and the average of the past eleven years, were still lower than 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 2007/08.

Figure 1-9 Annual (calendar year) streamflow at Goulburn River

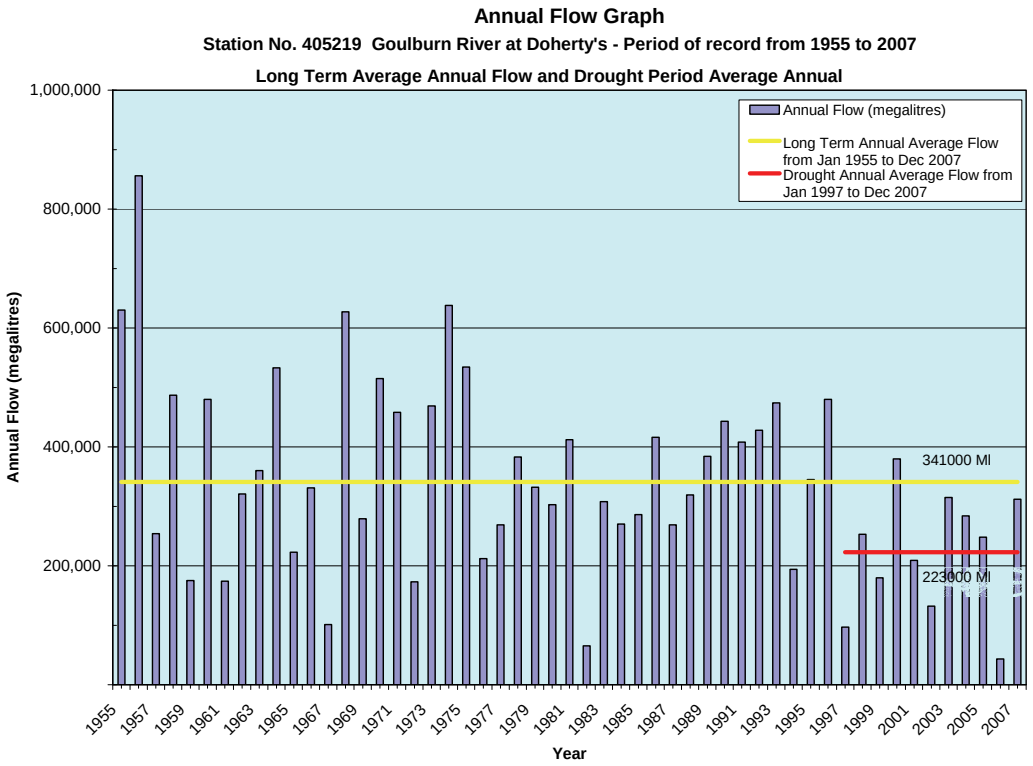


Figure 1-10 depicts annual flows in the Loddon River at Vaughan, which is upstream of Cairn Curran Reservoir. Over the past 11 years, annual flows here have been 31% of the long term average. Flows in 2007 were higher than those recorded in 2006, but were still less than half the annual average flow of the past eleven 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 1-10 Annual streamflow at Loddon River

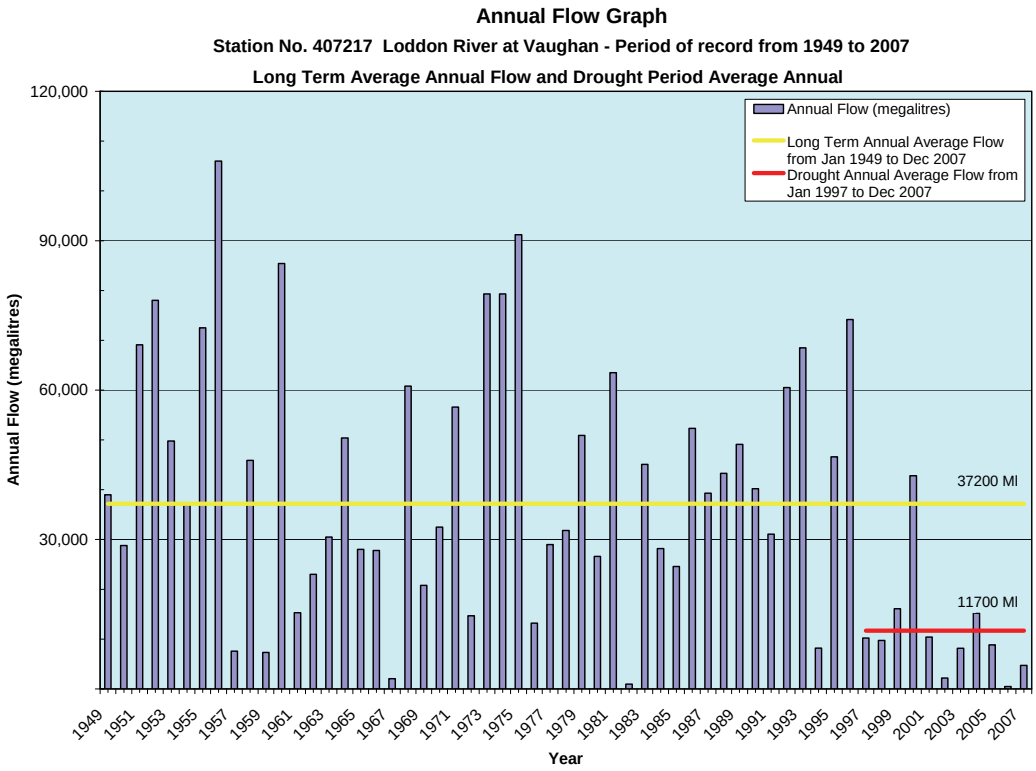


Figure 1-11 depicts annual flows in the Wimmera River at Glynwylln. The Wimmera River at this location has also experienced a severe decrease in flows over the past 11 years, with average annual flows over this period at 16% of the long term average. Flows in 2007 were higher than 2006, but were still extremely low at 10% of the long term average. The extreme water shortage in the basin resulted in water levels falling to their lowest since construction of the storages and meant that GWMWater could only provide limited channel supplies throughout the region. Customers that didn't receive a channel supply continued to rely on the rural water carting program for essential needs, while users in the Wimmera irrigation area did not receive an allocation for the fourth year in a row. Severe restrictions also remained in place for towns and for rural licence holders in the basin over the entire year.

Figure 1-11 Annual streamflow at Wimmera River

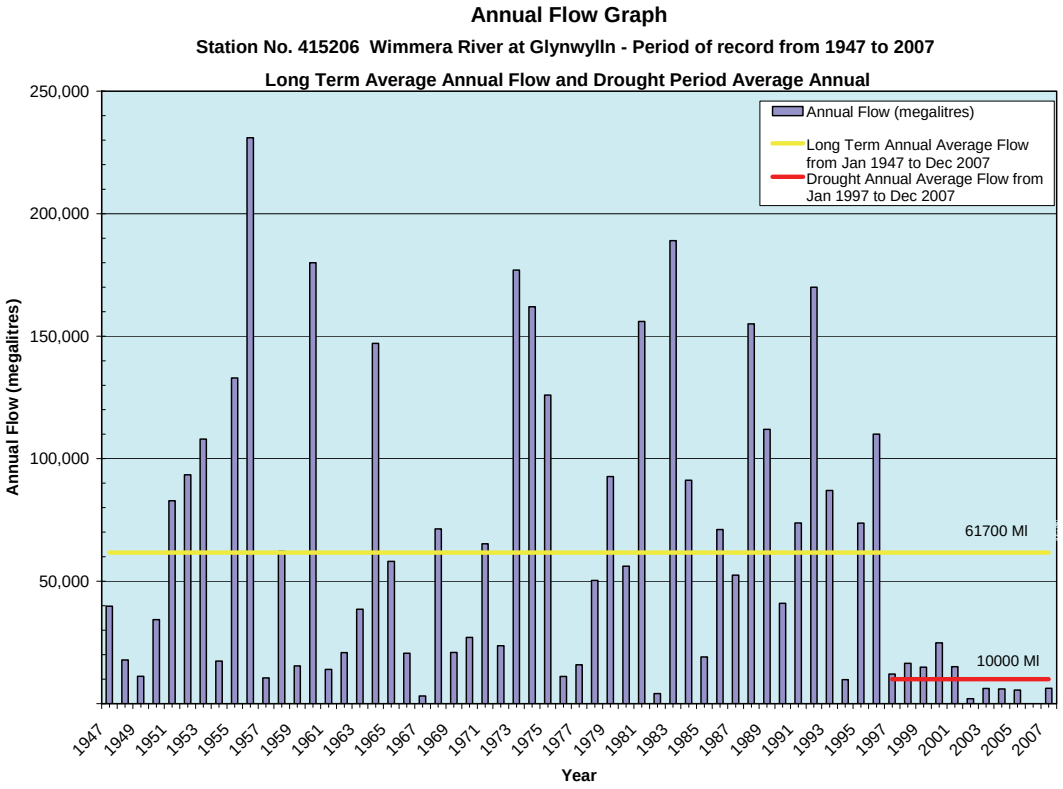


Figure 1-12 depicts annual flows in the Mitchell River at Glenaladale, which is approximately 25 kilometres upstream of Bairnsdale. Annual flows in the Mitchell River over the past eleven years have been 66% of the long term average. Flows in 2007, however, were slightly higher than the long term average due to the heavy rainfall and flooding event in late June 2007. Urban and rural water use was mostly unrestricted throughout the year.

Figure 1-12 Annual streamflow at Mitchell River

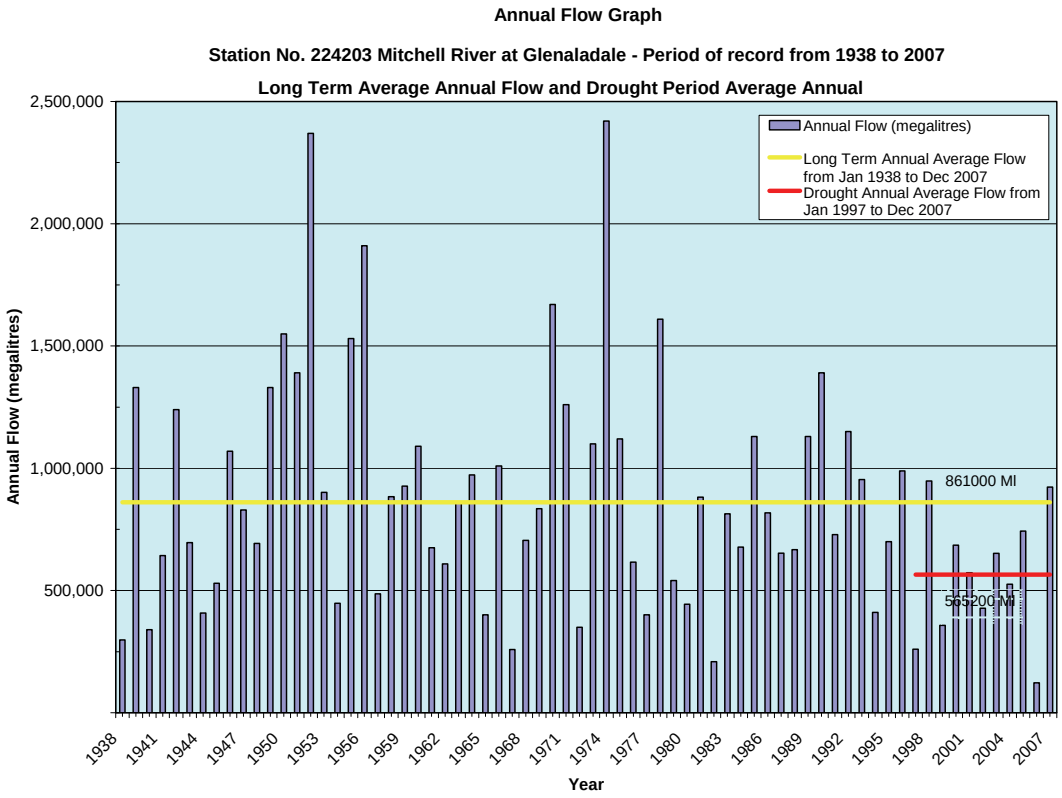


Figure 1-13 depicts annual inflow to Melbourne's harvesting reservoirs in the Yarra and Thomson basins. Since 1997, the average annual inflows to Melbourne's storages have been 63% of the long term average. Inflows in 2007 were more than double what was recorded in 2006 but were still below the average inflows experienced in the past 11 years. The rainfall events in June and November boosted inflows to Thomson Reservoir, although these gains were offset by extremely low inflows to Melbourne's three reservoirs located in the Yarra basin. The system's failure to recover prolonged Melbourne's water shortage – Stage 3a restrictions continued throughout the year and the Yarra and Thomson River Environmental Entitlements were qualified, reducing environmental flows in these rivers.

.

Figure 1-13 Annual streamflow at Melbourne's storages

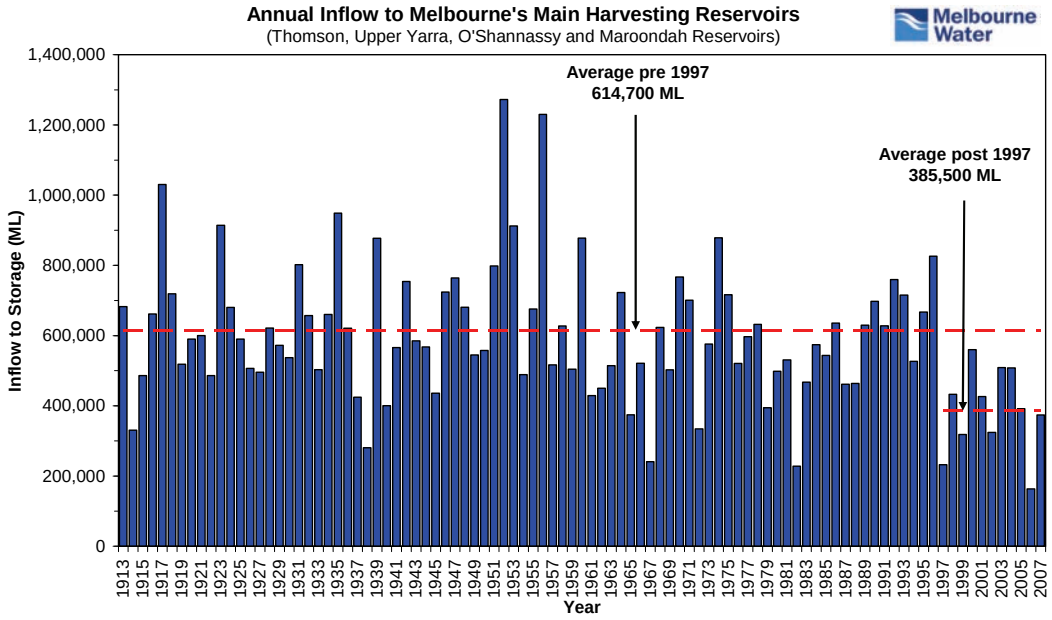


Figure 1-14 depicts annual flows in the Werribee River at Ballan where, over the past 11 years, annual flows have been 36% of long term average. Flows in 2007 were higher than 2006, but were half the annual average flow of the 11 years. Low storage levels in the Werribee basin, combined with low inflows, meant that very little surface water was available for use in the basin. The severe water shortage required a range of contingency measures to be implemented across the

basin to supplement rural supplies, which were severely restricted at 8% of licensed entitlement. Most towns in the basin can be supplied from the Melbourne system and were placed on Stage 3a restrictions as a condition of supply.

Figure 1-14 Annual streamflow at Werribee River

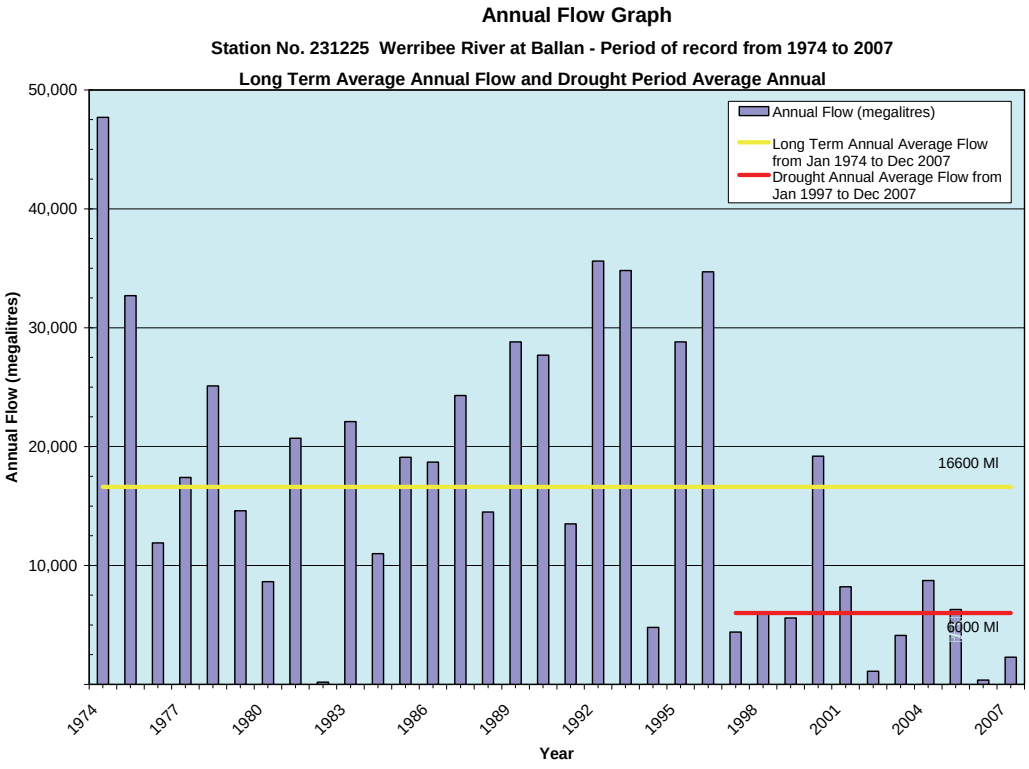
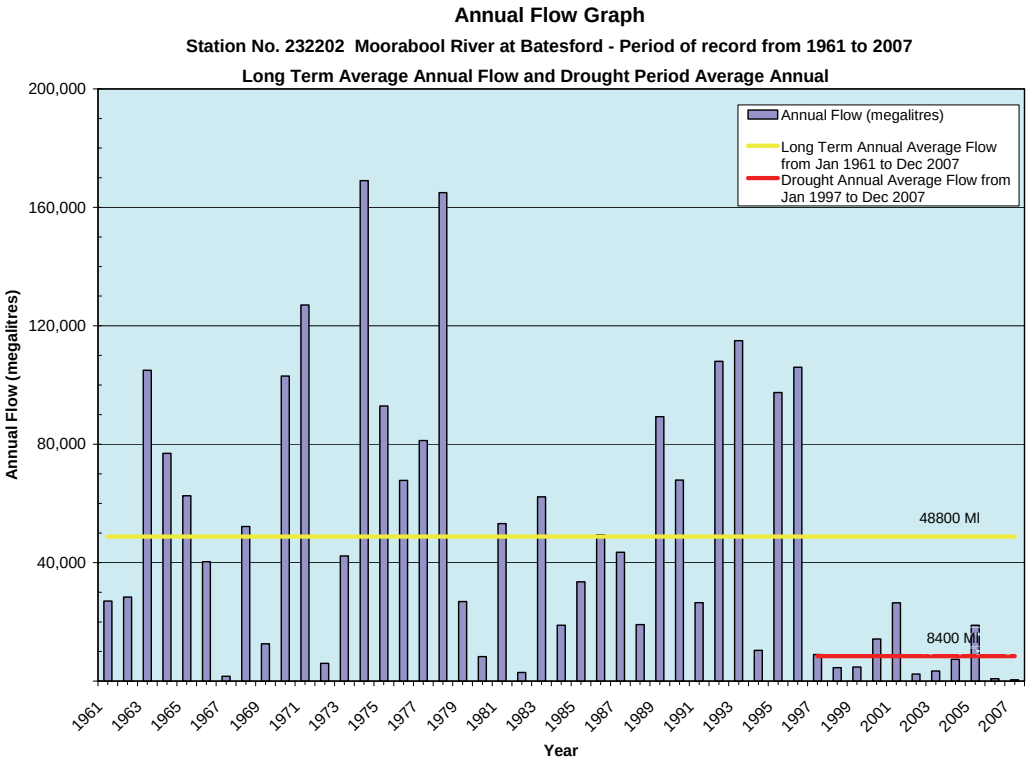


Figure 1-15 depicts annual flows in the Moorabool River at Batesford. Over the past 11 years, annual flows here have been 17% of long term average. Flows in 2007 were the lowest in recorded history (1% of the long term average) and followed on from record low inflows in 2006. The extremely dry conditions in the basin over the past two years severely impacted water availability in the basin, particularly for Ballarat.

Figure 1-15 Annual streamflow at Moorabool River



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

1.2.2 Floods

The 2007/08 year began with severe flooding throughout Gippsland, after an east coast low pressure system in late June brought well in excess of 100 millimetres of rainfall to many parts of the Thomson and Mitchell basins. The largest flood occurred in the Macalister River, with inflows of about 300,000 ML per day to Lake Glenmaggie, more than double the previous inflow record. Streamflows in the Thomson River at Cowwarr Weir (downstream of Thomson Reservoir) reached major flood levels, as did flows in the Mitchell River. The Thomson Reservoir catchment did not experience rainfall totals as extreme as those received in the Mitchell Basin, and inflows to Thomson Reservoir were not enough to significantly boost Melbourne's water supplies.

The floods did however cause significant and widespread damage: homes, businesses and farming land throughout the Macalister, lower Thomson and Mitchell valleys and communities adjacent to the Gippsland Lakes were inundated. Districts surrounding Licola, Newry, Tinamba, Sale, Glenaladale, Bairnsdale, Lakes Entrance, Paynesville, Loch Sport, Metung and Raymond Island were most affected.

Debris transported into the Macalister and Thomson Rivers, coupled with the very high flows, also caused substantial damage to many water supply assets. Significant repair costs resulted and Cowwarr Weir and parts of Lake Glenmaggie were closed to recreational activity during the year. The floodwaters in the Mitchell River also caused a major break in a pipeline which supplied 550 customers in Lindenow and Lindenow South.

The floodwaters deposited considerable volumes of ash into Gippsland's rivers from catchments burnt by fires in December 2006. To manage the resulting severe water quality problems, water corporations were forced to upgrade their water treatment systems and place towns such as Maffra, Stratford, Coongulla, Glenmaggie and Bairnsdale on severe restrictions. With the exception of Glenmaggie and Coongulla, restrictions had been eased across the region by October. Restrictions for Coongulla and Glenmaggie were eased in January 2009 after the system's treatment plant was upgraded.

1.2.3 Blue-green algal blooms

Cyanobacteria (blue-green algae) are 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.

Blue-green algal blooms are monitored regularly by water corporations and local waterway managers. Table 1-3 summarises the high alert blue-green algal blooms recorded in 2007/08. The high alert status advises that direct use for drinking water, domestic and 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 to ensure that treatment removes the algae or the water source is taken off-line.

Table 1-3 High alert blue-green algal blooms for 2007/08

Basin	Location	Major use	Time period	Management response
Ovens	Blampieds – Tagells / Entrance	R	July to August 2007	Stakeholders notified
Loddon	Lake Boga	R, IDS	July 2007 to January 2008	Public notified via the media
	Tullaroop Reservoir and creek	IDS	January to February 2008	Warning signs erected, stakeholders notified and the public notified via the media
	Lexton Reservoir	DW	February 2008	Reservoir taken off-line
	Barkers Creek Reservoir	R	May to June 2008	Warning signs erected and the public gates closed
Mallee	Hattah Lakes	R	July to October 2007	Warning signs erected
	Lake Hattah, Hattah-Kulkyne National Park	R	March to June 2008	Regular sampling, warning signs erected
	Lake Mournpall, Hattah-Kulkyne National Park	R	March to June 2008	Warning signs erected and regular sampling undertaken
East Gippsland	Sunlakes Storage Basin	DW	June 2008	n/a – reservoir not in use
Tambo Mitchell Thomson LaTrobe	Gippsland Lakes	R	December 2007 to April 2008	Public notified via the media, warning signs erected and regular sampling undertaken
South Gippsland	Lance Creek Reservoir	TWS	July to September 2007	Ongoing monitoring
Thomson	Sale Common	R	January to May 2008	Warning signs erected
	Port of Sale	R	April 2008	Increased monitoring, warning signs erected
Bunyip	Beaumont Waters Lake – Berwick	R	February to June 2008	Increased monitoring, warning signs erected
	Monbulk Retarding Basin – Lower Lake	R	February 2008	Increased monitoring, warning signs erected
	Karkarook Lake – Heatherton	R	May to June 2008	Warning signs erected, stakeholders notified
	Greeves Road Retarding Basin	R	February to March 2008	Increased monitoring, warning signs erected
Yarra	Yan Yean Reservoir	DW	May to June 2008	n/a – reservoir not in use
	Ornamental Lake, Royal Botanic Gardens	PR	January to June 2008	Warning signs erected, stakeholders notified
Maribyrnong	Jacksons Creek, Gisborne	DW & I	January to March 2008	Warning signs erected, stakeholders notified, public notified via the media and increased monitoring carried out
Werribee	Merrimu Reservoir – Embankment / Leeward	TWS	July to August 2007	Regular sampling, storage closed to public access, warning signs erected
Moorabool	Western Treatment Plant	STP	December 2007	Lagoon isolated and public notified via the media
Barwon	Painkalac Creek Reservoir	DW	September to October 2007	Regular monitoring
Hopkins	Lake Gillear Wildlife Reserve	R	December 2007 to June 2008	Warning sign erected
Glenelg	Lake Hamilton	R	January 2008	Warning signs erected, stakeholders notified, public notified via the media, increased sampling carried out

Legend:

DW	Drinking water	I	Irrigation
IDS	Irrigation, domestic and stock	PR	Passive recreation
R	Recreation	STP	Sewage treatment ponds
TWS	Town water supply		

1.3 Storages

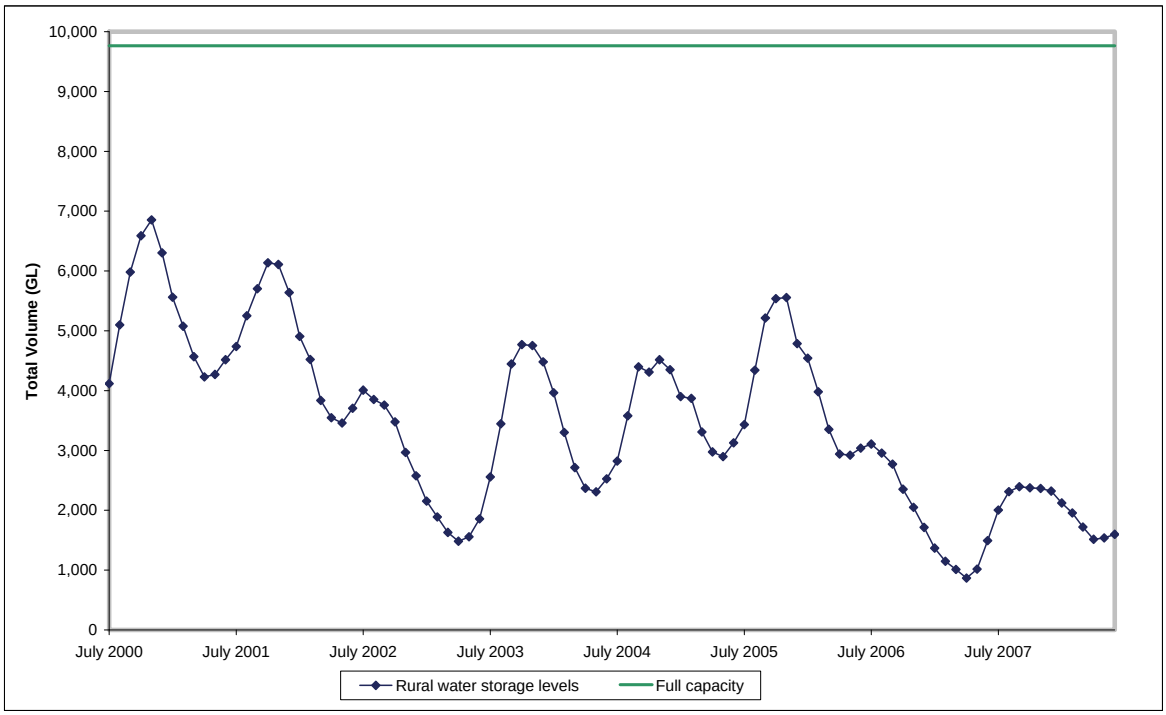
Victoria's major water storages are capable of holding around 11,540,000 ML. Of this, Melbourne's storage capacity is 1,773,000 ML, while the combined capacity of the state's regional storages is 9,767,000 ML. Victoria's storage capacity well exceeds annual use in any one year. For example, Melbourne's total water consumption in 2007/08 was around 370,000 ML, which is about 21% of the volume it can hold in its storages. This large storage capacity is necessary to manage the high year-to-year variability and yearly streamflow fluctuations in Victoria's rivers in order to provide continuous and reliable water supplies.

As can be seen in Figure 1-16 the total volume of water stored in Victoria's major rural reservoirs started the year at 2,003,510 ML (20.5% of capacity), increased marginally throughout 2007/08 and ended the year at 1,598,958 ML (16.4% of capacity). Levels peaked in October and declined over summer and autumn as inflows receded and water was released from the reservoirs for irrigation. Despite inflows being well below average, the observed filling pattern was relatively consistent with previous years. This was in contrast to the patterns observed in 2006/07 when storage levels did not recover.

Storage levels at the end of the year varied greatly across the state. For example, in May 2008 volumes in the Wimmera Mallee system fell to their lowest levels since construction and ended the year extremely low at 3.3% of capacity. Storages in the Broken, Campaspe, Werribee and Maribyrnong basins were also all less than 10% full at the end of June 2008. In contrast, storages in the Ovens and Latrobe basins were close to 60%.

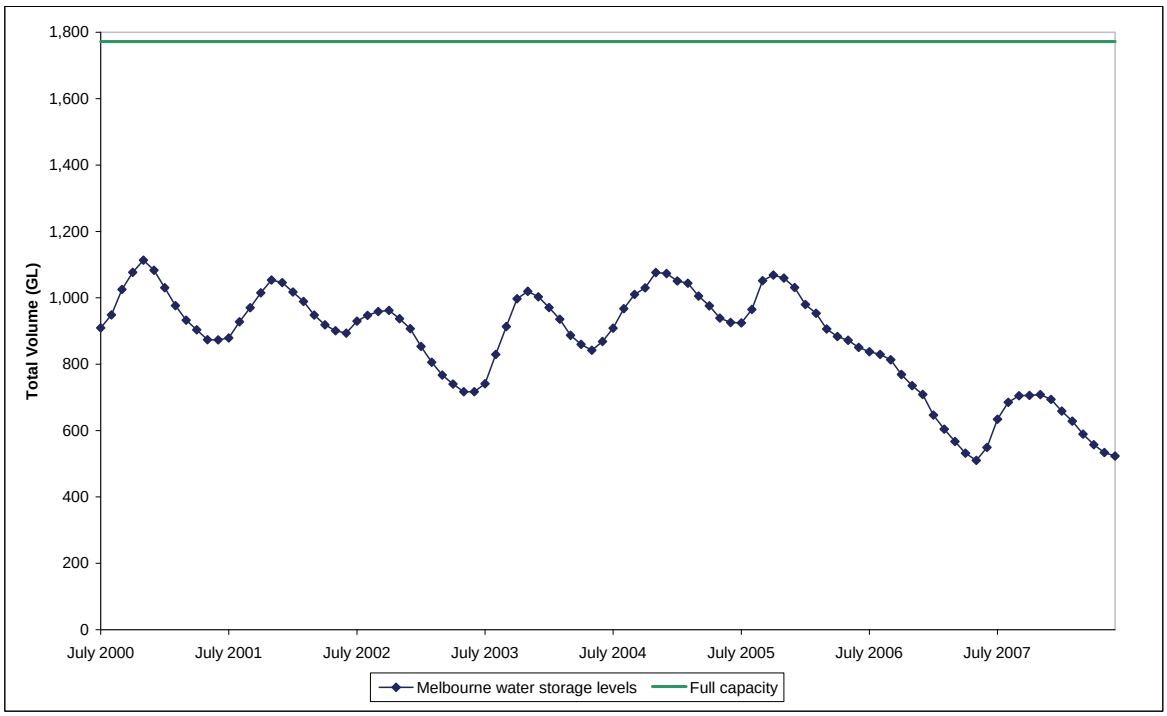
Information on storage levels in individual basins is set out in Appendix B and in the basin water accounts.

Figure 1-16 Volume in major rural water authority storages from 1 July 2000 to 30 June 2008



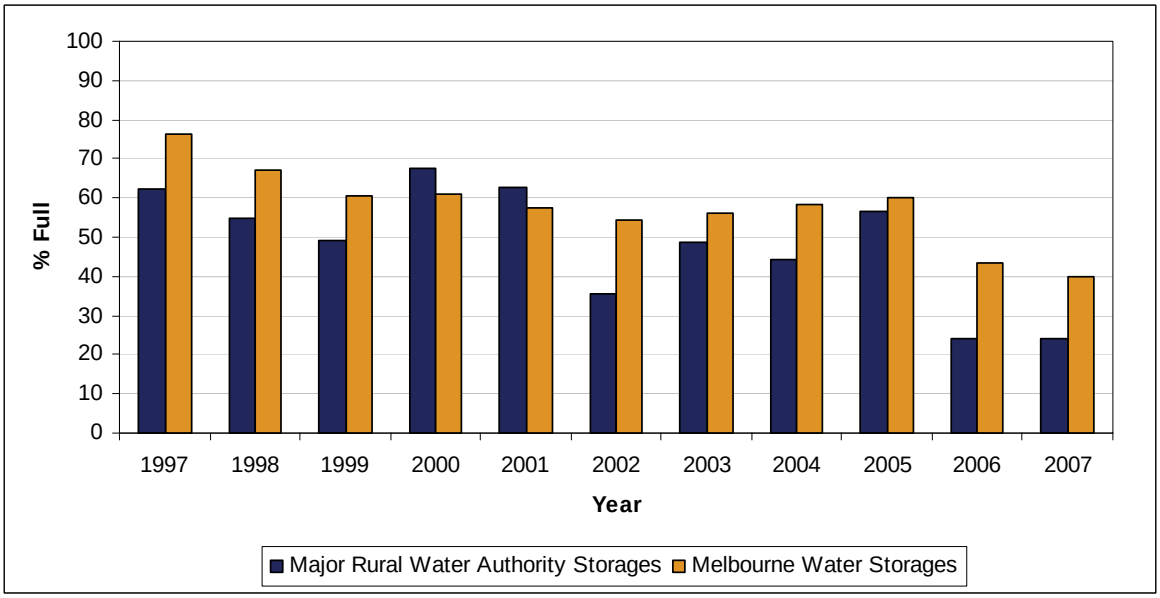
Melbourne's water storage levels decreased by 25,624 ML during 2007/08 and ended the year at 29.5% of capacity. Unlike in 2006/07, levels recovered over winter and spring, peaking in November at 708,515 ML (40.0%). Storage levels would have been lower had Stage 3a restrictions not been implemented and a proportion of environmental water not been retained in storage as a drought contingency measure.

Figure 1-17 Volume in Melbourne Water Corporation storages from 1 July 2000 to 30 June 2008



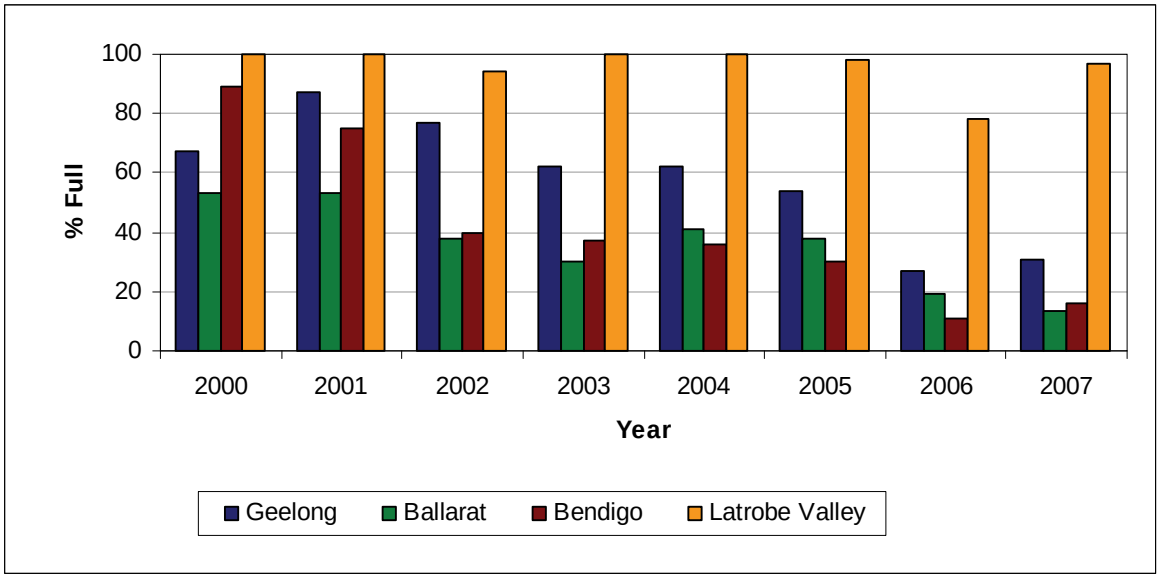
The total volume of water stored in Victoria's major reservoirs in October provides a good indication of water availability in a year because this is when levels are usually at their maximum. Figure 1-18 presents October storage levels, as a percentage of storage capacity, from 1997 to 2007 for Melbourne and Victoria's major rural water corporation reservoirs. It shows that October storage levels have generally declined over the last 11 years as inflows have not been sufficient for systems to recover. A significant drop in levels occurred between 2005 and 2006, when winter and spring rainfall failed to eventuate.

Figure 1-18 Water stored in reservoirs at the end of October, 1997-2007 (shown as a percentage of total storage capacity)



October storage levels from 2000 to 2007 for selected regional centres are shown in Figure 1-19. With the exception of the Latrobe Valley, storage volumes in Victoria's regional cities have generally declined in the past eight years. The failure of winter and spring inflows in 2006 caused a significant drop in levels for the state's major regional centres, while a combination of inflows and system augmentations in 2007 helped levels recover slightly for Geelong and Bendigo. A failure of inflows to Ballarat's storages meant that levels continued to decline in 2007 and were 12% of capacity at the end of October.

Figure 1-19 Water stored in key regional cities' reservoirs at the end of October, 2000-2007 (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 the groundwater or surface water resources there 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 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 was entered into 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. This area 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 quality and yield (how much can be pumped out) are highly variable. The suitability of groundwater for use is generally determined by the level of salinity.

Security of access to groundwater is dependent on stable groundwater levels. The state monitors approximately 2,500 bores on a quarterly basis to understand the groundwater level trends. Additionally, the rural water corporations conduct monthly monitoring of approximately 500 bores. During 2007/08, the bore network was reviewed in 26 priority management units with locations of new bores agreed by the Department of Sustainability and Environment and the rural water corporation. Agreements were signed with the rural water corporations, with drilling to commence in 2008/09.

During 2007/08, groundwater quality samples were also collected from 289 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.

Development of the groundwater resource coupled with drought and climate change has led to declining groundwater levels across many of the groundwater management units. Groundwater has been sourced to improve water security for houses, farms, industry and towns when the security of surface water is low or unavailable.

Compared to groundwater level trends in 2006/07, a larger number of management units are now showing a declining trend. Whilst this can be attributed to continuing demand for groundwater, external factors such as climate change and lack of recharge are also causing a decline in water levels and are outside of the groundwater management framework.

Declining groundwater levels can result in reduced access to the resource. For some users, this can lead to increased pumping costs or the need to drill deeper bores. For other areas, there may be a need to enforce restrictions to ensure groundwater levels do not continue to decline. The environment can be affected by declining groundwater levels when the baseflow to waterways, wetlands and other groundwater-dependent ecosystems is reduced. The challenge is to manage the resource sustainably, optimising the volume extracted and the value obtained from the resource, whilst 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 – 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 Bore Observation Network (SOBN) are presented in Figure 1-20, Figure 1-21 and Table 1-4.

To improve water use compliance and accounting for groundwater use, a state-wide metering program was implemented in 2004. The program requires all new groundwater licences to be metered and all groundwater licences greater than 20 ML/year must be retrospectively fitted with meters. The program is partly subsidised by the Victorian Government with customers funding the balance. This program is largely complete and a breakdown is provided in Chapter 3.

Water metering is fundamental to responsible management of Victoria's water resources.

Figure 1-20 Groundwater trends in WSPAs

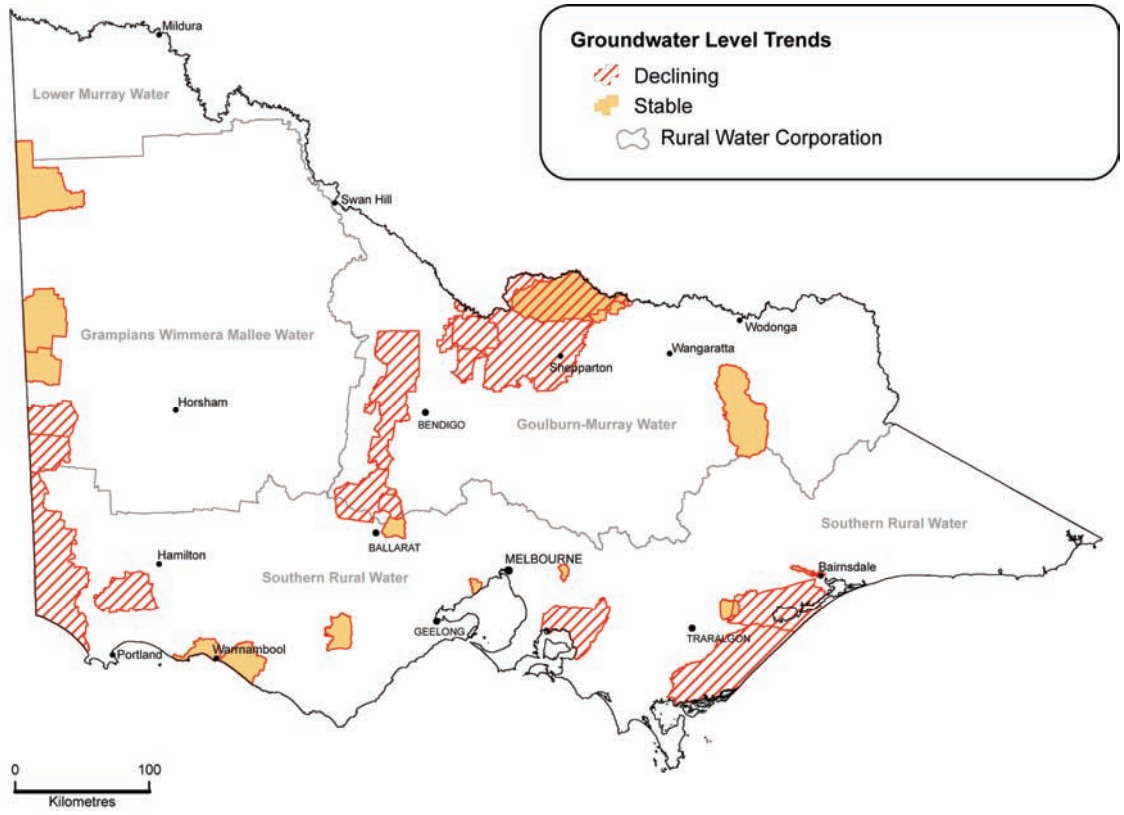


Figure 1-21 Groundwater trends in GMAs

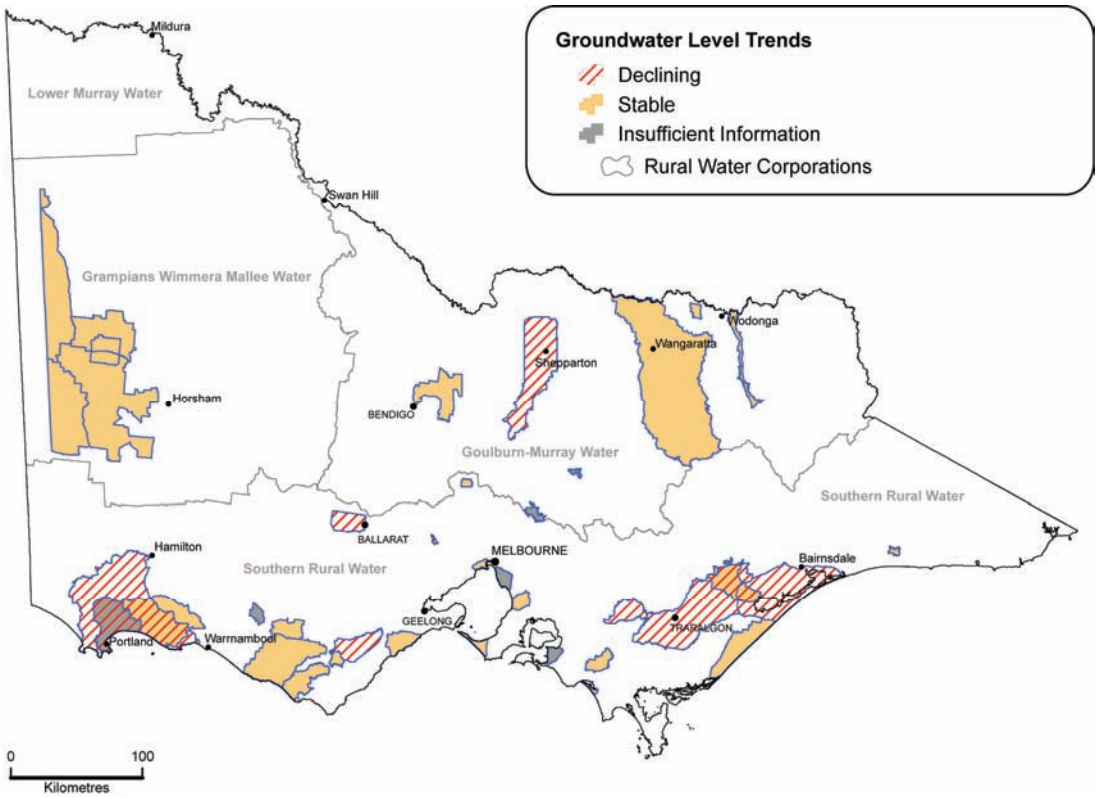


Table 1-4 Groundwater level trends in WSPAs

	SOBN Coverage	Groundwater Level Trend 2007/08	Groundwater Level Trend 2006/07	Management activities
Goulburn Murray Water				
Campaspe Deep Lead	Adequate	Declining	Stable	R, MP, A
Katunga	Adequate	Stable	Stable	R, MP
Mid Loddon	Adequate	Declining	Declining	
Shepparton Irrigation Region	Adequate	Declining	Declining	MP
Spring Hill	Limited	Declining	Stable	R, MP, A
Upper Loddon	Limited	Declining	Declining	A
Upper Ovens(1)	Limited	Stable	N/A	MP*
Grampians Wimmera Mallee Water(2)				
Apsley	Limited	Declining	Stable	A, MP*
Kaniva	Limited	Stable	Stable	A, MP*
Murrayville	Limited	Stable	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	Stable	MP*
Nullaware	Adequate	Stable	Stable	MP, A
Sale	Adequate	Declining	Stable	A
Wandin Yallock	Adequate	Stable	Stable	
Warrion	Adequate	Stable	Stable	MP*
Wy Yung	Adequate	Stable	Stable	
Yangery	Adequate	Stable	Stable	MP, A
Yarram	Limited	Declining	Declining	

Management activities key:

MP Management plan
MP* Management plan being prepared
R Restrictions on use
A Resource appraisal commenced

Notes:

(1) 2007/08 is the first year the Upper Ovens WSPA has been reported in the Victorian Water Accounts.
(2) 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

Despite receiving more rainfall than the extreme lows experienced in 2006/07, continuing below average totals, particularly between August and October, combined with dry catchment conditions meant that streamflows across most of Victoria remained well below average in 2007/08.

This extended the current dry conditions to eleven years and meant water availability across many parts of Victoria remained low. Storage levels in Victoria's major rural reservoirs had increased slightly by the end of the year to hold 16.4% of capacity, while Melbourne's storages continued to decline, ending the year just under 30%.

In contrast, streamflows and storage levels were close to average in central Gippsland due to an intense rainfall event in June 2007 and higher than average summer rainfall. Although the high streamflows improved water availability in the region, the floods caused significant and widespread damage and inundation, severely impacting the raw water quality of surface water sources. Streamflows were highest in the Macalister and Mitchell Rivers, and Melbourne's Thomson Reservoir did not receive the volumes of inflows needed to improve water availability for the metropolitan region.

The continuing dry conditions also impacted groundwater supplies, with 20 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.

2 Management of scarce water resources

2.1 Living with less water

Victoria has now experienced 11 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 of rainfall 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 11 years has resulted in a major reduction in streamflows and inflows into Victoria's major reservoirs, resulting in 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, and restrictions, rosters and bans on users in unregulated catchments. However, the duration and severity of the low flows of the last 11 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.

A large number of measures were employed across the state in 2007/08 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 Victorian 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 contingency plans in 2007/08 as water availability did not significantly improve across much of the state. To reduce the impacts of the water shortages, the government requested each business review and update its contingency plans based on the experiences of managing water supplies in 2006/07. It also continued to work 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 the risks of dry years within their bulk entitlements by implementing their drought response plans, and making up shortfalls in water supply through the water market where possible. However, 2007/08 continued to be extremely dry in many places and required the Minister for Water to again invoke his emergency powers to declare water shortages and qualify rights to water in many water systems throughout the state. These included the large water systems in northern Victoria, such as the Murray and Goulburn systems, as well as Melbourne. Having the government coordinate agreements on revised water sharing arrangements under qualifications helped ensure essential urban, rural and environmental needs were met and the necessary contingency measures implemented in a consistent manner across the state.

In October 2007, the government announced a further $100 million in drought relief assistance to help farmers and rural communities manage through the extremely dry conditions. The government consulted widely in developing the comprehensive package of measures that included water rebates for irrigators worth $55 million, a new $10 million program to assist farmers to improve water security and to boost future productivity, and further support for mental health services.

To complement the drought relief package, the government launched the Future Farming Strategy aimed at improving farming services, driving growth and innovation in agriculture and helping the sector respond to new challenges. The $205 million strategy sets out new investment built around seven key actions to provide farmers with the tools they need to boost their productivity.

The government also provided funding for a range of urban water savings measures in 2007/08. The Water Smart Gardens and Homes Rebate Scheme was extended to provide rebates for purchases of water saving products for an additional four years. Over 162,000 rebates on water-efficient products were claimed prior to the scheme being extended, providing Victorians with some $10 million off their water bills.

As part of its commitment to helping business and industry use less water, the government provided a further $10 million for the Stormwater and Urban Recycling Fund, and $10 million for the Water for Industry Fund and Smart Water Fund. It also launched the waterMAP program, which required 1,850 non-residential consumers using more than 10 ML per annum across the state to produce water efficiency plans by the end of 2007. Water consumption by those consumers in 2007/08 was down by 10 gigalitres from 2006/07.

The government also plays an important role in long term water resource planning for Victoria. Through the release of the second stage of the *Our Water Our Future* action plan in June 2007, the government has committed

approximately $4.9 billion to major infrastructure projects to boost Victoria's water supplies and protect against drought. Projects include the Wonthaggi desalination plant, major pipeline projects and upgrading Melbourne's Eastern Treatment Plant.

The government is also currently developing sustainable water strategies that consider all aspects of water resource management in each region of Victoria over the next 50 years.

2.3 Victoria's regional sustainable water strategies

Victoria continues to plan for its future water resource management across the state through development and implementation of its sustainable water strategies.

All draft strategies will consider the potential impacts of climate change on water availability into the future and outline options to deal with these risks.

Implementation of the first of the strategies to be approved, the Central Region Sustainable Water Strategy, commenced in 2006.

A report on progress on implementation of actions undertaken within the strategy is available in the Department of Sustainability and Environment's 2007/2008 Annual Report.

2.3.1 Northern Region Sustainable Water Strategy

In 2007/08, work commenced on the Northern Region Sustainable Water Strategy with the draft released in October 2008.

With continuing drought and the effects of climate change as the context, the draft strategy recognises that sufficient water will not be available to meet all the requirements of the environment and consumptive users and that trade-offs are required to be made now and into the future.

The draft strategy documents proposals that will further develop greater certainty and flexibility in the water sector to allow the community to plan for and direct the required changes in where, when and how water is used.

This will be achieved through reforms to improve water allocation processes, water trading and carry-over arrangements, and the management of the environmental water reserve. The proposals in the draft strategy will also facilitate the efficient delivery of urban and rural water services.

The final strategy is expected to be released in the 2009/10 financial year.

2.3.2 Western Region and Gippsland Region Sustainable Water Strategies

Both of these strategies were earmarked for preparation beyond 2007/08 in consultation with regional stakeholders and other State Government agencies. The strategies will analyse potential risks to water availability for all users in their regions and identify actions for the future management of their water resources.

During development of the strategies, the Department of Sustainability and Environment will engage a range of stakeholders through the consultative committees appointed by the Minister for Water, and directly with regional organisations.

The Western region draft strategy will be open for public comment after its release in the second half of 2009. It will outline significant issues affecting water resources in the region and present proposals to secure water supplies for homes, towns, businesses and the environment.

Public comments about the draft Western region strategy, together with input from a broad range of technical and stakeholder groups, will be used to resolve management options for the final strategy, expected to be released in 2010.

A discussion paper on the Gippsland Region Sustainable Water Strategy was released by the Department of Sustainability and Environment in July 2009. The discussion paper is the first step in the development of the Gippsland Region Sustainable Water Strategy: it outlines the Gippsland region's current water resources, the emerging challenges to water availability and quality, and poses questions about what the water future in Gippsland might look like.

Feedback on the discussion paper will be used to develop a draft strategy, expected to be released late in 2009 with the final strategy planned for the first half of 2010.

2.4 Victoria's water plan

The continuing record drought has meant that Victorians have needed to conserve water and use it more wisely than ever before. Continuing population growth coupled with diminishing rainfall called for significant changes to how water is managed and used.

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. 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.

One of the key components of the water plan is the recognition that some parts of the state which had historically experienced reliable rainfall and hence water supply, can no longer rely on their own catchments to supply their residents, industries and other users.

While water conservation initiatives coupled with water restrictions have significantly reduced demand, without linkages to non-traditional sources of water the extreme shortages brought about by the continuing drought would have left some locations short of supply.

Pipelines are a key plank in the water plan and will provide townships and surrounds with greater security of supply. In 2007/08 the Goldfields Superpipe commenced operation delivering much needed supply to Bendigo, Ballarat and surrounding districts.

With about 21,800 ML transferred through the pipeline, just over 13,200 ML was made available for Bendigo after its connection became operable in August 2007.

Of the remaining 8,660 ML transferred, the vast majority was stored at Lake Eppalock for future use by Ballarat and surrounding districts. After Ballarat was connected to the supply in May 2008 a total of 800 ML was transferred to White Swan Reservoir.

Details relating to other pipelines to be constructed under the water plan are available in Table 2-1.

While linking water sources with users has occurred in Victoria for much of its settled history, previous methods of transmission however, particularly in areas that irrigate with water, have proven highly inefficient. In particular, large volumes of water fed into earthen channel irrigation systems at the source invariably deliver greatly diminished supply at the users' end.

With over 17,500 kilometres of open earthen channel, the domestic and stock system within the Wimmera Mallee accounted for the loss of 103,000 ML a year through evaporation and groundwater infiltration.

Replacement of the leaky system is well underway with construction of the 8,800 kilometre pressurised Wimmera Mallee Pipeline nearing completion.

Irrigation systems within northern Victoria have also proven leaky. Through the installation of more efficient irrigation infrastructure, the Northern Victorian Irrigation Renewal Project (NVIRP) will recover 225,000 ML of water currently lost through leaks, evaporation and system inefficiencies.

As at May 2008, the first works had commenced with the installation of new water control gates, which will automate the core structure of the region's irrigation system.

Savings realised from completion of the project will be shared; up to one third will go to the Melbourne water supply system via the Sugarloaf interconnector. This follows the investment in the project by the Melbourne metropolitan water corporations for one third of its cost.

One of the highest impact components of the water grid is the desalination plant under construction at Wonthaggi. With the drought continuing, Melbourne's future water security hinges on the introduction of a rainfall independent source of additional water supply.

By the end of June 2008 planning for and early work on the desalination plant was well advanced. Acquisition of the land required for the plant had commenced, while work on liaising with affected landholders began after an alignment for the transfer pipeline and power supply route had been determined. Once completed, the desalination plant will deliver up to 150 billion litres of water to Melbourne each year. This represents approximately one third of Melbourne's current water requirements.

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

Project name	Supply impact	Project type	Supply objective	Completion date
Goldfields Superpipe	20,000 ML/year to Bendigo and 18,000 ML/year to Ballarat	Link	Provide central Victorian urban and rural sectors with a more reliable supply of water by linking Bendigo and Ballarat to the Goulburn system via a pipeline from the Waranga Main Channel at Colbinabbin	May 2008
Tarago Reservoir	Up to 15,000 ML/year on average	Link	Increase supplies by 15,000 ML/year for Melbourne through the construction of a water treatment plant to ensure the water meets potable water quality standards. Allow efficient distribution through modifications to the dam and outlet structures and through the upgrade of the transfer network.	June 2009
Wimmera Mallee Pipeline	Savings of approx 103,000 ML/year	Efficiency	Save losses through evaporation and groundwater infiltration by replacing 17,500 km of earthen irrigation channel with 8,800 km of pressurised pipeline	Expected completion April 2010
Sugarloaf interconnector	Up to 75,000 ML/year	Link	Link the Goulburn River and Sugarloaf Reservoir and deliver Melbourne's one third annual share of the water savings generated by the Northern Victoria Infrastructure Renewal Project	February 2010
Hamilton – Grampians interconnector	2,000 ML /annum	Link	Connect Rocklands Reservoir with Wannon Water's existing Grampians Headworks Pipeline to supply the Hamilton system	June 2010
Desalination plant	150,000 ML/year	New supply	Will boost water supplies, providing around one third of Melbourne's current water needs	End of 2011
Melbourne – Geelong interconnector	Up to 16,000 ML/year	Link	Connect Geelong to Melbourne's water supply system	End of 2011
Northern Victoria Infrastructure Renewal Project	Stage 1: Systemwide savings of 225,000 ML/year	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: June 2012
Eastern Treatment Plant upgrade	Up to 100,000ML/year Class A recycled water	New source	Upgrade the Eastern Treatment Plant's treatment process to improve the quality of the coastal discharge at Boags Rocks to meet environment protection requirements. The treatment upgrade will produce Class A recycled water, 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

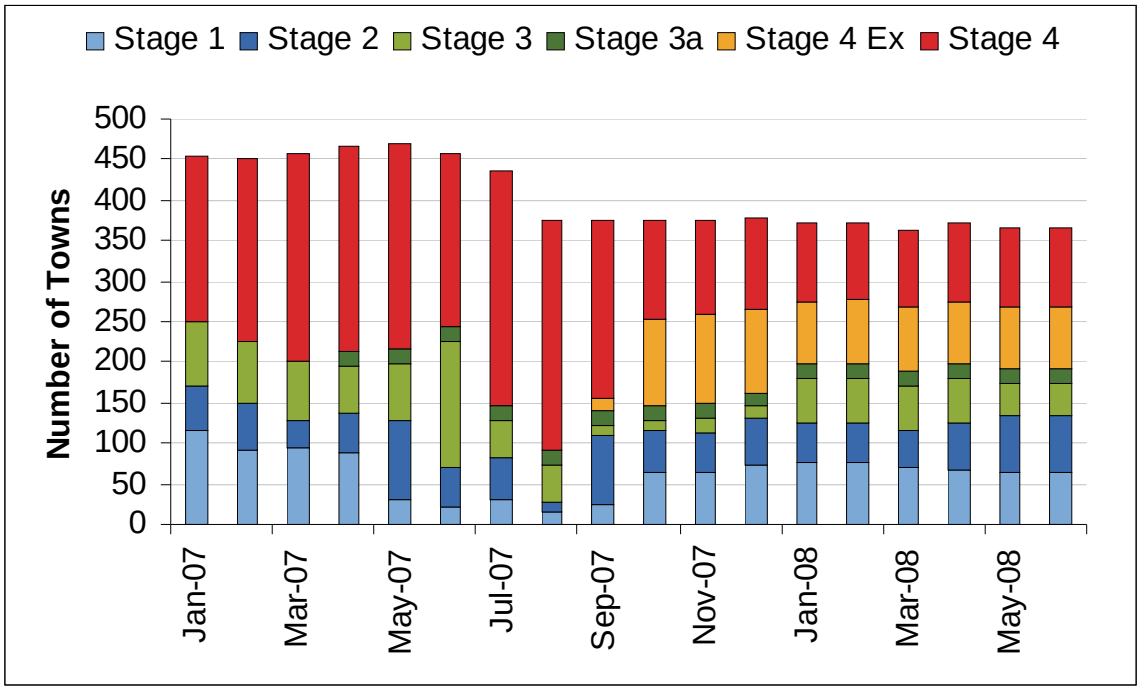
Under the Victorian Uniform Drought Water Restriction Guidelines, all Victorian towns moved to a uniform scale of water restrictions in mid to late 2006. The scale has six stages of restrictions, including intermediate Stages 3a and 4 Ex, with increasing levels of severity. Whilst water businesses are able to tailor the restrictions under each stage to suit local conditions, each stage's restrictions are mostly generic. The trigger points for each stage of water restrictions are outlined in the drought response plan of each water business. These plans also include contingency measures for temporary water supplies or savings beyond Stage 4.

The number of towns on water restrictions reduced during 2007/08. At 1 July 2007, 457 towns were on some form of water restrictions. By 30 June 2008, that number had decreased to 366, with 97 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.

Figure 2-1 summarises the number of towns on restrictions over 2006/07 and 2007/08, and the level of those restrictions.

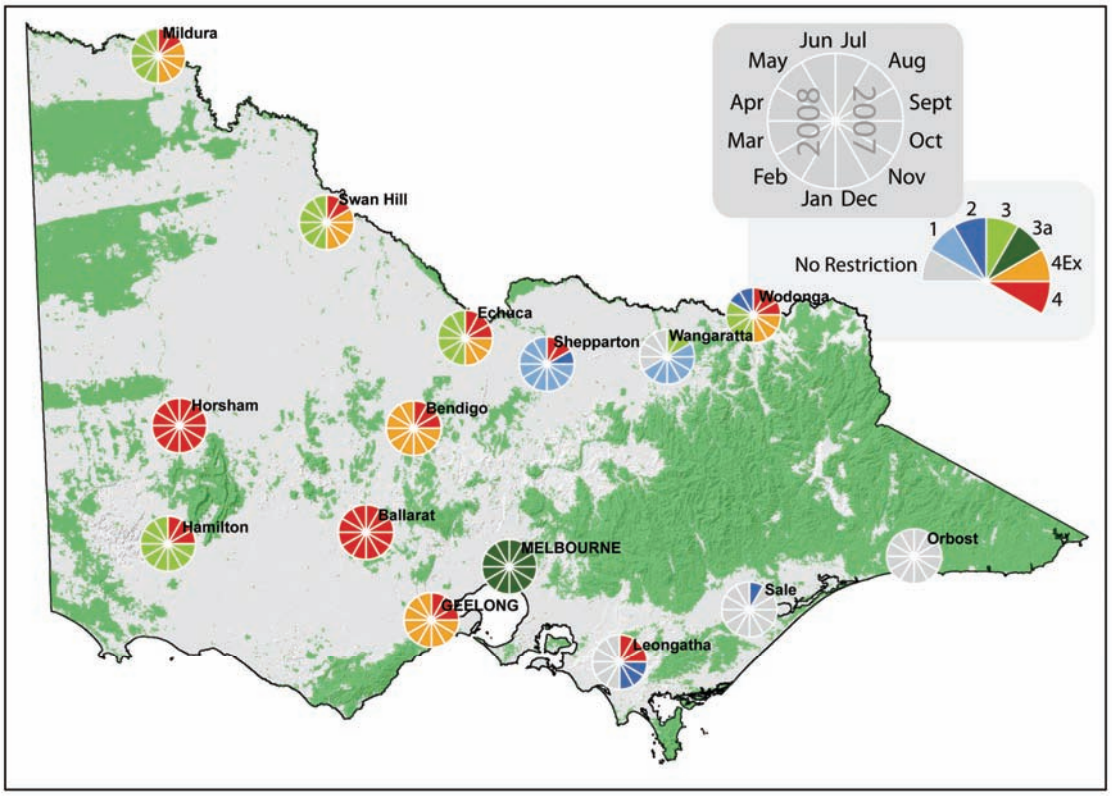
Figure 2-1 Number of Victorian towns on restrictions from January 2007 to June 2008



As discussed in Chapter 3, increasing restrictions have significantly contributed to substantially lower water consumption compared with either historic or recent levels. Urban water businesses reported that metered water use was 9% or 56,660 ML lower in 2007/08 compared with 2006/07.

Figure 2-2 shows the level of restrictions for the major population centres and the manner in which they changed over 2007/08. All towns shown finished the year on either the same level or a lower level of restriction than they began. Towns in East and South Gippsland and Latrobe basins ended the year on permanent water savings measures.

Figure 2-2 Changes in restrictions levels for major towns, 2007/08



2.6 Seasonal allocation of water in irrigation districts

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, which will vary from year to year, of the available resource. An irrigator's seasonal allocation can be used at any time throughout the irrigation season.

Seasonal allocations are expressed as a percentage of high reliability and low reliability water shares. 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 water businesses throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water businesses do not know until late spring how much water will be available for use.

The 2007/08 seasonal allocations for Victoria's irrigation districts are shown in Table 2-2. Low inflows resulted in all irrigation systems except the Thomson-Macalister receiving less than 100% allocation. Irrigation allocations varied from the 2006/07 allocations, with some irrigation systems receiving lower allocations than in 2006/07, while others received higher allocations. All irrigation systems in northern Victoria started with zero allocation for the first time ever. For the Wimmera it was the sixth consecutive year of zero water allocation, while four irrigation districts ended 2007/08 with zero allocation.

The Thomson-Macalister irrigation district was the only district to have received more than 100% allocation in 2007/08. In contrast, the Murray system received 34% in 2007/08, down from the 95% allocation in 2006/07.

Table 2-2 Seasonal irrigation water allocations

Irrigation system	Initial allocation August 2007 (% of entitlement)	Mid season allocation February 2008 (% of entitlement)	Final allocation May 2008 (% of entitlement)	2006/07 final allocation (% of entitlement)
Murray – gravity & pumped (%HRWS)(1)	0	34	43	95
Goulburn (% HRWS) (1)	0	47	57	29
Broken (% HRWS) (1)	0	56	71	77
Campaspe (% HRWS) (1)	0	12	18	0
Loddon (% HRWS) (1)	0	5	5	0
Bullarook Creek (% HRWS) (1)	0	0	0	36
Wimmera (% entitlement volume)	0	0	0	0
Thomson – Macalister (% water right)	100	200	200	60
Werribee (% water right)	0	8	8	10
Bacchus Marsh (% water right)	0	8	8	10
Maribyrnong (Southern Rural Water) (% water right)	0	0	0	5
Maribyrnong (Melbourne Water) (% licence volume)	0	0	0	0

Note:
(1) High reliability water share

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, urban water businesses and power stations sought to augment their water supply.

2.7 Restrictions on diversions from unregulated streams

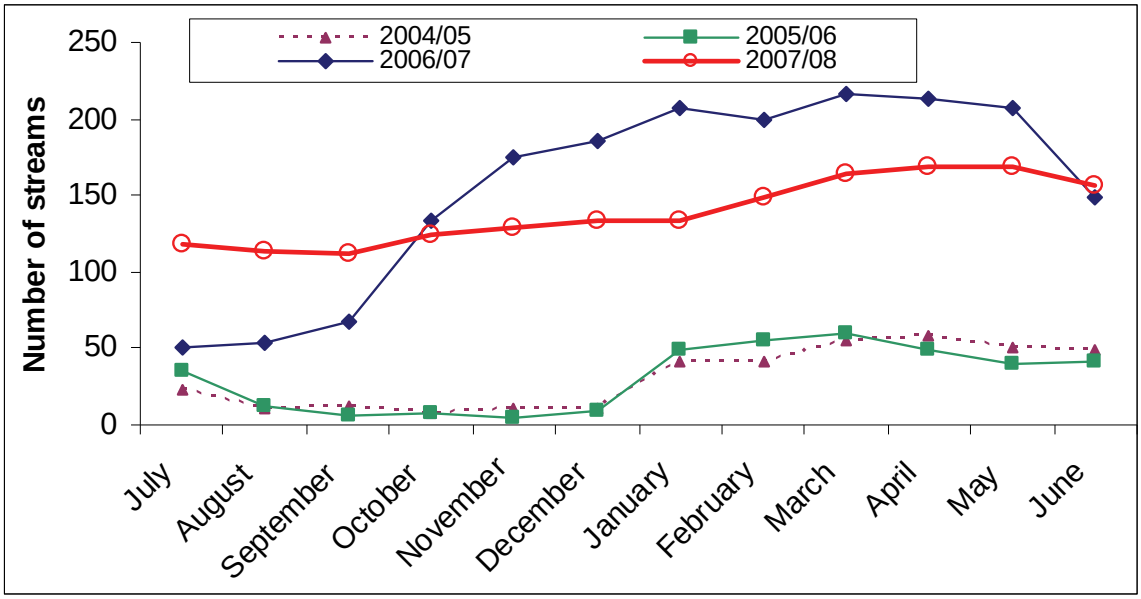
When streamflow in an unregulated stream drops below a specified threshold, water businesses have the power to impose restrictions, rosters and bans on the water pumped from the stream by licensed diverters. Rosters and restrictions set out the order in which licence holders are allowed to take water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

Restrictions on diversions in 2007/08 broadly followed this trend. The magnitude of restrictions during 2007/08 was generally slightly reduced from that experienced during 2006/07, however it was still significantly higher than that

experienced in 2004/05 and 2005/06. Restrictions were at their most severe in summer, with an increase in February through to April, and a slight reduction towards June. Restrictions reached their peak in April 2008, with 169 unregulated streams on restrictions and irrigation bans on the majority. In June 2008, some 156 streams were on some form of restriction compared to 118 in June 2007.

Figure 2-3 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 is less than 100% of the licensed entitlement, restricting extraction of groundwater to:

- 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 2007/08, seasonal allocations applied for the following management areas:

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

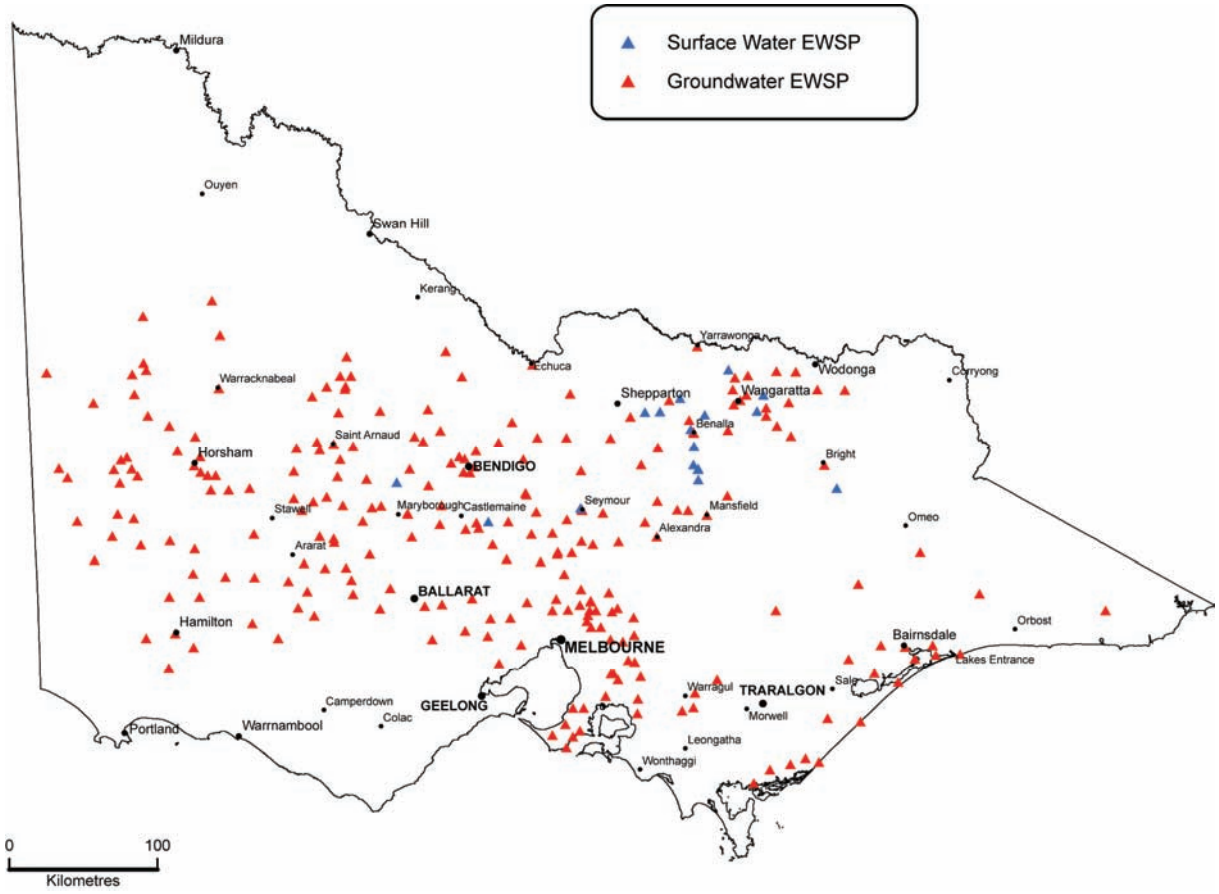
2.9 Emergency water supply network

In locations where water shortages were becoming critical, the Victorian Government and water businesses acted to ensure emergency water supply points were available to eligible customers. Emergency water supply points comprise a combination of municipal drought relief bores, urban surface water standpipes and surface extraction points on channels and streams.

In 2007/08, the emergency water supply system was expanded with the upgrade or addition of 157 emergency water supply points at a cost of $5.6 million. The aim of the emergency water supply points program was to ensure that landholders did not have to travel more than 20 kilometres to access emergency water in the most drought-affected areas. Some supply points are fitted with Country Fire Authority standard fittings to allow access in case of an emergency.

Two hundred and seventy emergency water supply points were in operation across Victoria in 2007/08. These were accessed by rural customers who carted the water to their properties for domestic and stock purposes and for emergency use. Local councils are responsible for the maintenance of the supply points.

Figure 2-4 Emergency water supply point network 2007/08



2.10 Water carting

When a water supply system cannot meet the demands made, water carting is sometimes necessary. Doing so, however, is a time-consuming and expensive exercise and is therefore usually only implemented as a last resort to supply smaller towns. By way of example, Goulburn Valley Water spent approximately $2.5 million during the year on carting 252 ML of water from Seymour to Broadford.

Table 2-3 summarises the towns that received carted water in 2007/08.

Table 2-3 Towns receiving carted water 2007/08

Basin	Water authority	Town receiving water	Source of water	Period	Volume
Ovens	North East Water	Springhurst	Wangaratta	July	0.06 ML per day
Ovens	North East Water	Bundalong	Yarrawonga	October, June to end of year	0.2 ML per day
Goulburn	Goulburn Valley Water	Broadford	Seymour	July, November to end of year	0.9 - 1.0 ML per day
Campaspe	Coliban Water	Axedale	Bendigo	July to end of year	0.05 ML per day
Loddon	Coliban Water	Raywood(1) and Sebastian	Bendigo	July to end of year	0.05 - 0.08 ML per day
Loddon	Coliban Water	Serpentine	Bendigo	February to end of year	0.03 - 0.06 ML per day
Avoca	GWMWater	Berriwillock and Culgoa	GWMWater system	January to April	0.25 - 0.65 ML per day
Wimmera	GWMWater	Clear Lake	GWMWater system	October to end of year	0.01 - 0.33 ML per day
Wimmera	GWMWater	Jeparit	GWMWater system	March to June	Not available
Mitchell	East Gippsland Water	Lindenow and Lindenow South(2)	Mitchell River	July	Not available
Thomson	Gippsland Water	Coongulla and Glenmaggie(3)	Heyfield	July to October	0.1 ML per day
South Gippsland	Westernport Water	Westernport	Anderson bore	July	0.3 ML per day
Werribee	Central Highlands Water	Blackwood	Colebrook reservoir	July	0.04 ML per day
Werribee	Western Water	Myrniong	Bacchus Marsh	N/A	1.6 ML in total
Moorabool	Barwon Water	Meredith	Lethbridge	December to end of year	0.2 - 0.6 ML per day

Notes:
(1) Carting ceased to Raywood in April.
(2) Carting required due to pipeline damage during Mitchell River flood in June/July 2007.
(3) Carting required due to high turbidity levels in Lake Glenmaggie as a result of Macalister River flood in June/July 2007.
(4) Grampians Wimmera Mallee.

GWMWater continued to implement its extensive rural water carting program in 2007/08. It provided emergency water supplies to rural customers in the Wimmera Mallee system whose house dam water had become unusable and who could not be provided with supplies via the channel systems. Under the program, GWMWater provided 28 kilolitres of water to fully occupied houses for domestic use every second month. The water was carted from town storages or one of a number of other strategic carting sites. Water needed for intensive industries, stock watering and crop spraying was made available to customers to cart themselves. Overall, some 2,747 deliveries were made to GWMWater customers in 2007/08, carting a total of approximately 66 ML of water.

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 2006/07 were again employed in 2007/08, 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.

The most significant project completed in 2007/08 was the $278 million, 132.5 kilometre Goldfields Superpipe, which connected the major rural centres of Bendigo and Ballarat to the Goulburn system.

A significant amount of work was also completed on the $688 million Wimmera Mallee Pipeline Project in 2007/08. By the end of June 2008, GWMWater had completed works on supply systems 1, 7 and 5, and over 80% of supply system 2. Once completed in 2010, the project will have constructed almost 9,000 kilometres of reticulated pipeline to replace over 16,000 kilometres of existing, highly inefficient open channels.

Table 2-4 Infrastructure augmentations to improve water availability 2007/08

Basin	Water business	Infrastructure	Description
Murray & Broken	North East Water	Pipeline	The $3.9 million, 42 kilometre pipeline to supply treated water from the Yarrawonga water treatment plant to the towns of Tungamah, St James and Devenish was completed in December 2007
Goulburn, Campaspe, Loddon, Barwon	Coliban Water & Central Highlands Water	Pipeline	The $278 million, 132.5 kilometre Goldfields Superpipe was completed in May 2008. The Superpipe connects Bendigo and Ballarat to the Goulburn system from the Waranga Main Channel at Colbinnabin. Water has flowed to Bendigo since September 2007 and to Ballarat since May 2008
Goulburn	Goulburn Valley Water	Reservoir	Goulburn Valley Water finished constructing an off-stream balancing storage, the Mansfield Ritchie No 2 Reservoir, to improve water supply security for Mansfield
Goulburn	Goulburn-Murray Water	Pumps	Two temporary pumping stations installed in Waranga Basin in 2006/07 were re-commissioned in 2007/08. This enabled Goulburn-Murray Water to access 86 GL of dead storage from the reservoir to supply rural water users on the Goulburn system
Loddon	Coliban Water and Goulburn-Murray Water	Pipeline	The Catumnal Pipeline Project was completed in March 2008, replacing the Catumnal domestic and stock area earthern channel with a pipeline. The water savings were able to be transferred as water entitlements to Coliban Water
Loddon	Coliban Water	Alternative supply pipeline	Coliban Water continued constructing a pipeline to transfer recycled water from Epsom Recycled Water Plant to Spring Gully Reservoir. The project is due to be completed in September 2008. Recycled water started flowing to some of Coliban Water's rural customers for the first time in November 2007
Loddon	Central Highlands Water	Pipeline	In January 2008, Central Highlands Water completed the Newlyn Reservoir pipeline and pump station which connects Newlyn Reservoir to Cosgrave Reservoir to augment Ballarat's water supply
Loddon	Central Highlands Water	Pumps	Temporary pumps were installed at Tullaroop Reservoir in March 2008 to pump dead storage for supplies to Maryborough and for environmental flows
Avoca	Central Highlands Water	Groundwater bore	Central Highlands Water drilled a drought relief bore at Amphitheatre to augment surface water supplies
Wimmera and Mallee	GWMWater	Pipeline	Construction of the Wimmera Mallee Pipeline continued. Supply Systems 1, 7 and 5 were fully installed and over 80% of Supply System 2 completed at the end of June 2008. Once completed, the $688 million project will have constructed almost 9,000 kilometres of reticulated pipeline to replace over 16,000 kilometres of existing, highly inefficient open channels
Mitchell	East Gippsland Water	Groundwater bore	East Gippsland Water successfully constructed a new emergency water bore field in the Woodglen area to supplement surface water supplies for the Bairnsdale system
Mitchell	East Gippsland Water	Storage lining	East Gippsland Water completed works including lining and covers on storages at Lindenow, Eagle Point and Wy Yung to reduce evaporation losses and improve water quality
Mitchell	East Gippsland Water	Pipeline	East Gippsland Water constructed a temporary pipeline to supply Lindenow after floods damaged the existing pipeline
Latrobe	Gippsland Water	Groundwater bores	Gippsland Water drilled drought groundwater bores to augment the Thorpdale supply system
South Gippsland	Westernport Water	Pump station and pipeline	Westernport Water constructed a new pump station on Bass River to divert additional water into Candowie Reservoir
South Gippsland	Westernport Water	Groundwater bore and pipeline	Westernport Water constructed a bore and pipeline to pump water from the Corinella aquifer into Candowie Reservoir
South Gippsland	South Gippsland Water	Treatment plant	South Gippsland Water installed a temporary water treatment plant at its groundwater bore at the Yarram Golf Club to supplement Yarram's supplies with groundwater when streamflows in the Tarra River are low
Yarra	Melbourne Water	Lining works	Melbourne Water lined 3.7 kilometres of aqueduct in 2007/08 to reduce leakage
Werribee	Western Water	Treatment Plant	Western Water completed construction of the Lancefield Filtration Plant, which can treat both bore and surface water, increasing Western Water's supply flexibility
Werribee	Souther Rural Water	Pumps	Southern Rural Water installed pumps to access dead storage from Pykes Creek Reservoir to supply water to Bacchus Marsh irrigators
Moorabool	Barwon Water	Pipeline	Barwon Water constructed a pipeline to connect Lethbridge to the Moorabool Water Treatment Plant

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 that a water shortage exists 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 2007/08 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.

Qualifications were declared on 21 occasions in 13 different basins in 2007/08. These are summarised in Table 2-5, while more detail is provided in the relevant basin water accounts.

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 under qualifications to provide additional reserves for Melbourne.

Rights to groundwater were qualified in two WSPAs in 2007/08. 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 2008. A small number of exemptions were applied as part of the qualification.

In the Campaspe Deep Lead, licence volumes were multiplied by 130 per cent to support farming enterprises suffering from low surface water availability in the region. The Campaspe Deep Lead 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 2007/08

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			✓	✓		✓		✓
Latrobe	1					✓			
South Gippsland	5		✓	✓					
Maribyrnong[(1)]	1			✓					
Yarra	2			✓					
Werribee	3				✓		✓		
Moorabool	2	✓		✓					
Total	24								

Note:

(1) The amendment to Southern Rural Water's bulk entitlement on the Maribyrnong system was treated as a qualification because it is temporary in nature.

2.13 Conclusion

Victoria's rainfall pattern over the last 11 years is unprecedented. Although streamflows in 2007/08 were mostly higher than those experienced in 2006/07, many parts of the state continued to experience well below average conditions, requiring the government, water businesses and communities to continue to play an active role in managing reduced water availability. The large number of actions taken, ensured essential supplies were maintained throughout the year and water resources remained at a sustainable level for commencing 2008/09.

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

Water for consumptive use in Victoria is taken from reservoirs, streams and aquifers under entitlements issued by the Victorian Government and authorised under the *Water Act 1989*. These entitlements have been formally issued by government through a number of different mechanisms.

3.1.1 Bulk entitlements

A bulk entitlement is a right to water granted to urban and rural water businesses and other selected bodies (e.g. electricity generators) to use and supply water. Water businesses then distribute the water to their customers.

Customers of rural water businesses include irrigators who receive a regulated supply under their own entitlements in the form of water rights or licences, urban businesses that receive a bulk supply under their own delivery bulk entitlement, and rural properties that receive a domestic and stock supply.

Bulk entitlements are also held by the Minister for Environment and Climate Change and used for environmental purposes. The Act provides for the Minister to be issued with environmental entitlements. It is expected that over time bulk entitlements held by the Minister will be converted to environmental entitlements.

In urban areas, customers receive reticulated metered water supplies from an urban water business. The business holds the entitlement to water, not the customer.

3.1.2 Water rights and water shares

A water right is a right granted to a person to use water in an irrigation district as declared under the Water Act and set out in the district register. Water right holders receive an allocation each year and are entitled to sales water when sufficient water is available.

In 1 July 2007, water rights were unbundled in northern Victorian regulated systems into water shares, delivery shares and water-use licences. Information on these entitlements is stored in the Victorian Water Register. Unbundling for the large regulated districts in southern Victoria will commence from 1 July 2008.

3.1.3 Water licences

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 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 2007/08 and 2006/07. 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 there is only a minor increase 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. This ensures no net increase in entitlement in a capped catchment. Only a small increase in the volume of bulk entitlements occurred between 2006/07 and 2007/08. The increase included two new Living Murray bulk entitlements issued for the Goulburn System and Campaspe River. While there was an increase in surface water entitlements, groundwater entitlements reduced compared with 2006/07.

The minor change in the volume of licences may be explained by improvements in record keeping by the water businesses. The decrease in groundwater licences results from an audit of licences across the water corporations responsible for groundwater licensing.

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

Entitlement	Volume 2007/08 (ML)	Volume 2006/07 (ML)
Surface water		
Bulk entitlements[1]	6,065,030	5,839,440
Licences[2]	330,742	330,910
Small catchment dams (mainly domestic and stock)[3]	494,700	364,700
Groundwater licences	950,620	1,001,000
Total water entitlements	**7,841,092**	**7,536,050**

Notes:

(1) An estimate of the total volume of bulk entitlement granted as at 30 June 2008. Total volume does not include environmental entitlements. The increase from 2006/07 is caused mainly by conversion of long standing rights into bulk 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 2007/08 includes domestic and stock dams and also small catchment dams for commercial and irrigation use. The latter are required (by an amendment of the Water Act in 2001) to be licensed (or registered), a process that is currently underway. The 2007/08 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 2007/08 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 allocated to users through entitlements and licences has been far less than the available resource. A dramatic decline in streamflow in 2006/07 meant that the volume of surface water entitlements (6,535,050 ML) was much closer to the total available resource (7,091,100 ML). As Table 3-2 shows, higher streamflows in 2007/08 increased the available resource to 11,070,600 ML. It is important to note, however, that a large part of the available resource in 2007/08 can be attributed to the eastern basins, which have relatively low consumptive use relative to the available resource.

The substantial variation in the available resource demonstrates an important feature of the water allocation framework: an entitlement does not necessarily guarantee that the entitlement volume will always be available for diversion. A business with an entitlement must meet all the conditions of that entitlement including meeting passing flow obligations and sharing any shortfall of the available water with other entitlement holders including the environment. 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 that they operated within the conditions of their entitlements. As a consequence, total diversions by water businesses from streams across the state were 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 2007/08

	Surface water[1] (ML)	Groundwater[2] (ML)	Recycled water (ML)
Total resource	11,070,600	1,014,690	389,770
Entitlement/allocation	6,890,470	950,620	Not available
Water used	2,984,660	464,420	113,350

Notes:

(1) Catchment inflow as shown in each basin water balance in the 2007/08 Victorian Water Accounts, 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 2007-2008*, 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.

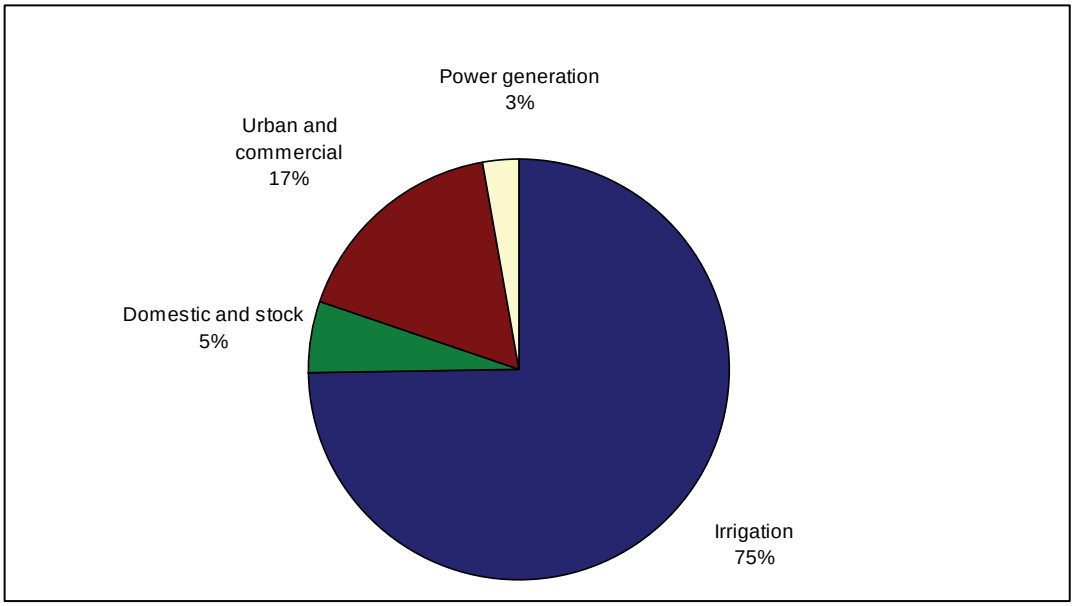
Table 3-3 Surface water diversions made under consumptive entitlements 2007/08

Consumptive end use	Volume of water diverted (ML)
Irrigation	2,230,140
Domestic and stock	163,860
Urban and commercial	504,320
Power generation	86,340
Total consumptive diversions 2007/08	2,984,660
Total consumptive diversions 2006/07	**3,456,440**

As demonstrated in Table 3-3, the volume of water taken under consumptive bulk entitlements reduced in 2007/08 compared with 2006/07. The reduction was mainly due to reductions in irrigation, urban and commercial use compared with 2006/07 following a reduction in allocations and increasing urban water restrictions.

Irrigation is still by far the highest category of water use in the state, comprising 75% of all diversions (Figure 3-1). While this portion has declined slightly in recent years due to lower allocations (resulting in less water being diverted for irrigation), it has increased from the 74% in 2006/07.

Figure 3-1 Total surface water diversions for consumptive purposes in Victoria, 2007/08



3.3.2 Urban surface water consumption

Consumption in urban areas is often measured by the metered volume of water delivered to customers. This differs from Table 3-3 and Figure 3-1 in that diversions do not take into account water lost in the distribution network through evaporation, leakage and any metering error. Therefore the metered consumption volumes discussed below are less than the urban diversion volumes in Table 3-3 and Figure 3-1.

Metered urban water consumption in Victoria fell as water restrictions and increased awareness of the sustainable use of the resource took effect. Total urban water consumption by residential and non-residential users fell by 9% in 2007/08 compared to 2006/07. The largest declines were in regional Victoria, with regional residential customers reducing their water consumption by 13% and power generators' usage declining by 10%.

Table 3-4 Urban metered water consumption in Victoria 2007/08

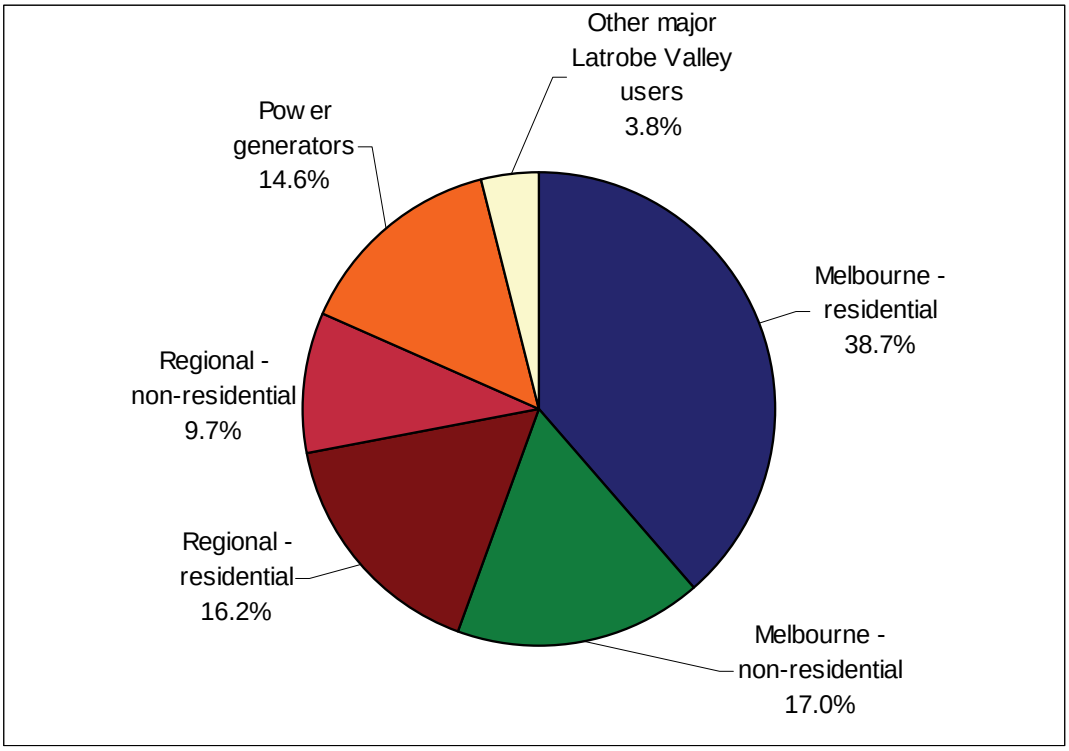
	2007/08 (ML)	2006/07 (ML)	% Change
Melbourne – residential	228,190	248,730	-8%
Melbourne – non-residential	100,290	108,100	-7%
Regional – residential	95,780	110,640	-13%
Regional – non-residential	57,430	60,350	-5%
Power generators[(1)]	86,340	96,130	-10%
Other major Latrobe Valley industrial users	22,430	23,350	-4%
Total urban consumption	**590,460**	**647,300**	-9%

Note:

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

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 2007/08



3.3.3 Consumption by major users

In October 2006, the *Water Act 1989* and the *Water Industry Act 1994* were amended to require urban water corporations and the metropolitan retailers to publicly report on major urban water customers. In accordance with the amendments, 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 2007/08. In the *Victorian Water Accounts 2006-2007* the total number of consumers reported using 50 ML per annum or more was far greater than the totals reported below. This was due to the inclusion last year of a number of users apportioned to two of the rural water corporations. The nature of the use by the major users which those two corporations supply is not required to be reported upon.

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

Water consumption	Number of customers 2007/08
Equal to or greater than 50 ML and less than 100 ML	160
Equal to or greater than 100 ML and less than 200 ML	75
Equal to or greater than 200 ML and less than 300 ML	28
Equal to or greater than 300 ML and less than 400 ML	17
Equal to or greater than 400 ML and less than 500 ML	6
Equal to or greater than 500 ML and less than 750 ML	13
Equal to or greater than 750 ML and less than 1,000 ML	4
Greater than 1,000 ML	13
Total customers	**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.

Some 1,850 waterMAP consumers reduced their consumption by 10 GL from 2006/07 to 2007/08.

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 195,600 rebates for urban water customers, saving almost two billion litres of potable water each year (to 30 June 2008).

New products have been incorporated and adjustments have been made to rebate amounts as the scheme has developed. While high pressure cleaning devices were removed in June 2006 from the list of products approved for rebate, Victorians were lodging claims for purchases of the devices made prior to the rebate ceasing.

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

Product	Rebates 2007/08	Rebates 2006/07
AAA shower rose	513	2,112
AAA shower rose[(1)]	345	N/A
Dual flush toilet	1,845	3,389
Greywater permanent tank system	790	704
High pressure cleaning device[(2)]	55	705
Hot water recirculator[(1)]	45	N/A
Rainwater tank to toilet system	172	399
Rainwater tanks	5,191	4,385
Water conservation audit[(3)]	5,446	822
Rebate when purchasing $100 worth of goods	14,554	19,847
Large tank rebates: 2000 - 4999 litres (connected to toilet or laundry)[(4)]	850	241
Large tank rebates: > 5000 litres (connected to toilet or laundry)[(4)]	749	172
Large tank rebates: > 5000 litres (connected to toilet and laundry)[(4)]	1,320	278
Total number of rebates	**31,875**	**33,054**

Notes:
(1) Rebate commenced 1 July 2007.
(2) Rebate finished June 2006.
(3) Rebate increase to $50 on 1 January 2007.
(4) Rebate commenced on 1 January 2007.

3.4.2 Urban residential water consumption

Over the past 11 years, as rainfall and the consequent availability of water resources across Victoria declined significantly, the state's urban water consumers have been targeted to achieve water savings.

Victoria's urban water consumption has reduced through this period through the implementation of urban water restrictions, behaviour change programs for industry and individuals, as well as the availability of government rebates for the installation of water saving and harvesting devices.

As the period of lower-than-average rainfall continues, Victorians are frequently reminded of the need to conserve water and have shown a significant willingness to do so.

Table 3-7 provides urban water consumption figures for the top 20 population centres within Victoria.

Total volumes of water consumed have been obtained from the 2007/2008 annual reports of water corporations while the average volumes of consumption have been calculated by the Department of Sustainability and Environment.

Presentation of the data in Table 3-7 is not intended to be comparative. Differences in the levels of water restrictions and climatic conditions experienced within different locations are two examples of factors which affect water consumption at a local level.

Continued publication of urban water consumption figures in the Victorian Water Accounts on an annual basis will facilitate the comparison of data across time in an effort to gauge changes in water consumption at a local level.

Furthermore, the inclusion over time of additional locations, once methodological issues are addressed, will assist Victorians in getting a better understanding of average consumption levels within their local area.

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

Table 3-7 Urban residential water consumption for the top 20 population centres in Victoria 2007/08

Location	Permanent population	Total residential consumption (ML)[1]	Average residential consumption (L) per capita per day	Total residential connections	Average residential consumption (L) per connection per day
Bachus Marsh	19,090	1,147	165	7,474	420
Bairnsdale	16,608	2,415	398	16,238	407
Ballarat and district[2]	99,719	5,193	143	42,611	334
Bendigo	82,684	5,293	175	35,908	404
Colac and district	14,709	1,859	346	6,233	817
Cowes and district	13,440	931	190	15,055	169
Echuca	12,891	1,208	257	5,707	580
Geelong[3]	252,390	16,242	176	67,526	659
Horsham	13,479	1,127	229	7,135	433
Melbourne	3,764,711	228,190	166	1,425,761	438
Melton	47,589	3,101	179	18,179	467
Mildura[4]	41,188	5,230	348	16,563	865
Moe/Newberry	22,409	1,688	206	10,364	446
Morwell/Traralgon & Surrounds[5]	41,246	4,539	301	23,284	534
Shepparton[6]	40,470	4,535	307	15,702	791
Sunbury/Macedon	61802	3,474	154	22,530	422
Wangaratta	19,591	1,739	243	7,575	629
Warragul/Drouin	19,164	1,640	234	10,034	448
Warrnambool[7]	27,983	2,228	218	12,473	489
Wodonga[8]	35,076	2,645	207	12,646	573

Notes:

(1) Totals appearing in this column are sourced where possible from 2007/08 Annual Reports for the relevant water corporations.

(2) Ballarat non-residential water consumption figures include concessional customers (not-for-profit and religious organisations).

(3) Geelong also includes Lara, Batesford, Waurn Ponds, Fyansford and adjoining semi-rural deveolpment, Leopold, Drysdale, Clifton Springs, Portarlington, Indented Head, St Leonards, Queenscliff, Point Londsale, Ocean Grove, Barwon Heads, Torquay, Jan Juc, Anglesea, Winchelsea and Birregurra. Geelong non residential water consumption does not include non-revenue water (unaccounted water).

(4) Mildura also includes Merbein and Irymple.

(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) Warrnambool residential connections include developed and undeveloped customers.

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

3.4.3 Schools Water Efficiency Program

Additional savings of potable water are also being achieved in the Victorian 2,200 primary and secondary schools connected to the reticulated water supply system. Operating since 2006, the Schools Water Efficiency Program 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 leaks.

At the end of 2007/08, some 1,067 schools had committed to join SWEP, 523 schools had completed audits to identify estimated water savings opportunities, and 492 had all works completed.

Water use records indicate that schools enrolled in SWEP have achieved an average reduction in water consumption of about 12.8% by the end of 2007/08.

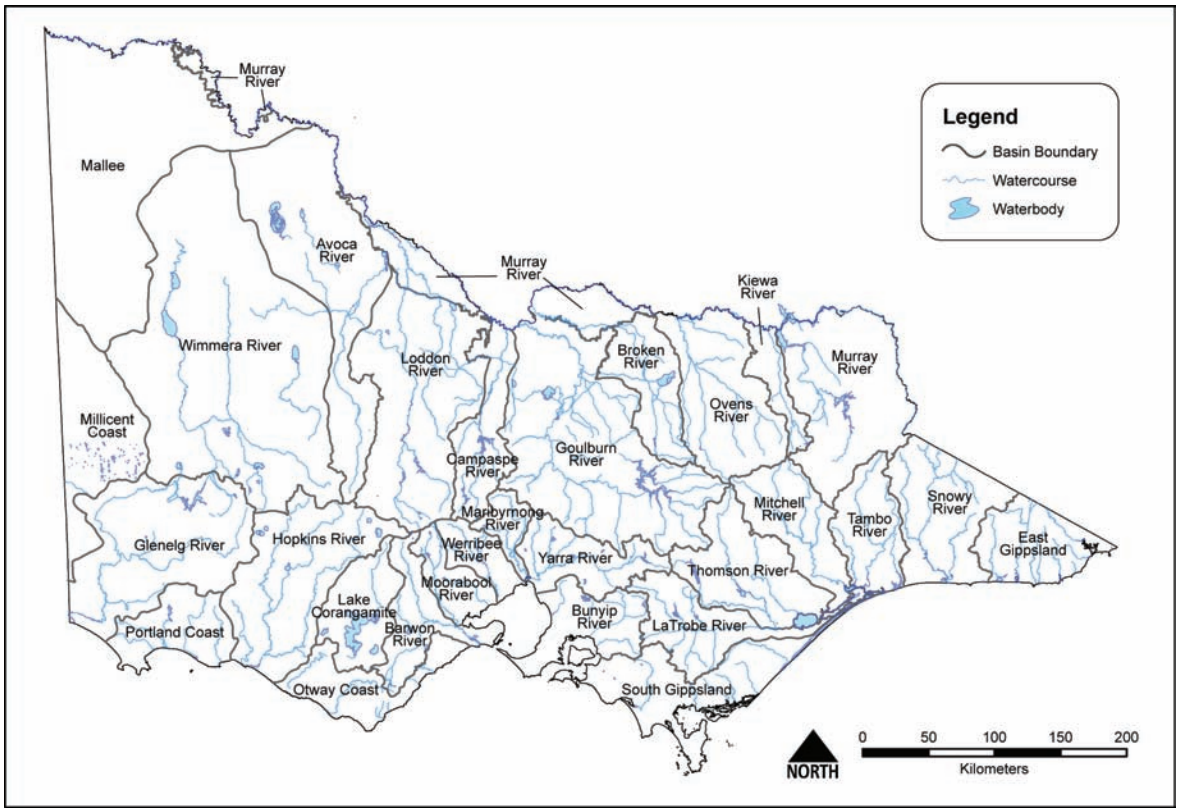
In May 2008 the Department of Education and Early Childhood Development mandated that all of Victoria's public schools participate in SWEP.

3.4.4 Stormwater and Urban Water Conservation Fund

In 2007/08, progress was made on the delivery of the 66 projects under the $10 million Stormwater and Urban Water Conservation Fund. Each project demonstrates the use of stormwater and recycled water and water conservation education programs across the state. Project funding has been provided to local government, water businesses, managers of recreational facilities and business and industry. The projects are expected to save in excess of two billion litres of potable water per year.

3.5 Surface water entitlement and use

Figure 3-3 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 3-3. 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 2007/08. 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 2007/08 was 38% of the entitlement volume. Water taken from basins such as the Campaspe, Loddon, Wimmera, Werribee and Maribyrnong was again well below average because water availability was severely limited.

Table 3-8 Volume allocated and taken under surface water entitlements in 2007/08

Basin	Bulk entitlements[1]			Unregulated river licensed diversions[1]			Small catchment 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	2,151,100	816,090	38%	29,090	14,600	50%	6,500
Kiewa	1,160	540	47%	18,590	17,000	91%	3,900
Ovens	58,510	19,150	33%	24,500	14,000	57%	15,900
Broken	48,590	11,720	24%	9,800	1,900	19%	15,800
Goulburn	2,140,240	713,780	33%	40,260	16,500	41%	47,500
Campaspe	140,090	15,480	11%	9,240	1,300	14%	28,800
Loddon	134,620	2,990	2%	27,950	13,800	49%	21,500
Avoca	380	100	26%	3,620	1,600	44%	12,700
Mallee	0	0	n/a	0	0	n/a	0
Wimmera	206,470	9,400	5%	2,490	1,800	72%	14,400
East Gippsland	620	200	32%	920	400	43%	1,100
Snowy	2,200	800	36%	3,930	910	23%	3,400
Tambo	3,650	50	1%	4,110	1,080	26%	3,900
Mitchell	5,900	4,690	79%	16,210	8,000	49%	4,500
Thomson	458,940	356,640	78%	13,820	5,780	42%	7,000
Latrobe	216,840	133,140	61%	18,070	8,450	47%	20,500
South Gippsland	15,620	8,510	54%	13,230	5,780	44%	24,300
Bunyip[5]	0	6,290	n/a	14,390	7,150	50%	15,500
Yarra	411,250	215,470	52%	45,560	12,520	27%	15,900
Maribyrnong	9,920	1,160	12%	2,020	500	25%	7,800
Werribee	36,190	3,280	9%	1,620	260	16%	9,300
Moorabool	43,100	6,280	15%	2,050	1,120	55%	22,200
Barwon	55,730	28,880	52%	4,410	1,970	45%	30,900
Corangamite	0	0	n/a	992	70	7%	12,300
Otway Coast	19,230	14,130	73%	11,600	2,250	19%	12,800
Hopkins	630	170	27%	9,070	1,880	21%	64,600
Portland Coast	0	0	n/a	2,070	80	4%	16,200
Glenelg[6]	5,000	2,310	46%	1,030	280	27%	55,500
Millicent Coast	0	0	n/a	100	100	100%	0
Total	**6,165,980**	**2,371,250**	**38%**	**330,742**	**141,080**	**43%**	**494,700**

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 2008. 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 harvested by small catchment dams, (i.e. for both domestic and stock and irrigation and commercial use) including water estimated as lost to evaporation. This is similar to the approach used in 2005/06, and is a change from the method used in 2006/07.

(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 and is therefore included only under the Wimmera basin for reporting purposes in this table.

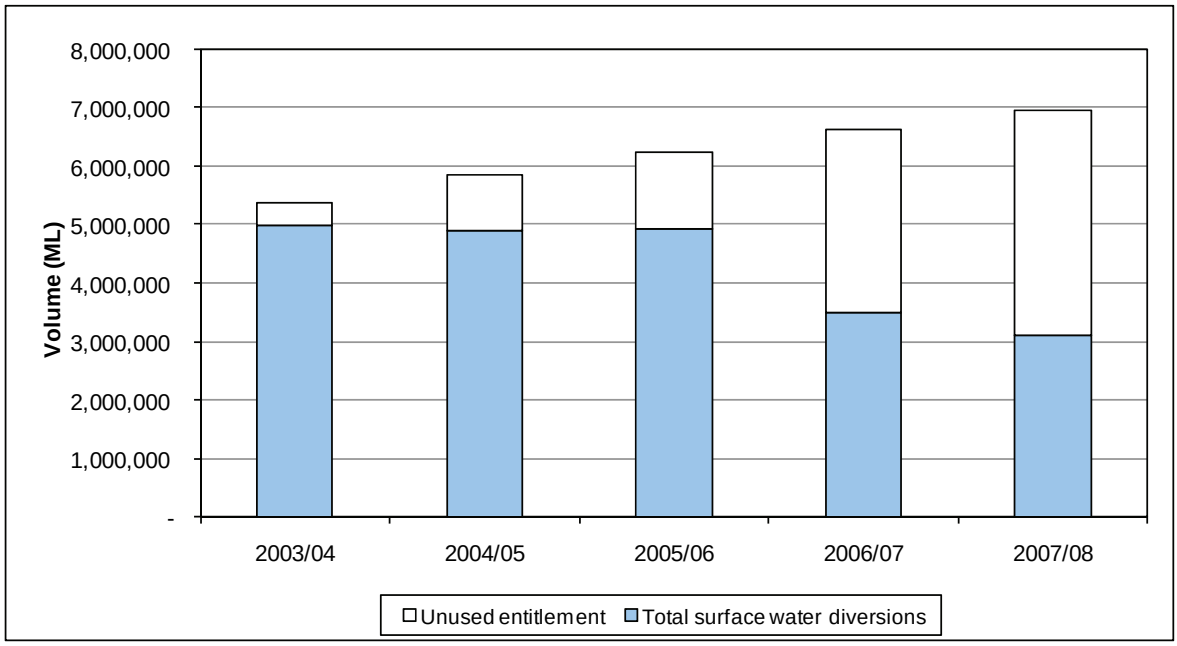
n/a: not applicable

Figure 3-4 shows the volume of water diverted under surface water entitlements, over the past five years. The volume of entitlements has grown each year for the reasons outlined in section 3.2. For the first three years, the volume diverted under these entitlements and licences 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.

In 2007/08, the ongoing drought further reduced water availability, resulting in reductions in irrigation allocations compared with 2006/07. While the severity of some urban restrictions were eased, widespread restrictions remained in place in 2007/08. In contrast, the number of unregulated streams with irrigation bans or other restrictions fell

compared to 2006/07 as a result of improved streamflow conditions in 2007/08. The total volume of water diverted in 2007/08, however, still declined from 2006/07.

Figure 3-4 Surface water entitlements and associated diversions



3.6 Groundwater use

In 2007/08, a number of changes were made to management area boundaries to better reflect the extent of groundwater systems. These changes are included in Table 3-9. Due to the low volume of extraction and low risk to the resource, Goorambat is no longer a GMA.

Table 3-9 Changes to groundwater management area boundaries

New GMA/WSPA	Former GMA/WSPA
Upper Ovens WSPA & Lower Ovens GMA	Murmungee GMA
Southern Campaspe Plains GMA	Ellesmere GMA
Mid Goulburn GMA	Kialla GMA & Nagambie GMA
	Goorambat GMA

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 management areas to cap groundwater extraction. Some 26 PCVs were declared for GMAs and WSPAs in 2006.

3.7 Statewide overview of groundwater use for 2007/08

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 2007/08 are presented in Appendix A. In summary:

- Total groundwater entitlement is approximately 950,000 ML across the state.
- The total groundwater use across the state, including domestic and stock, was approximately 464,420 ML, a decrease of approximately 11 percent from the volume used in 2006/07 (526,110 ML).
- In 2007/08 the total volume of licensed groundwater extracted from GMAs and WSPAs was approximately 370,900 ML (not including UAs). This includes metered use of 354,200 ML and estimated use of 16,700 ML. This is a decrease of 15% when compared with 2006/07 (437,700 ML). The decrease in extraction can be attributed to slightly wetter conditions in summer and the restrictions on groundwater use in some areas.
- Groundwater users in the Shepparton WSPA access groundwater from its shallow system where groundwater pumping is encouraged to combat rising groundwater levels and control salinity. Drought and climate change coupled with groundwater pumping has reduced the risk of rising groundwater levels. The volume extracted fell almost 20% in this area due to falling groundwater levels. Some users shandy it with surface water, however a lack of surface water supply means that this groundwater cannot be used.

- Domestic and stock use is estimated to account for approximately 11% of total groundwater use. This is higher than the estimated 9% of total use reported in 2006/07.
- The small rise in domestic and stock's share of total groundwater use is attributed to a rise in the number of domestic and stock bores across southern Victoria.
- In Victoria's GMAs, licensed groundwater entitlements totalled 211,900 ML with total use of 102,700 ML consisting of 86,900 ML of metered extractions and an estimated 15,800 ML of unmetered extractions. Estimated domestic and stock use in these areas was 20,000 ML.
- Licensed groundwater entitlements in WSPAs totalled 619,100 ML, with total use of 268,200 ML consisting of 267,300 ML of metered extractions and an estimated 900 ML of unmetered extractions. Estimated domestic and stock use in these areas was 25,700 ML.
- Estimated groundwater entitlement in the unincorporated areas was approximately 120,000 ML, with approximately 44,800 ML extracted. This is similar to 2006/07 where entitlement was approximately 114,000 ML and 46,500 ML was extracted.
- The total volume of groundwater extracted for urban use in 2007/08 was 25,000 ML, which is approximately 5.5% of the total groundwater extracted.
- Approximately 60 towns are reliant on groundwater as either a supplementary or primary water supply, which is consistent with 2006/07. The largest of these is Geelong with extraction of 12,605 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 is expected to be issued in 2008/09. Figure 3-5 shows the location of towns where groundwater is used for urban water supply.

Figure 3-5 Location of towns where groundwater is used for urban supply

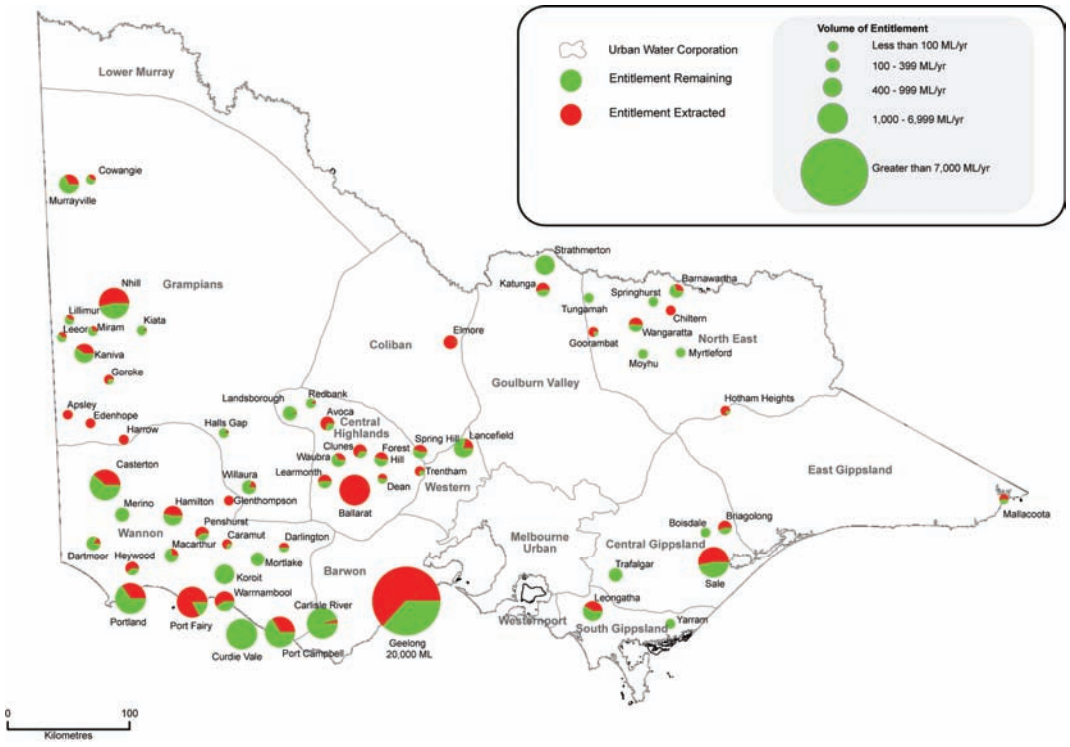
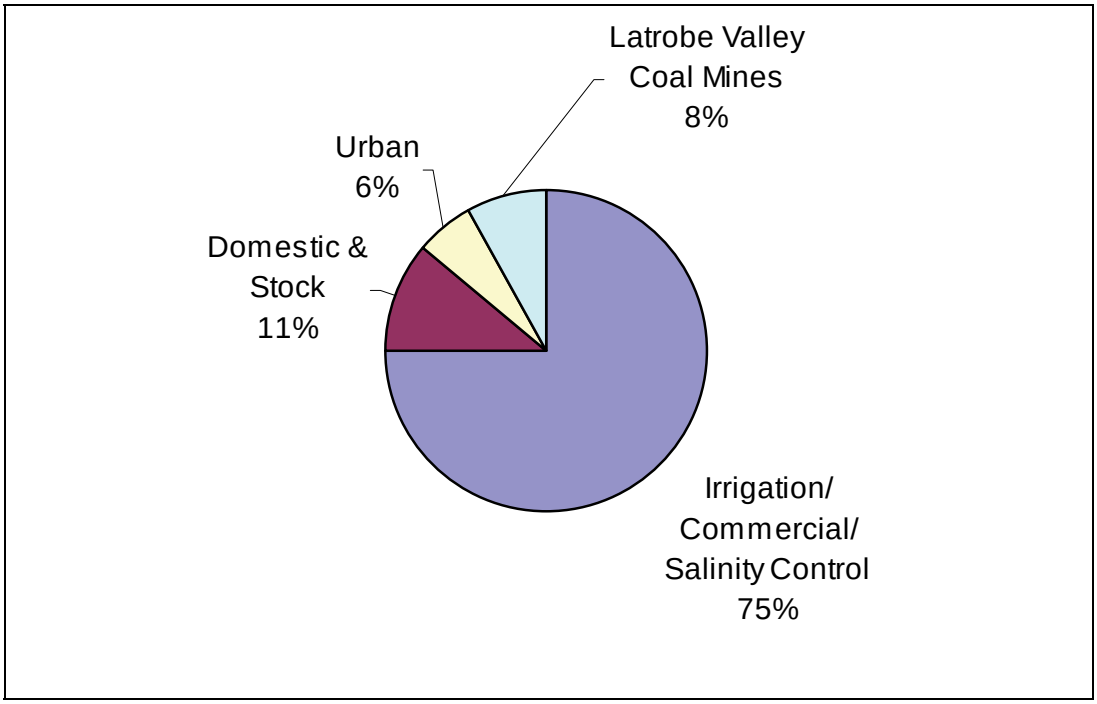


Figure 3-6 shows groundwater extraction by use in GMAs and WSPAs.

Figure 3-6 Groundwater extraction by use in GMAs and WSPAs



3.8 Water entitlement transfers

The water markets, where they exist, are the main mechanism by which irrigators and urban water businesses manage their water needs. The large number of irrigators and entitlement volumes in the Murray and Goulburn basins means the trades in these two basins account for approximately 90% of the transactions in the market. Other irrigation districts such as Macalister, Werribee and Bacchus Marsh have much smaller markets and comprise the majority of the balance.

Trade is generally more active in dry conditions and when seasonal allocations are low – this is when the 'scarcity' value of water increases. An exception to this is when seasonal allocations are exceptionally low, which means that the volume of water available to trade on the temporary market is lower and sometimes non-existent.

Due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007, transfer data for the 2007/08 year is difficult to compare to previous years. In these systems 'change of location of water shares' in previous years is comparable to 'permanent entitlement transfers', while 'temporary transfers' are now referred to as 'transfer of allocation'.

The volume of surface water entitlements transferred on a permanent or temporary basis in southern Victoria and the unregulated systems of northern Victoria is shown in Table 3-10. The volume of transferred entitlements (change of location of water shares) and allocations (transfer of allocation) in the regulated systems of northern Victoria is shown in Table 10-5. Note that the transfer information for unbundled entitlements includes some trades from unregulated systems.

In total, 1,300 ML of permanent water entitlements were traded in southern Victoria and the unregulated systems of northern Victoria in 2007/08 from 19 transactions, most of much were in the Murray Irrigation District. This does not include trades in unregulated systems of the unbundled northern basins.

Approximately 44,400 ML of water shares were traded in the unbundled northern basins, including permanent trades in a number of unregulated systems. Details on transactions for change of location of water shares were not available for 2007/08 due to changed reporting arrangements.

The temporary market is always more active than the permanent market and approximately 7,500 ML was temporarily exchanged in southern Victoria and the unregulated systems of northern Victoria in 2007/08 via 116 transactions. In the unbundled northern basins, 404,110 ML of allocation was transferred in over 20,000 transactions.

While 2007/08 trading figures are not directly comparable with 2006/07, a reduced volume of water shares (permanent entitlement) was transferred in 2007/08, while an increased volume of allocations (temporary entitlement) was transferred.

Table 3-10 Permanent and temporary trades in systems not yet unbundled, 2007/08

Basin	Permanent entitlement transfers				Temporary entitlement transfers			
	Bought (ML)	Sold (ML)	Number of trades	Net transfer to basin	Bought (ML)	Sold (ML)	Number of trades	Net transfer to basin
Avoca	0	0	0	0	0	0	0	0
Kiewa	0	0	0	0	740	740	10	0
Mallee	0	0	0	0	0	0	0	0
Wimmera	0	0	0	0	0	0	0	0
East Gippsland	0	0	0	0	0	0	0	0
Snowy	0	0	0	0	0	0	0	0
Tambo	0	0	0	0	0	0	0	0
Mitchell	0	0	0	0	0	0	0	0
Thomson	1,160	1,160	16	0	3,840	3,840	58	0
Latrobe	0	0	0	0	2,200	2,170	29	40
South Gippsland	0	0	0	0	0	0	0	0
Bunyip	0	0	0	0	0	0	0	0
Yarra	0	0	0	0	0	0	0	0
Maribyrnong	0	0	0	0	0	0	0	0
Werribee	140	140	3	0	700	700	28	0
Moorabool	0	0	0	0	750	750	1	0
Barwon	0	0	0	0	0	0	0	0
Corangamite	0	0	0	0	0	0	0	0
Otway Coast	0	0	0	0	0	0	0	0
Hopkins	0	0	0	0	0	0	0	0
Portland Coast	0	0	0	0	0	0	0	0
Glenelg	0	0	0	0	0	0	0	0
Millicent Coast	0	0	0	0	0	0	0	0
Total	**1,300**	**1,300**	**19**	**0**	**8,230**	**8,2000**	**126**	**40**
Unaccounted difference	n/a	n/a	n/a	0	n/a	n/a	n/a	40

n/a: not applicable.

Table 3-11 Transfer of unbundled entitlements, 2007/08[1]

Basin	Change of location of water shares (ML)[2]				Transfer of allocation (ML)[2]			
	Bought (ML)[3]	Sold (ML)[3]	Number of trans-actions[3]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of transactions	Net transfer to zone (ML)
Murray				15,430	266,400	170,190	10,540	96,210
Ovens				90	1950	1,990	40	-40
Broken				2	2840	5,620	330	-2,780
Goulburn				16,940	117,400	193,390	8,530	-75,990
Campaspe				940	1,160	1,620	130	-460
Loddon				11,030	14,360	19,330	750	-4,970
Total 2007/08	**0**	**0**	**0**	**44,432**	**404,110**	**392,140**	**20,320**	**11,970**
Total 2006/07	**0**	**0**	**0**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:

(1) Comparable transfer information not available for 2006/07.

(2) For the unregulated trading zones, change of location of water shares should be read as permanent entitlement transfer, and transfer of allocation should be read as temporary transfer of entitlement.

(3) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

Urban water businesses that participated in the water market in 2007/08 were Barwon Water, 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 13,000 ML of temporary water to irrigators from a number of its bulk entitlements in 37 different transactions. Coliban Water purchased over 8,000 ML of permanent water and 5,000 ML of temporary water. Details of trades are reported in the Victorian Water Accounts for each of the bulk entitlements held by water businesses.

Compared to 2006/07, trade in permanent licensed groundwater entitlements increased in 2007/08. In total, there were 28 transfers of permanent entitlements in groundwater totalling 3,400 ML, compared to 360 ML in 2006/07. Temporary trades in 2007/08 were similar to that of 2006/07 with 232 trades and 18,760 ML traded.

3.9 Recycled water

The volume of water recycled by Victoria's water businesses in 2007/08 increased to a total of 95,900 ML of wastewater recycled for use external to treatment plants. This represents approximately one quarter of the total volume available for reuse at the end of the wastewater treatment process. An additional 17,406 ML was recycled for use within the wastewater treatment process, which increases the proportion of recycled water to 29% 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.

An increase of 417 ML occurred in the total volume of water recycled for use from 2006/07 to 2007/08. The total volume of 389,550 ML of wastewater produced in 2007/08 was lower than the 392,093 ML produced in 2006/07.

In 2007/08, the volume of water recycled by the Eastern Treatment Plant was 7,881 ML, which was a reduction on the 10,424 ML recycled in 2006/07. 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 increased from 51,440 ML in 2006/07 to 56,778 ML in 2007/08. This increase is attributable to increased use of recycled water in the Werribee Irrigation District recycling scheme, with recycled water sold to irrigators under the scheme increasing to 12,814 ML in 2007/08, and beneficial allocation increasing to 15,930 ML. Recycled water used by Melbourne Water's Werribee Agricultural Group on pasture used for sheep and cattle farming within the Western Treatment Plant boundary decreased to 29,723 ML in 2007/08.

Including the treatment plants operated by the Melbourne metropolitan retailers, the volume of water recycled in Melbourne was 66,923 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 29%, or 29,022 ML, of the wastewater available for reuse. Although the volume of recycled water used in regional Victoria fell from 2006/07 (30,878 ML), this was due to lower overall water consumption and therefore less wastewater entering the treatment plants.

Table 3-12 Volume of wastewater recycled in 2007/08

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	8,182	3,776	46%	0	46%
Kiewa	256	91	36%	0	36%
Ovens	1,771	651	37%	0	37%
Broken	394	331	84%	0	84%
Goulburn	6,469	5,965	92%	0	92%
Campaspe	1,594	1,443	91%	0	91%
Loddon	6,544	2,389	37%	0	37%
Avoca	106	90	85%	0	85%
Mallee	n/a	n/a	n/a	n/a	n/a
Wimmera	1,379	1,379	100%	1	100%
East Gippsland	97	97	100%	0	100%
Snowy	268	268	100%	0	100%
Tambo	763	763	100%	0	100%
Mitchell	1,522	1,522	100%	0	100%
Thomson	496	454	91%	0	91%
Latrobe	22,279	710	3%	0	3%
South Gippsland	4,487	352	8%	5	8%
Bunyip	139,475	9,970	7%	13,924	17%
Yarra	9,073	562	6%	1,533	23%
Maribyrnong	2,337	1,191	51%	174	58%
Werribee	144,628	60,387	42%	270	42%
Moorabool	n/a	n/a	n/a	n/a	n/a
Barwon	25,033	1,349	5%	1,405	11%
Corangamite	1,946	255	13%	29	15%
Otway Coast	1,281	325	25%	58	30%
Hopkins	5,137	641	12%	8	13%
Portland Coast	2,897	129	4%	0	4%
Glenelg	1,102	823	75%	0	75%
Millicent Coast	35	35	100%	0	100%
Total 2007/08	**389,550**	**95,945**	**25%**	**17,406**	**29%**
Total 2006/07	**392,093**	**95,528**	**24%**	**15,978**	**28%**

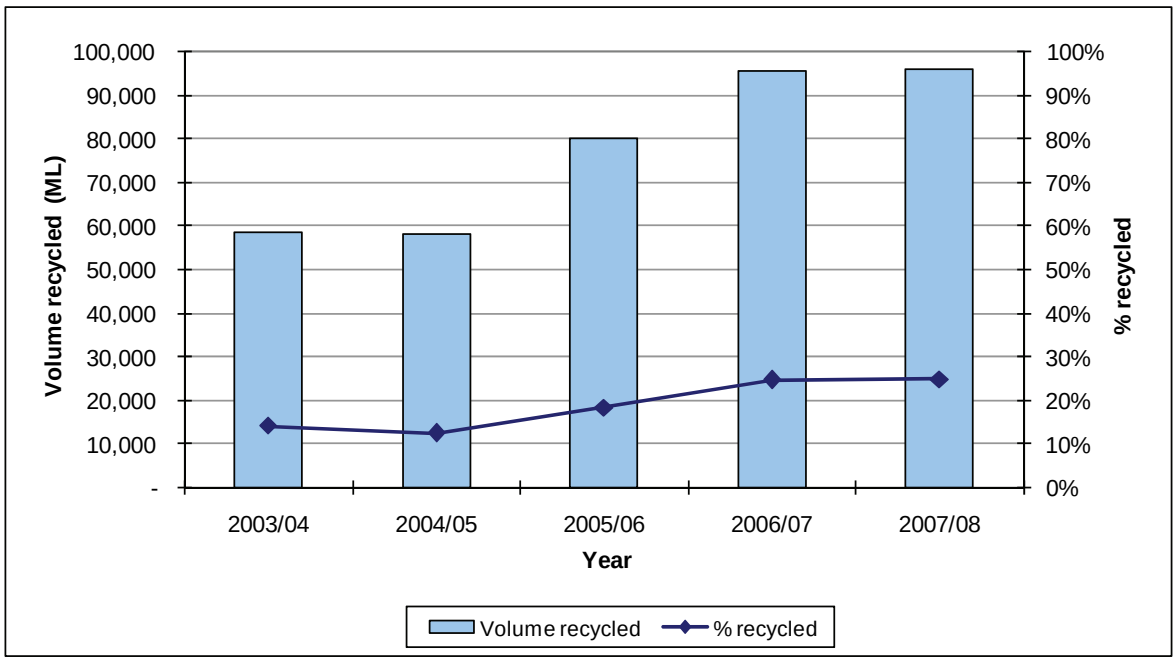
Notes:

(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 3-7 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 has grown substantially, as has the percentage recycled. As noted above, Melbourne recycled more than 66,000 ML in 2007/08 – three times the volume it recycled in 2003/04. Regional Victoria has continued to reuse around 30% of the wastewater it produces, which, depending on the volumes entering the treatment plants, has ranged from around 29,000 ML to 38,000 ML per annum.

Figure 3-7 Recycled water volume and percentage 2003/04 to 2007/08 (excluding recycled water used 'within process')



3.10 Conclusions

The ongoing drought has resulted in further reductions in water availability to most sectors, resulting in a reduction in the volume of water used. Diversions from streams under bulk entitlements fell by about 20% compared to 2006/07, storages were drawn down and seasonal irrigation allocations were lower.

In the past five years, the volume of entitlements has grown as an increasing number of bulk entitlements has been formalised. The volume of water taken from streams had remained relatively stable at around 5,000,000 ML each year from 2003/04 to 2005/06. In 2006/07, however, surface water diversions fell to 3,500,000 ML from entitlements totalling more than 6,400,000 ML. In 2007/08 surface water diversions reduced further to around 3,200,000 from entitlements of more than 6,800,000 ML.

Groundwater use across the state decreased by 11% in 2007/08 to 464,420 ML. This can generally be attributed to a slightly wetter year than 2006/07 and the restrictions placed on groundwater extraction in a number of management units.

Approximately 60 towns relied on groundwater as a primary or supplementary supply. The total volume of groundwater extracted for urban use in 2007/08 was 25,000 ML, an increase of 9% from 2006/07.

Faced with a reduction in inflows and declining storage levels, and the associated decrease in surface water diversions, water businesses and their customers have sought alternative sources of water to augment traditional surface water supplies.

Recycled water use has increased in recent years, particularly in Melbourne. Water businesses now recycle 37,400 ML more wastewater than they did three years ago. Regional Victoria recycled more than 29% of its wastewater and the Melbourne water businesses increased their reuse to 23%.

As water has become more scarce, water businesses and, to a larger extent, irrigation customers have sought to meet their water needs by trading water allocations on the water market (where water markets exist). Water trading activity has increased significantly since 2003/04. In the unbundled northern basins, approximately 44,400 ML of water shares were exchanged and 405,000 ML of seasonal allocations transferred in 2007/08. In southern Victoria and the unregulated systems of northern Victoria, 1,300 ML of water entitlements were permanently traded and approximately 7,500 ML temporarily exchanged.

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 and streams. In 2006/07 and 2007/08 the EWR in many rivers was 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.

4.2 Reporting on the EWR

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

- entitlements for the environment
- passing flow requirements
- streamflow 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.

4.3 Entitlements for the environment

Two new environmental entitlements were created in 2007/08: the Campaspe and Goulburn Living Murray environmental entitlements. The entitlements are designed to provide increased environmental flows along the River Murray, specifically to meet the ecological objectives of the Living Murray initiative which was developed by the Murray-Darling Basin Commission, now known as the Murray-Darling Basin Authority.

As set out in Table 4-1, of the entitlements in place for 2007/08, two were amended with an effective date of 1 July 2007:

- An amendment to the River Murray Flora and Fauna entitlement created an additional 100,412 ML of low reliability entitlement in the River Murray and Broken Creek systems. As with the newly created Campaspe and Goulburn environmental entitlements, this additional water is part of Victoria's Living Murray commitment. The amendment to the River Murray Flora and Fauna entitlement also revised the operating rules for the Barmah-Millewa Forest Environmental Water Allocation.
- The Loddon entitlement was similarly amended to add 2,105 ML of low reliability entitlement.

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 were created through water saving projects such as the decommissioning of Lake Mokoan and pipelining domestic and stock supply systems. Allocations under these entitlements are used by Victorian irrigators who would otherwise have received allocations from water diverted from the Snowy River. This water instead remains in the Snowy River to improve environmental flows. Over the longer term, this water will be shared with the Murray River, so that two thirds of the water stays in the Snowy system as environmental water and the remaining third goes to the Murray River.

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 Ministerial Council, 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 is deducted to account for loss of water through evaporation.

Table 4-1 lists the entitlements for the environment in place in 2007/08. Where relevant, the use of this water is described more fully in the separate basin chapters in Part 2.

Table 4-1 Entitlements for the environment in storage in 2007/08 (ML)

Entitlement	Entitlement at 30 June 2008 A	2007/08 allocation B	Allocation carried over from 2006/07 C	Total water available in 2007/08 B+C	Water used in 2007/08 D	Carried over to 2007/08 B+C-D
River Murray						
– Flora and Fauna	27,600	11,868	6,591.1	18459.1	10,432	8027
– Living Murray	100,412	0	0	0	0	0
Wimmera and **Glenelg** Rivers[(1)]	40,563	186	3,679	3865	8	3796
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	12,679	11,696	24,375	10,896	13,479
Thomson River	10,000		5,874			5,874
Loddon River						
- High reliability	2,000	100	0	100	100	0
- Low reliability	2,105	0	0	0	0	0
Yarra River	17,000	0	0	0	0	0
Goulburn River – Living Murray	141,046	0	0	0	0	0
Campaspe River – Living Murray	5,085	0	0	0	0	0

Note:

(1) The Wimmera and Glenelg Rivers entitlement actually operates on a November to October water year, however figures reported in the table are based on a July to June year.

4.4 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 townships which reached critically low levels of supply. Qualifications of rights, enacted by the Minister for Water, is the legal instrument through which such arrangements are made.

As part of the qualification of rights process 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 water supplies are secured through augmentation projects or inflows are sufficient to allow storages to recover.

In order to assist the securing of Melbourne's water supplies before the desalination plant is commissioned, the Minister for Water qualified rights in the Yarra and Thomson Rivers in October 2007 and December 2007 respectively. The qualification reduced environmental flows in the Yarra by up to 10 GL a year and the Thomson by up to 10 GL a 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.

The Minister for Water also qualified rights and reduced environmental flows to assist in securing urban water supplies in the following rivers: Wimmera River; Glenelg River; Loddon River; Goulburn River, Campaspe River, Coliban River, Creswick Creek, Tullaroop Creek, Moorabool River, Bass River, Tarwin River and Macalister River.

As well as these qualifications, an amendment to the Wannon Water Bulk Entitlement (Hamilton) Conversion Order 1997 redices passing flow requirements in Grampian headwork streams to secure Hamilton's drinking supplies during severe drought scenarios.

4.5 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 2007/08 and details are in the basin water accounts in Part 2 of this report.

Water businesses reported a number of actions were underway in 2007/08 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.

As discussed in Chapter 2, the Minister for Water acted to qualify rights in relation to passing flow requirements in seven basins during 2007/08. Qualifications included a reduction or elimination of the need to meet passing flow requirements.

4.6 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, it is important to note that 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 2007/08 the basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow were the Loddon (6%), Werribee (2%), Wimmera (0%), Avoca (0%) and Moorabool (3%). The Loddon, Werribee and Avoca basins also had less than 5% of water leaving the basin in 2006/07.

The proportion of annual flow leaving the basin was greater than 90% in 2007/08 in eight basins, down from nine basins in 2006/07. All were in the south of the state.

Across the state the proportion of total flow leaving the basins has reduced from the 67% in 2006/07 to 66% in 2007/08. However, in volumetric terms the amount of water leaving the basins increased by 54% from 4,747 GL in 2006/07 to 7,314 GL in 2007/08, reflecting substantially higher basin inflows.

Figure 4-1 Basin outflows 2003/04 to 2007/08

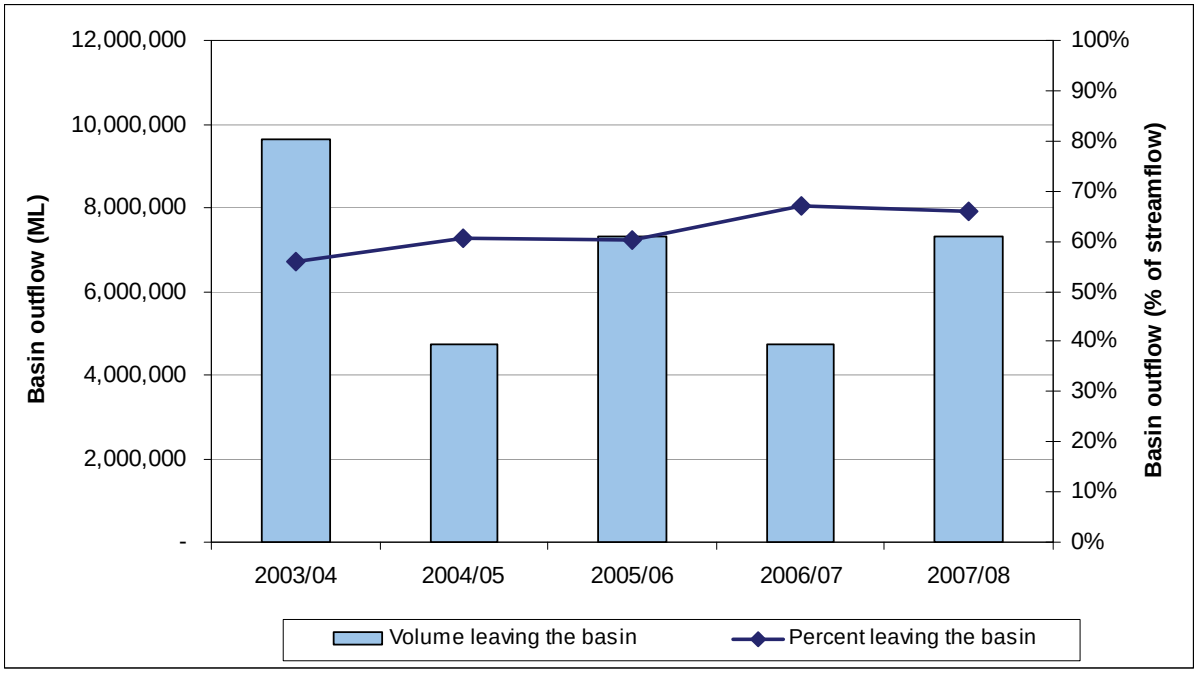


Table 4-2 Volume leaving the basin 2007/08

Basin	Outflow to	2007/08			2006/07	
		Streamflow if no extractions (ML)	Total volume leaving the basin (ML)	Proportion of total flow leaving the basin in 2007/08 (%)	Total volume leaving the basin (ML)	Proportion of total flow leaving the basin in 2006/07 (%)
Murray [1]	River Murray (South Australia)	1,632,800	404,500	13%	807,900	71%
Kiewa[2]	River Murray	325,100	292,800	90%	147,000	87%
Ovens	River Murray	589,700	525,900	89%	119,400	63%
Broken	River Murray	66,000	21,800	33%	28,100	39%
Goulburn	River Murray	1,260,800	230,200	18%	165,500	21%
Campaspe	River Murray	93,400	11,700	12%	4,300	12%
Loddon	River Murray	57,900	3,400	6%	2,800	7%
Avoca[6]	Lake Bael Bael and the Marshes	26,900	0	0%	0	0%
Mallee[3]	River Murray	not available	not available	not available	not available	not available
Wimmera[6]	Lakes Hindmarsh and Albacutya	25,700	100	0%	100	0%
East Gippsland	Bass Strait	466,700	464,900	100%	786,900	100%
Snowy (Vic. only)[4]	Bass Strait	893,900	888,100	99%	774,900	99%
Tambo	Gippsland Lakes	146,700	139,500	95%	108,800	94%
Mitchell	Gippsland Lakes	609,400	590,700	97%	335,700	95%
Thomson	Gippsland Lakes	1,188,000	927,600	78%	326,600	49%
Latrobe	Gippsland Lakes	575,200	426,700	74%	194,000	63%
South Gippsland	Bass Strait, Western Port	538,300	494,700	92%	147,200	77%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	398,300	372,600	94%	241,700	91%
Yarra[5]	Port Phillip Bay	386,900	153,100	40%	136,100	35%
Maribyrnong	Port Phillip Bay	25,900	11,000	42%	4,600	23%
Werribee	Port Phillip Bay	23,600	500	2%	900	6%
Moorabool	Port Phillip Bay	39,200	1,300	3%	3,400	14%
Barwon	Port Phillip Bay, Bass Strait	182,300	112,300	62%	31,700	38%
Corangamite[6]	Corangamite lakes	61,400	43,900	71%	2,300	20%
Otway Coast	Bass Strait	622,600	591,000	95%	264,700	89%
Hopkins	Bass Strait	210,400	117,900	56%	31,000	38%
Portland Coast	Bass Strait	315,400	297,400	94%	39,100	68%
Glenelg	Bass Strait	308,100	189,900	62%	42,200	30%
Millicent Coast[3]	South Australia	not available	not available	not available	not available	not available
Total		**11,070,600**	**7,313,500**	**59%**	**4,746,900**	**67%**

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) There are no significant streams in this basin.

(4) 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.

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

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

4.7 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 two SFMPs in effect in Victoria at the start of 2007/08, both of which are located in the Yarra basin. Four SFMPs were finalised during 2007/08 and 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 a SFMP is the declaration by the Minister 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. No additional WSPAs were declared in 2007/08 however preparatory work including technical studies were conducted in order to work towards the declaration of others.

In the future, compliance with each approved SFMP will be reported annually 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 2007/08
Kiewa	Preparatory work – technical studies
Ovens River above Myrtleford	Continuing work – technical studies The plan will be a combined surface water and groundwater management plan. Further investigation was carried out to confirm the scope of the plan.
Goulburn: King Parrot Creek Yea River Sevens Creek	 Continuing work Continuing work Preparatory work
Thomson: Avon River	 Continuing work
Latrobe (upper)	Preparatory work – technical studies
South Gippsland: Tarra River	 Preparatory work – technical studies
Yarra: Diamond Creek, Hoddles Creek, Plenty River Pauls/Steels/Dixons Creeks, Olinda Creek and Stringybark Creek Woori Yallock Creek and Little Yarra/Dons Creeks	 All approved and operational Continuing work
Maribyrnong (upper)	Preparatory work – technical studies
Barwon: Main stem and tributaries to the south including Leigh River, but excluding Moorabool River	 Preparatory work – technical studies
Otway Coast: Gellibrand River	 Preparatory work – technical studies
Hopkins: Merri River	 Preparatory work – technical studies
Upper Wimmera River	Preparatory work – technical studies

4.8 Donations

One way in which water can be provided to the EWR is through donations of water to the environment.

To date, donations have taken the form of temporary transfers. Under this approach seasonal allocations of water in declared systems may be transferred to the environment in order to alleviate environmental stress. In non-declared systems, licences or water rights may be transferred temporarily to achieve the same outcome. Temporary transfers typically occur towards the end of the irrigation system when the water holder is confident they will not need the water. From an environmental perspective temporary transfers can be very useful, however as they often occur towards the end of the irrigation season they can be difficult to plan for and hence the benefits may be limited.

Donated water may be provided to the environment through 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) this 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.

Four megalitres of water was donated to the environment in 2007/08. One megalitre was used to protect the iconic Eagle Tree, an ancient River Red Gum near Gunbower Forest of high value to the local community. Three megalitres was used on a small section of floodplain at Buxton Bend near Karadoc to prevent the loss of River Red Gum trees and to provide drought refuge for floodplain flora and fauna.

4.9 Interjurisdictional trade (Water from the Commonwealth)

The Commonwealth established a Commonwealth Environmental Water Holder (CEWH) under the *Water Act 2007* 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 Commonwealth completed its first round of water purchases in the southern Murray-Darling basin during 2007/08, resulting in almost 7 GL of high reliability water shares in Victoria. No water allocations were available for environmental watering until 2008/09.

While no water allocations were received by Victoria from the CEWH in 2007/08, some 6,000 ML was received from the Living Murray program. Some 2,000 ML was provided to Gunbower Forest and 4,000 ML was delivered to the Lindsay and Wallpolla islands complex.

4.10 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*). No trade occurred in environmental water in 2007/08 except internal trades between environmental allocation bank accounts to facilitate use in different trade zones.

4.11 Conclusion

The *Victorian Water Accounts 2007-2008* documents the second full year of the EWR in operation.

The ongoing drought has presented a number of challenges for the use of environmental water. As water availability continued to decline in 2007/08, managing the balance between the water needs of urban and rural consumers and the environment remained a critical issue.

The Minister for Water declared 21 qualifications of rights in 2007/08 to allow water, which under normal circumstances would be used for other purposes, to supply townships that reached critically low levels of supply. Of the 21 qualifications of rights declared in 2007/08, seven had the effect of reducing passing flow requirements or postponing releases of environmental water.

Low water availability in 2007/08 also resulted in a 33% reduction in environmental releases in 2007/08, compared to 2006/07. The volume of water released under environmental entitlements (excluding the Barmah/Millewa Forest Environmental Allocation) reduced from 46,359 ML in 2006/07 to 21,436 ML in 2007/08.

While basin outflows in 2007/08 were lower as a percentage of total inflows than in 2006/07, the total volume of water leaving the basins increased from 4,747 GL in 2006/07 to 7,314 GL in 2007/08. This volume was still significantly lower than outflows recorded during the 2003/04 to 2005/06 period.

Although no new WSPAs were declared in 2007/08, work continued on many SFMPs. Six SFMPs were in operation in 2007/08.

Part 2
Basin water accounts 2007/08

Part 2 presents an account of water in each of Victoria's 29 river basins during 2007/08.

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 2007/08
- 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

Basin	Chapter
Avoca	13
Barwon	28
Broken	9
Bunyip	23
Campaspe	11
Corangamite	29
East Gippsland	16
Glenelg	33
Goulburn	10
Hopkins	31
Kiewa	7
Latrobe	21
Loddon	12
Mallee	14
Maribyrnong	25
Millicent Coast	34
Mitchell	19
Moorabool	27
Murray	6
Otway Coast	30
Ovens	8
Portland Coast	32
Snowy	17
South Gippsland	22
Tambo	18
Thomson	20
Werribee	26
Wimmera	15
Yarra	24

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 needs of 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 2007 to 30 June 2008. The responsibilities for water management are reported in the Victorian Water Accounts as they existed during the 2007/08 period. Any changes to responsibilities since the end of June 2008 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 catchmentautom 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 2007-2008* 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 Commission (MDBC)
- water consumption and recycled water data collected from water businesses by the Essential Services Commission (ESC)
- 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 2006/07

This is the fifth year that the water accounts have been compiled. Water balance information for each basin in 2007/08 is presented alongside the values reported in 2006/07 for comparative purposes.

Differences between 2007/08 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 2006/07 data were

identified in preparing the 2007/08 data. In these cases, revised 2006/07 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 2006/07 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 terms in the water balance, any change to one of those terms 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 2007/08 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. Each aquifer is reported individually in the water accounts.

The concentration of bores and groundwater use varies considerably across groundwater management units (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. 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 7,581 ML of urban licensed volume. 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 9-7 includes the Goorambat GMA and 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% and Nagambie GMA, with 0.02% of their areas within the Goulburn basin, have not been included in Table 9-7, because it is lower than the 5% threshold. In this instance, the 1.1% and 0.02% 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. The 2007/08 water accounts also include PCVs declared in the government gazette listed on 3 July 2008 (although not technically within the reporting year). 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. A review of PCVs is currently underway in identified areas where the sum of licensed entitlements is greater than the PCV. This review is expected to be completed in the 2008/09 financial year.

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 is 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 number of domestic and stock bores in northern Victoria has decreased. The 2007/08 report only includes bores recorded in the Water Register, whereas previous years reported all bores in the Victorian groundwater management system.

The level of metering of groundwater resources is increasing. Generally, metering within WSPAs is approaching 100% of all significant users, 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 2007/08 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 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 and 2007/08 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 are generally obtained from annual reports prepared by the relevant water corporations.

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 right or licensed volume) and, should water be available, seasonal allocations are allowed to be greater than 100% of entitlement (sales water). 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 in diversion rate respectively
- 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 is 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

As in 2006/07, 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 2007/08, flows were generally higher than in 2006/07. Therefore the usage and impact of small catchment dams on inflows were assumed to be similar to that estimated for the 2005/06 year.

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.

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 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 web-site. 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 2008, compliance against that entitlement has not been assessed in the 2007/08 water accounts and will be presented in future water accounts.

5.9 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.

5.10 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.

5.11 Comparison of the water accounts with other data sources

The 2007/08 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

Despite being 43% higher than those experienced in 2006/07, inflows to the Murray basin in 2007/08 were again very low at 24% of the long term average.

Water levels in the basin struggled to recover after being drawn down significantly the previous year. This resulted in record low allocations and the need for water managers to focus on securing water supplies for essential domestic and stock needs.

Allocations began the year at 0% and increased to 43% - this was the first time Murray system entitlement holders had experienced such low allocations. Goulburn-Murray Water also 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 2008/09 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 while allocations were extremely low. As a result, all towns supplied from the regulated system were placed on Stage 4 restrictions, while domestic and stock customers only had access to water for essential needs. Urban water corporations were able to gradually ease restrictions over the year as allocations increased and more water became available on the market.

The water market, under which unbundled water entitlements were able to be traded for the first time, was again very active in 2007/08. While there was a net export of water shares from the basin, there was a net import of allocation.

For the second consecutive year, rural diverters on unregulated streams were placed on severe restrictions. Irrigation bans were placed on many streams for much of the year. Water resource managers agreed to enforce a uniform restriction policy across northern Victoria at the beginning of the season and subsequently placed all towns supplied by unregulated systems on Stage 3 or Stage 4 restrictions. Depending on the local conditions, restrictions were able to be eased gradually throughout the year as water availability improved.

Groundwater users in parts of the Katunga water supply protection area were restricted to 70% of licence volume, however total groundwater use in the basin only reduced slightly compared to 2006/07.

At the end of the year, the volume of water available to Victoria in the Murray basin was almost double that at the start. This can be attributed to low demands (water use was down 45% from 2006/07) as a result of low allocations, a shortened irrigation season and individuals having the capacity to carry their allocations over to manage the risk of low water availability in 2008/09.

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 2007/08. 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), 2007/08

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Murray-Darling Basin Authority (1)				Jointly co-ordinates waterway management along the River Murray
River Murray Water				Operates the River Murray supply system
Department of Sustainability and Environment				Co-ordinates 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 2007/08

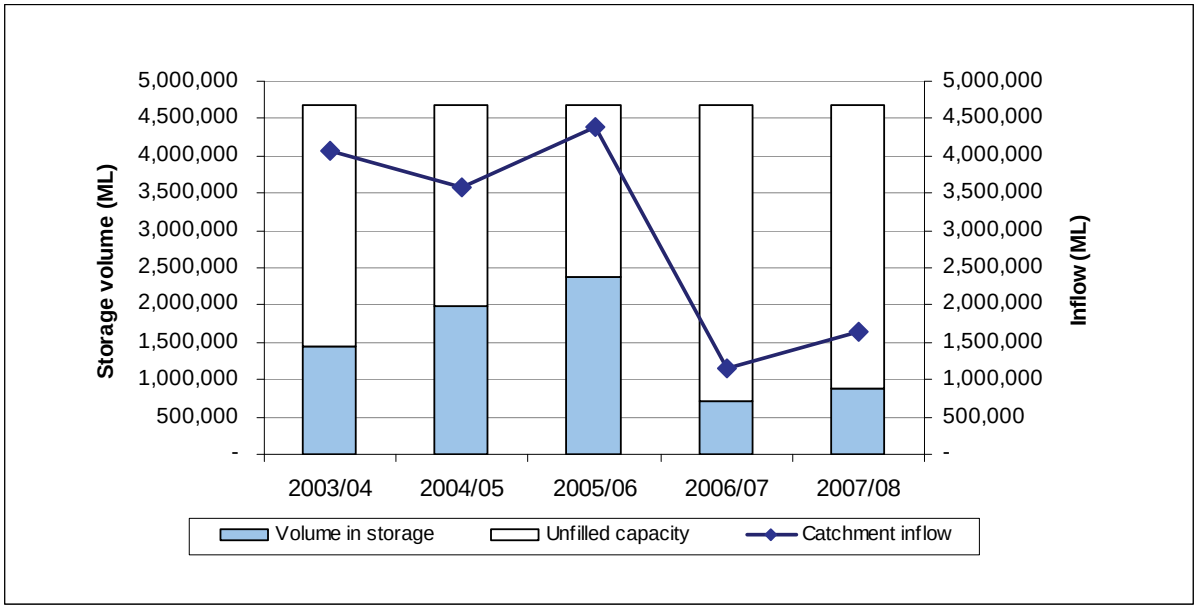
In 2007/08, rainfall in the Murray basin was generally between 60% and 80% of the long-term average. Although catchment inflows were again low at 23% of the long term average (of 7,000,000 ML), they were 43% higher than the record low inflows (16% of long term average) experienced in 2006/07.

The Victorian component of water flowing from the Murray basin to South Australia was 404,500 ML in 2007/08. This represents 25% of the total inflows into the basin, compared with 71% in 2006/07. The Victorian component released to South Australia in 2006/07 was 807,900 ML.

The volume of water held in major storages (greater than 1,000 ML capacity) in the Murray basin increased from 715,200 ML at the start of the year to 893,700 ML, or 19% of the storage capacity, by the end of the year. In the Murray basin this usually includes Victoria's share of Lake Hume, Lake Dartmouth, Lake Cullulleraine, Lake Victoria and the Menindee Lakes, however Victoria was unable to access any storage from the Menindee as storage levels were insufficient in 2007/08, as they were in 2006/07. The increased volume in storage resulted from low allocations, and hence consumption volumes, and carry-over of allocations.

Only volumes for major on-stream storages have been included in the water balance. The total volume in major on-stream storages increased by 177,400 ML in 2007/08 to 892,600 ML.

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), 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	1,680,100	837,200
Groundwater[2]	117,000	51,200
Recycled water	8,180	3,780

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 6-8 and the estimated domestic and stock use as presented in Table 6-9. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

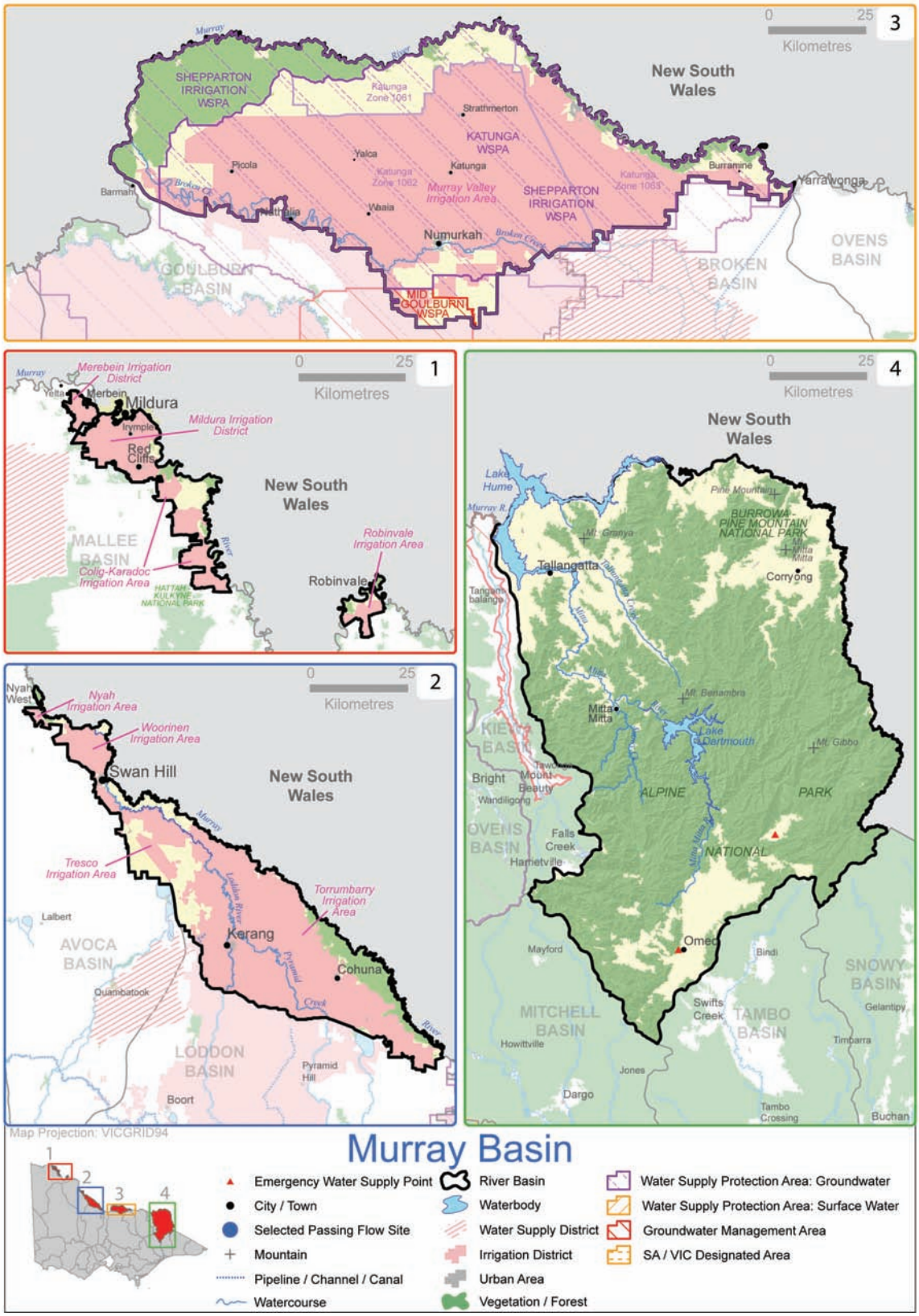
6.4.1 Infrastructure projects to improve water availability

One major infrastructure project was completed in the Murray basin during 2007/08. North East Water finished constructing a 45 kilometre pipeline from Yarrawonga to Devenish in December 2007 to improve the security of supply for the townships of Tungamah, St James and Devenish. The pipeline now supplies these townships, located in the Broken basin, from the Murray system.

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	2007/08 (ML)[1]	2006/07 (ML)[1]
Major on-stream storage		
Volume in storage at start of year	715,200	2,376,400
Volume in storage at end of year	892,600	715,200
Change in storage	**177,400**	**-1,661,200**
Inflows		
Catchment inflow[2]	1,632,800	1,140,900
Spills from NSW share of storage	0	0
Return flow from irrigation	44,200	65,100
Treated wastewater discharged back to river	3,110	3,070
Sub-total	**1,680,100**	**1,209,100**
Usage		
Urban diversions	27,090	38,170
Irrigation district diversions	543,200	1,150,700
Licensed diversions from regulated streams	235,400	252,600
Licensed diversions from unregulated streams	14,600	21,300
Environmental water diversions	10,400	19,300
Small catchment dams	6,500	6,500
Sub-total	**837,200**	**1,488,600**
Losses		
Net evaporation losses from major storages	129,400	162,200
Evaporation from small catchment dams [3]	1,100	800
In-stream infiltration to groundwater, flows to floodplain and evaporation[4][5]	35,200	354,200
Sub-total	**165,700**	**517,200**
Water passed at outlet of basin		
River Murray flow to South Australia from Victoria's allocation	404,500	807,900
Spills to NSW share of storages	0	0
Ceding to NSW storages per Murray-Darling Basin Agreement	95,300	56,600

Notes:

(1) The volumes in this table may not be consistent with the MDBC'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 'instream losses' component is a balancing item which is affected by errors in all other components and it appears too low, however the numbers are based on the best possible information at the time of finalising the *Victorian Water Accounts 2007-2008*.

6.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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

Water entitlement transfers in the Murray basin include transfers within the basin, transfers to other basins within Victoria and interstate transfers.

A summary of New South Wales and South Australian entitlements transferred into and out of the Murray basin is shown in Table 6-5 (where a negative value represents water being traded into Victoria), while a summary of Victorian entitlements traded within the Murray basin is shown in Table 6-6. Due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007, transfer data for the 2006/07 year is difficult to compare to 2007/08. In these systems, permanent entitlement transfers are comparable to change of location of water shares, while temporary transfers are now referred to as transfer of allocation. Because entitlements in unregulated systems have not been unbundled, the old terminology still applies in these systems.

Overall, a net export of water shares from the basin was due to the large volume of water shares transferred from irrigation areas to the non-water user category. For allocation trades, there was a net import of water into the basin during 2007/08.

Table 6-5 Interstate transfer of entitlements in the Murray basin (Victoria)

Transfer type	Net transfer to NSW (ML)	Net transfer to SA (ML)	Net transfer to interstate (ML)
Change of location of high reliability water shares[1]	n/a	n/a	n/a
Change of location of low reliability water shares	n/a	n/a	n/a
Transfer of allocation	-56,906	45,395	-11,511

Notes:

(1) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling.

n/a: Information not available.

Table 6-6 Transfer of entitlements in the Murray basin (Victoria)

Trading zone	Change of location of water shares[1]					Transfer of allocation[1]			
	Reliability	Bought (ML)[2]	Sold (ML)[2]	Number of trans-actions[2]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
6 VIC Murray - Barmah to SA [3]	High				-7,461	32,754	44,054	2,015	-11,300
	Low				121				
7 VIC Murray - Dart to Barmah[4]	High				-11,109	233,569	126,059	8,523	107,510
	Low				-3,261				
160 Upper Murray Unregulated	Licence volume					73	73	3	0
Total 2007/08					**-21,710**	**266,396**	**170,186**	**10,541**	**96,210**
Total 2006/07[5]					**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:

(1) The volumes in this table may not be consistent with the MDBC'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. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

(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 'instream losses' component is a balancing item which is affected by errors in all other components and it appears too low, however the numbers are based on the best possible information at the time of finalising the *Victorian Water Accounts 2007-2008*.

6.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 6-7.

The total volume diverted in 2007/08 was considerably less than in 2006/07 due to low allocations. Irrigation diversions under River Murray bulk entitlements received an allocation of 43% compared to 95% in 2006/07.

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 6-7 if water use is not more than the maximum volume allowed to be diverted in 2007/08.

Table 6-7 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[1]
East Gippsland Water					
Omeo[2]	n/a	n/a	0	55	n/a
Coliban Water					
River Murray	1	6,285	12	3,393	Yes
Goulburn Valley Water					
River Murray	1	5,593	0	3,798	Yes
North East Water					
Bundalong	1	51	0	15	Yes
Corryong	1	680	0	293	Yes
Cudgewa	1	29	0	0	Yes
Dartmouth	1	60	0	23	Yes
Walwa	1	61	0	23	Yes
River Murray	1	12,794	1,739	6,849	Yes
GWMWater					
River Murray	1	3,492	1,373	2,526	Yes
Goulburn-Murray Water					
River Murray	1	1,532,247	0	456,521	Yes
Lower Murray Water					
River Murray – (former) Lower Murray Water	1	31,637	0	12,644	Yes
River Murray – (former) Sunraysia Water	1	445,812	0	277,011	Yes
River Murray – (former) FMIT	1	77,700	0	35,867	Yes
Environment Minister					
River Murray – Flora and Fauna	1	27,600	0	10,432	Yes
River Murray – Snowy Environmental Reserve	1	6,988	0	6,639	n/a
Total annual volume of bulk entitlements 2007/08		**2,151,105**	**3,124**	**816,088**	
Total annual volume of bulk entitlements 2006/07		**2,114,137**	**-35,789**	**1,460,780**	
Licensed diversions from unregulated streams 2007/08[3]		*29,086*		*14,600*	
Licensed diversions from unregulated streams 2006/07		*27,912*		*21,300*	

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 MDBC's Water Audit Monitoring Report 2007/08.

(2) Bulk Entitlement (Omeo) Conversion Order 2008 was finalised in June 2008.

(3) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

n/a: Not applicable.

6.7 Groundwater resources

Licensed groundwater entitlements and use within the Murray basin is presented for 2007/08 in Table 6-8. 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 2007/08 compared with 2006/07, predominantly due to a reduction in 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, dropping groundwater levels in 2007/08 resulted in many licensed groundwater users not having access to as much water. Furthermore, some groundwater from the Shepparton WSPA requires shandying with surface water to improve water quality and, as less surface water was available, less groundwater was extracted.

Extractions from the Katunga WSPA were restricted to a 70% allocation during 2007/08.

Table 6-8 Licensed groundwater volumes, Murray basin (Victoria) 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Katunga WSPA (80%)	>25	48,092	47,930	24,014	0	24,014	24,779
Shepparton WSPA (31%)	≤25	68,401	68,401	26,533	0	26,533	33,783
Total[5]		**116,493**	**116,331**	**50,547**	**0**	**50,547**	**58,562**

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 6-9.

Table 6-9 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Katunga WSPA (80%)	185	370
Shepparton WSPA (31%)	161	322
Total	**346**	**692**

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 6-8.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The number of bores is less than those reported in 2006/07 which included bores from the state groundwater management system and other unregistered domestic and stock bores.

(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 6-10. Groundwater use for the towns of Dinner Plain, Katunga and Strathmerton was slightly higher in 2007/08 compared with 2006/07. In 2006/07 the groundwater consumption for the town of Barnawartha was included in Murray basin groundwater consumption. Since Barnawartha is located in the Ovens basin, its groundwater usage has been reported as part of the Ovens basin reporting in 2007/08.

Table 6-10 Urban groundwater usage

Town supplied[1]	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Dinner Plain	60	48	35
Katunga	110	60	49
Strathmerton	730	0	0
Total	**900**	**108**	**84**

Notes:

(1) Barnawartha groundwater use has been previously reported within the Murray basin in previous Victorian Water Accounts. A review of the basin boundaries indicated that the extractions for Barnawarth are located in the Ovens basin.

6.8 Drought contingency measures

A range of drought contingency measures was implemented in the Murray basin in 2007/08, including restricting urban and rural water use (discussed in section 6.9) and a temporary qualification of rights. Details of the qualification is presented in Table 6-11 below.

Table 6-11 Qualifications of rights

Qualification type	Qualification description
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%. Dates: 1 July 2007 to 30 June 2008
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%. Dates: 1 July 2007 to 30 June 2008
Volume carried over from 2006/07	Qualified the right to carry over a maximum of 30% of entitlement volume (less 5% losses) from 2006/07 under the bulk entitlements held by Goulburn-Murray Water, Lower Murray Water, GWMWater, Coliban Water, Goulburn Valley Water, North East Water and the Environment Minister in the River Murray system. Dates: 1 July 2007 to 30 June 2008

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 6-12.

Table 6-12 Seasonal allocations and restrictions on water use in Murray basin (Victoria), 2007/08

Type of restriction	Area	Nature of restriction
Urban	Cohuna, Gunbower and Leitchville	Stage 4 restrictions from July to January 2007, and Stage 3 from January to June 2008
	Picola, Nathalia and Numurkah	Stage 4 restrictions from July to November 2007, Stage 1 from December 2007 to June 2008
	Katunga	Stage 1 restrictions from July 2007 to June 2008
	Barmah, Cobram and Strathmerton	Stage 4 restrictions from July to November 2007, Stage 1 from December 2007 to June 2008
	GWMWater customers serviced by the Northern Mallee Pipeline (including Ouyen, Patchewollock, and Walpeup)	Stage 4 restrictions from July 2007 to June 2008
	Lower Murray Water customers (including Kerang, Mildura and Swan Hill)	Stage 4 restrictions from July to December 2007 and Stage 3 from January to June 2008
	Cudgewa and Corryong	Stage 3 restrictions from July to August 2007, Stage 2 from September to December 2007 and Stage 1 from January to February 2008
	Dartmouth	Stage 3 restrictions from July to August 2007, Stage 2 from September to December 2007 and Stage 1 from January to February 2008
	Walwa	Stage 3 restrictions from July to August 2007, Stage 1 from September 2007 to April 2008.
	Bellbridge, Ebden and Tallangatta	Stage 4 restrictions from July to December 2007, Stage 3 from January to April 2008, Stage 2 from May to June 2008
Licensed diversions from unregulated streams	Sandy Creek	Irrigation ban in July 2007
	Snowy Creek	Irrigation ban from July 2007 to September 2007
	Little Scrubby Creek	Irrigation ban in July 2007 and from February 2008 to June 2008
	Little Snowy Creek, Back Creek	Irrigation ban in July and August 2007, Stage 3 restrictions introduced in September 2007, increased to Stage 4 restrictions in February 2008 and continued to June 2008
	Lockharts Creek, Livingstone Creek, Mitta Mitta tributaries	Irrigation ban from July 2007 to June 2008
	Sheepwash Creek (tributary of Ulupna Creek)	Stage 3 restrictions from July 2007 to June 2008
	Murray (below Hume) tributaries, Upper Murray (above Hume) tributaries, Indigo Creek, Black Dog Creek (upper)	Irrigation ban from July 2007 to June 2008
	Tallangatta Creek	Stage 2 restrictions from October 2007 to January 2008, an irrigation ban in February, Stage 2 restrictions in March 2008, an irrigation ban from April 2008, Stage 4 restrictions in May and June 2008
	Scrubby Creek	Irrigation ban from July to September 2007, Stage 3 restrictions from October 2007 to January 2008, and an irrigation ban again from February to June 2008
	Cudgewa Creek (Upper Murray)	Stage 2 restrictions from October 2007, increased in February 2008 to Stage 4 restrictions and continued to June 2008
	Waterfall Creek	Irrigation ban from February to June 2008
	Indi River (upper Murray)	Stage 1 restrictions from February to May 2008
	Nariel Creek	Stage 4 restrictions introduced in February 2008, reduced to Stage 2 restrictions from March 2008 and continued to May 2008
Irrigation	Murray system (gravity and pumped)	Allocation began the year a 0% of entitlement, increasing to 43% by April 2008 A 'bridging' allocation of 5% was announced on 15 August to enable the delivery of some water at the beginning of the irrigation season From 1 April 2008, all water resource improvements in the Murray system were directed to building supplies for the 2008/09 season
Groundwater	Katunga WSPA	Allocation restricted to 70%

6.10 Recycled water

Around 46% of the volume of wastewater passing through treatment plants in the basin was recycled for consumptive use (Table 6-13), mostly for agricultural purposes. This is approximately equal to the proportion recycled in 2006/07, however lower water consumption reduced total quantities of both production volume and recycling volume.

Table 6-13 Volume of recycled water

Treatment plant[1]	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)[4]
				Urban & industrial	Agriculture	Beneficial allocation[2]	Within process[3]		
Bellbridge	13	13	100%	0	13	0	0	0	0
Bundalong	0	0	0%	0	0	0	0	0	0
Cobram	314	314	100%	0	314	0	0	0	0
Cohuna	0	0	0%	0	0	0	0	0	0
Corryong	137	137	100%	0	137	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	16	16	100%	0	16	0	0	0	0
Koorlong	1,140	1,140	100%	0	1,140	0	0	0	0
Lake Boga	24	0	0%	0	0	0	0	0	24
Merbein	0	0	0%	0	0	0	0	0	0
Mildura	1,166	1,166	100%	0	1,166	0	0	0	0
Nathalia	63	63	100%	0	63	0	0	0	0
Numurkah	39	39	100%	0	39	0	0	0	0
Nyah/Nyah West	35	0	0%	0	0	0	0	0	35
Omeo	33	33	100%	0	33	0	0	0	0
Red Cliffs	103	103	100%	103	0	0	0	0	0
Robinvale	178	178	100%	0	178	0	0	0	0
Strathmerton	0	0	0%	0	0	0	0	0	0
Swan Hill	1,232	0	0%	0	0	0	0	0	1,232
Tallangatta	66	66	100%	0	66	0	0	0	0
Wodonga	3,338	223	7%	223	0	0	0	3,115	0
Yarrawonga	285	285	100%	0	285	0	0	0	0
Total 2007/08	**8,182**	**3,776**	**46%**	**326**	**3,450**	**0**	**0**	**3,115**	**1,291**
Total 2006/07	**8,738**	**4,320**	**49%**	**308**	**4,012**	**0**	**0**	**3,074**	**1,344**

Notes:

(1) Water recycled at the Echuca treatment plant was reported in the 2007/08 Victorian Water Accounts within the Murray basin, however reassessment of the basin boundaries indicated that the Echuca plant is located in the Campapse basin.

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

(3) 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.

(4) 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 and Kerang Wetlands are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention. These sites rely on the freshwater inputs from the River Murray to ecologically function.

In 2007/08 the Murray basin (Victoria) EWR comprised the following components:

- the River Murray Flora and Fauna bulk entitlement of 27,600 ML held by the Environment Minister
- the Barmah-Millewa Forest Environmental Water Allocation (EWA)
- 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 2007/08 comprised the following:

- the River Murray Flora and Fauna bulk entitlement of 27,600 ML held by the Environment Minister. In 2007/08, some 10,432 ML was released under this bulk entitlement, which was less than the 19,200 ML released in 2006/07 and substantially less than the 61,100 ML released in 2005/06
- the Goulburn River Living Murray environmental entitlement
- the EWA for watering the Barmah-Millewa Forest.

6.11.3 Passing flow compliance

North East Water reported that it met all passing flow requirements under its bulk entitlements in 2007/08

Table 6-14 shows selected passing flow compliance for the River Murray Flora and Fauna bulk entitlement.

Table 6-14 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 2007/08 exceeded those of 2006/07, however they were still less than half the long term average. Volumes passed from the Kiewa to the River Murray almost doubled those passed in 2006/07.

For the second year in a row, licensed diverters on tributaries of the Kiewa River were severely restricted due to low river flows. Towns supplied from the basin were subject to Stage 3 restrictions at the start of the year in line with the uniform restriction policy applied across northern Victoria. These were gradually eased as the year progressed and by September 2007 were generally at or below stage 1. Wodonga, the largest town in the Kiewa basin, is supplied from the Murray basin and was subject to severe restrictions for nearly half the year.

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, 2007/08

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 2007/08

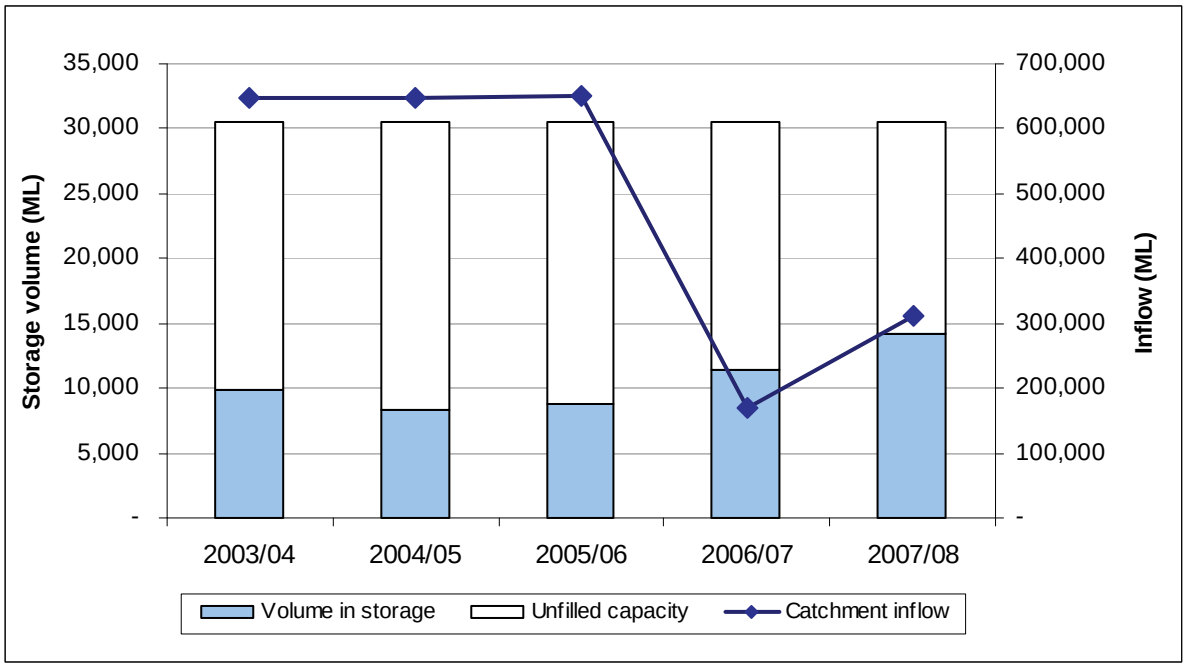
In 2007/08, rainfall in the Kiewa basin ranged between 60% and 100% of the long term average. Catchment inflows were 48% of the long term average (of 679,000 ML). Figure 7-1 illustrates the decline in inflows to the basin over recent years.

The volume of water flowing from the Kiewa basin into the River Murray was 292,800 ML in 2007/08 (including the New South Wales share of Kiewa River flows under the Murray-Darling Basin Agreement). This volume was almost double the 2006/07 ouflow volume of 147,000 ML, however is still considerably lower than the outflows in 2005/06 and 2006/07 (637,800 ML and 635,300 ML respectively). The volume of water flowing from the Kiewa basin into the River Murray in 2007/08 represented 90% of the total inflows into the basin, compared with 87% in 2006/07.

Although inflows were low, storage levels for major storages (greater than 1,000 ML capacity) in the Kiewa basin increased by 24% during 2007/08 to 14,200 ML.

Only volumes for major on-stream storages have been included in the water balance. The volume of water in the two major on-stream storages in the basin, Rocky Valley and Lake Guy, increased from 10,800 ML at the start of July 2007 to 13,500 ML by June 2008.

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 (7%) 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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	325,400	21,400
Groundwater [2]	1,600	1,000
Recycled water	260	90

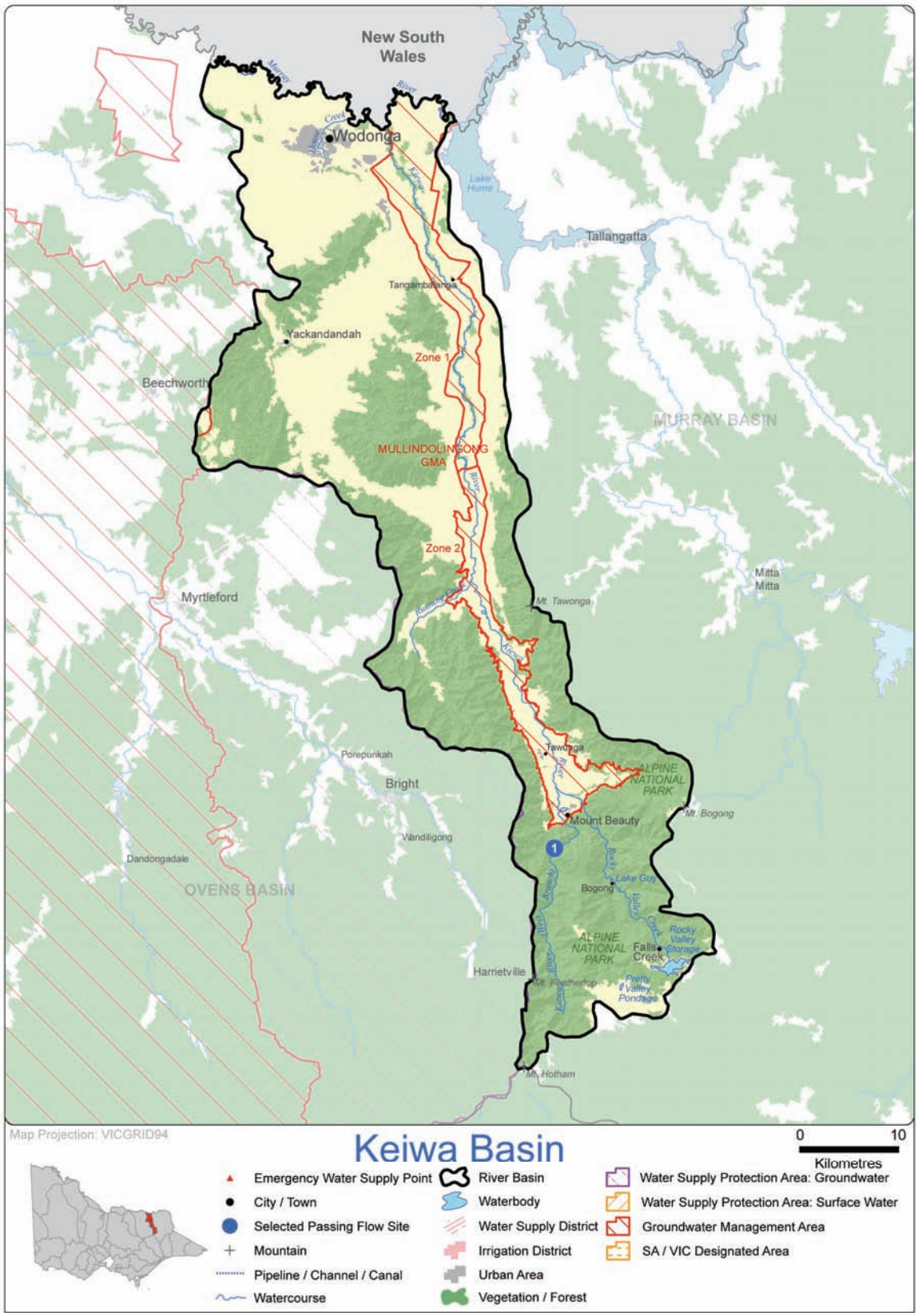
Note:

(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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

7.5 Location of water resources

Figure 7-2 Map of the Kiewa basin



Surface water resources

7.5.1 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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	10,800	8,300
Volume in storage at end of year	13,500	10,800
Change in storage	**2,700**	**2,500**
Inflows		
Catchment inflow (1)	325,100	169,800
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	300	150
Sub-total	**325,400**	**170,000**
Usage		
Urban diversions	540	690
Licensed diversions from unregulated streams	17,000	5,500
Small catchment dams	3,900	3,900
Sub-total	**21,400**	**10,100**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams (2)	1,100	2,900
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	7,400	7,400
Sub-total	**8,500**	**10,300**
Water passed at outlet of basin		
Kiewa basin outflow to River Murray – Victoria share	146,400	73,500
Kiewa basin outflow to River Murray – NSW share	146,400	73,500

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

7.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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.

7.5.3 Water entitlement transfers

A summary of Victorian entitlements transferred within the Kiewa basin is presented in Table 7-5. All entitlement transfers were of a temporary nature during 2007/08 and all occurred within the basin. As such, there was no net transfer to or from the basin.

Entitlements in the Kiewa basin were not affected by the unbundling of water entitlements in northern Victoria.

Table 7-5 Transfer of entitlements in the Kiewa basin

Trading zone	Permanent entitlement transfer					Temporary entitlement transfer			
	Reliability	Bought (ML)(1)	Sold (ML)(1)	Number of trans-actions(1)	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
Kiewa Main Stem unregulated	Licence volume					735	735	11	0
Total 2007/08		**0**	**0**	**0**	**0**	**735**	**735**	**11**	**0**
Total 2006/07(2)		**7**	**7**	**2**	**0**	**1,966**	**1,966**	**84**	**0**

Notes:

(1) Details of the transactions relating to permanent entitlement transfers were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling in northern Victoria. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

7.5.4 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. In 2007/08 North East Water's Yackandandah entitlement volume increased by 7 ML as a result of the purchase of permanent entitlement during 2006/07. 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. 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(1)
North East Water					
Kiewa – Tangambalanga	1	179	0	0	Yes
Mount Beauty – Tawonga	1	719	0	370	Yes
Yackandandah	1	209	0	141	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 2007/08		**1,157**	**0**	**536**	
Total annual volume of bulk entitlements 2006/07		**1,150**	**0**	**685**	
Licensed diversions from unregulated streams 2007/08(3)		*18,594*		*17,000*	
Licensed diversions from unregulated streams 2006/07		*18,514*		*5,500*	

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 MDBC's Water Audit Monitoring Report 2007/08.

(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) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

7.6 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 60% of the licensed entitlement volume. A number of new groundwater licences were issued in the Mullindolingong GMA during 2007/08, increasing licensed entitlement volume and estimated extraction volume.

Table 7-7 Licensed groundwater volumes, Kiewa basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Mullindolingong GMA (100%)	All depths	6,980	1,512	0	907	907	771
Total		**6,980**	**1,512**	**0**	**907**	**907**	**771**

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 60% 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, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Mullindolingong GMA (100%)	28	56
Total	**28**	**56**

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 those in the Victorian Water Register. 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.

7.7 Drought contingency measures

The main drought contingency measures undertaken in the Kiewa basin in 2007/08 were the continuation of restrictions on urban water use and diversions on unregulated streams, discussed in more detail in section 7.8.

North East Water's rights to supply Tangambalanga, Kiewa and Wodonga were qualified as part of the Murray system qualification (refer to Table 6-11). No rights were qualified for supply systems that source water from the Kiewa basin in 2007/08.

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

Water restrictions applying to urban customers and licensed diversions in the Kiewa basin during 2007/08 are shown in Table 7-9. Many of the restrictions were reduced or removed during the year. The most severe urban restrictions experienced were six months of Stage 4 restrictions in Tangambalanga, Kiewa and Wodonga, which are all supplied from the Murray system.

Groundwater use was unrestricted in the Kiewa basin during 2007/08.

Table 7-9 Seasonal allocations and restrictions on water use in Kiewa basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Baranduda	Stage 1 restrictions from July 2007 to April 2008
	Mount Beauty, Tawonga and Tawonga South	Stage 3 restrictions from July to August 2007, Stage 1 from September 2007 to April 2008
	Tangambalanga, Kiewa and Wodonga	Stage 4 restrictions from July to December 2007, Stage 3 from January to April 2008 and Stage 2 from May to June 2008.
	Yackandandah	Stage 2 restrictions from July to August 2007, Stage 1 from September 2007 to April 2008
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	Irrigation ban from July 2007 to June 2008
	Running Creek (Kiewa C)	Irrigation ban from July 2007 to August 2007
	Yackandandah Creek and tributaries	Irrigation ban from July to September 2007, Stage 3 restrictions from October to December 2007, and an irrigation ban from January to June 2008
	Simmonds Creek	Irrigation ban from July to August 2007 and from December 2007 to June 2008
	Kinchington Creek, Plain Creek, Junction Creek	Irrigation ban from December 2007 to June 2008

7.9 Recycled water

Four wastewater treatment plants are in the Kiewa basin: three operated by North East Water and the Dinner Plain treatment plant operated by East Gippsland Water. The volume of wastewater recycled decreased from 2006/07, however the proportion of wastewater recycled fell due to a significant increase in the volume of recycled water produced.

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	47	47	100%	0	47	0	0	165	0
Mount Beauty	165	0	0%	0	0	0	0	165	0
Yackandandah	44	44	100%	0	44	0	0	0	0
Total 2007/08	**256**	**91**	**36%**	**0**	**91**	**0**	**0**	**165**	**0**
Total 2006/07	92	56	61%	0	56	0	0	36	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.

7.10 Water for the environment

7.10.1 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 Murray River helping to protect environmental assets such as the the Barmah-Millewa and Gunbower Forests within that basin.

In 2007/08 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.

7.10.2 Passing flow compliance

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

North East Water and AGL Hydro both reported that they met all passing flow and flow-sharing requirements under their bulk entitlements in 2007/08.

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 7 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

Still recovering from the severe water shortages of 2006/07, the historically reliable Ovens basin recorded its second successive year of well below average inflows. Despite this, water users in the basin were not as impacted by the dry conditions as those on the heavily regulated systems of northern Victoria.

Towns supplied from surface water in the Ovens basin were placed on Stage 3 restrictions at the start of the year in line with the uniform restriction policy applied across northern Victoria, however by August most of the restrictions had been eased. Towns supplied from the Murray basin, such as Rutherglen and Yarrawonga, were subject to severe restrictions for almost half the year.

Rural diverters from a number of tributaries within the basin were placed on restrictions and bans throughout the year, however supplies from the larger rivers, such as the Ovens and King rivers, remained mostly unrestricted.

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, 2007/08

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

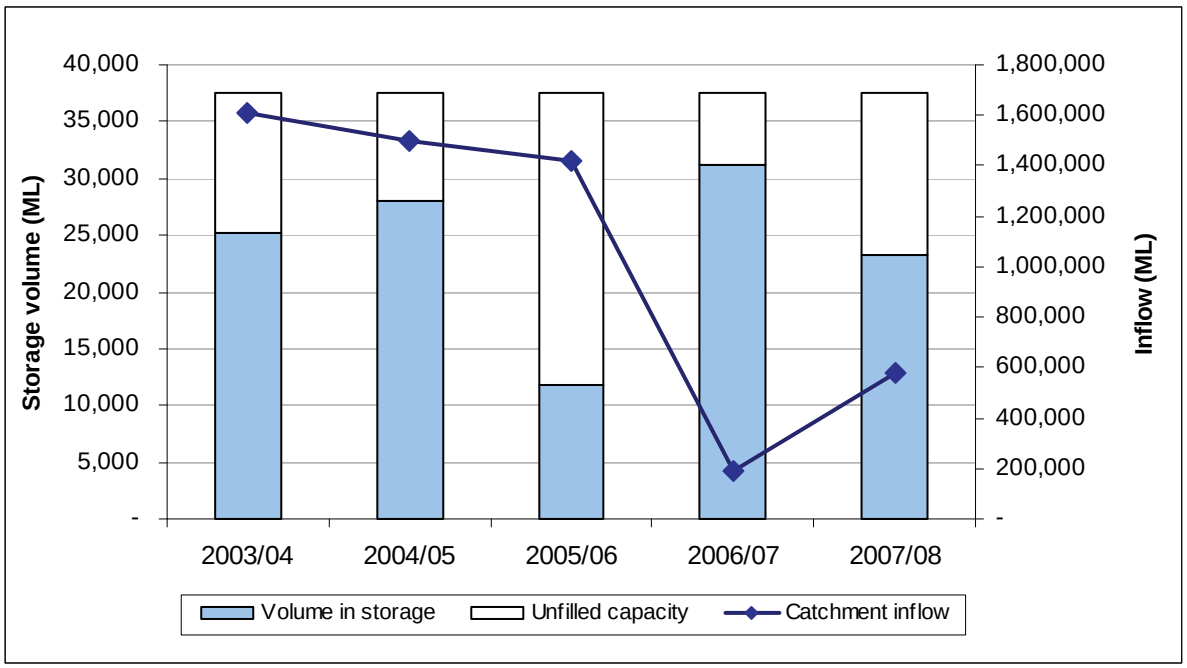
8.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall across the Ovens basin ranged between 60% and 80% of the long term average. Inflows in 2007/08 were 35% of the long term annual average (1,692,000 ML), compared with 11% in 2006/07.

The volume of water flowing from the Ovens basin into the River Murray was 525,900 ML in 2007/08. This represents 90% of the total inflows into the basin, compared with 63% in 2006/07, due to higher inflows but similar usage and losses.

Despite the increase in inflows, the total volume of water held in major storages in the Ovens basin reduced by 25% during the course of the year. The total volume in the major on-stream storages (Lake Buffalo and Lake William Hovell) decreased by 7,900 ML in 2007/08 to 23,300 ML (62% of capacity).

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 2007/08 of 590,800 ML was nearly three times the volume available in 2006/07 (191,200 ML). Overall water use increased by approximately a third compared with the volume used in 2006/07.

Table 8-2 Summary of total water resources and water use in the Ovens basin, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	590,800	49,100
Groundwater [2]	20,000	12,200
Recycled water	1,770	650

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 8-7 and the estimated domestic and stock use as presented in Table 8-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

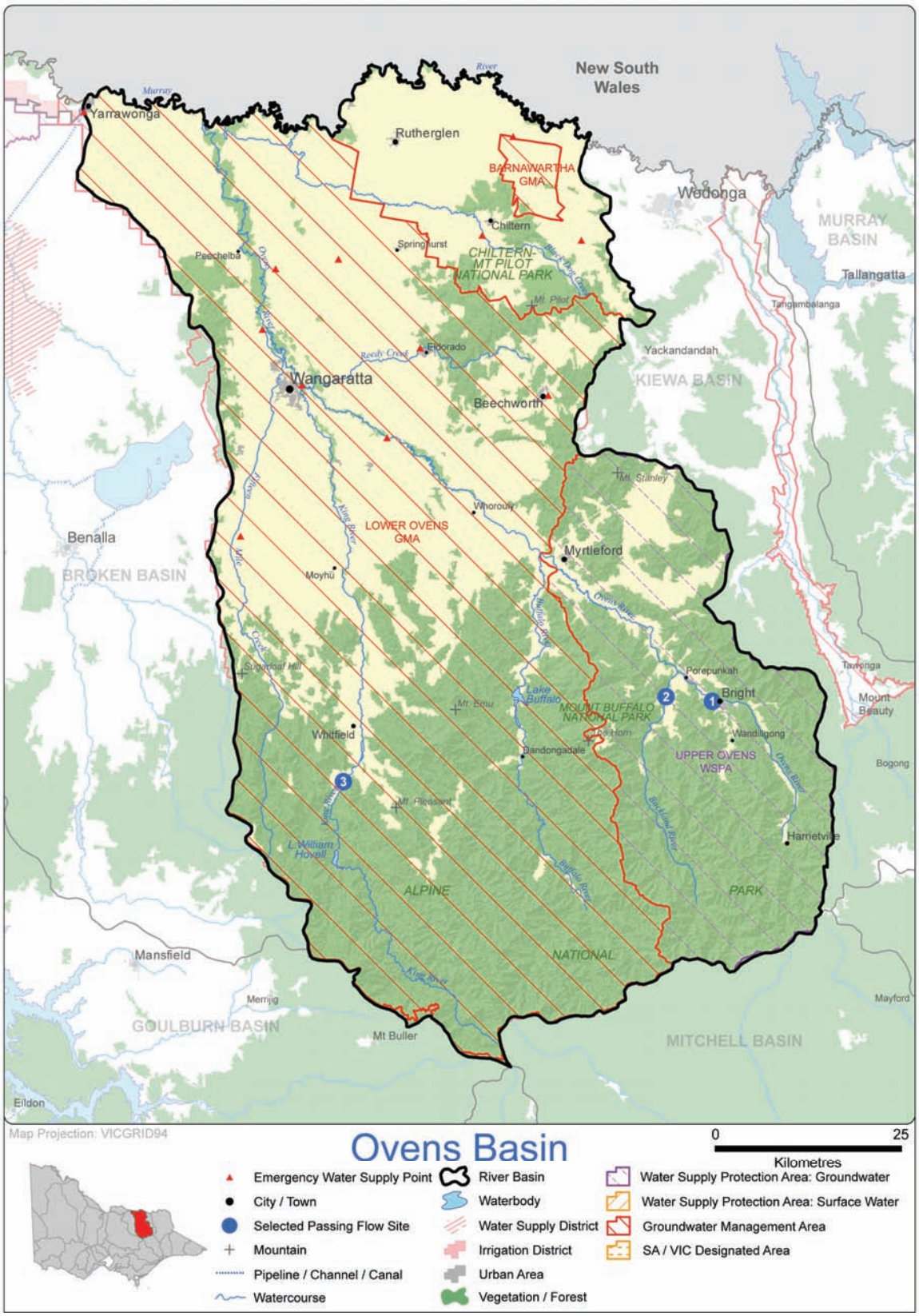
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

8.4.1 Infrastructure projects to improve water availability

In July 2007, North East Water began constructing a 16 kilometre pipeline from Wodonga to Chiltern to secure water supply for the towns of Barnawartha and Chiltern. This project is scheduled for completion in April 2009.

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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	31,200	11,900
Volume in storage at end of year	23,300	31,200
Change in storage	**-7,900**	**19,300**
Inflows		
Catchment inflow(1)	589,700	190,400
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,120	780
Sub-total	**590,800**	**191,200**
Usage		
Urban diversions	5,980	6,170
Licensed diversions from regulated streams	13,200	10,000
Licensed diversions from unregulated streams	14,000	4,100
Small catchment dams	15,900	15,700
Sub-total	**49,100**	**36,000**
Losses		
Net evaporation losses from major storages	-30	1,200
Evaporation from small catchment dams(2)	4,500	5,900
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	19,200	9,400
Sub-total	**23,700**	**16,500**
Water passed at outlet of basin		
Ovens basin outflow to River Murray	525,900	119,400

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. This is a change in methodology from the *Victorian Water Accounts 2006-2007*.

8.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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

A summary of Victorian entitlements transferred in the Ovens basin is presented in Table 8-5, showing a small net transfer of water shares and allocation out of the basin.

Transfer data for the 2006/07 year is difficult to compare to 2007/08 due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007. In these systems permanent entitlement transfers are comparable to change of location of water shares, while temporary transfers are now referred to as transfer of allocation. It should be noted that seasonal allocations in the Ovens system are assumed to be 100 per cent however may be subject to rationing depending on water availability in the system. Because entitlements in unregulated systems have not been unbundled, the old terminology still applies in these systems.

In 2007/08 there was a small net transfer out of the basin. North East Water also made a temporary transfer from its Glenrowan water entitlements to Whitfield as shown in Table 8-6.

Table 8-5 Transfer of entitlements in the Ovens basin

Trading zone	Change of location of water shares[1]					Transfer of allocation[1]			
	Reliability	Bought (ML)[2]	Sold (ML)[2]	Number of trans-actions [2]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
9A Ovens[3]	High				-112	1162	1162	23	0
	Low				-18				
9B King	High				0	408	408	11	0
	Low				0				
180 Ovens and King unregulated	Licence volume				0	378	416	10	-38
Total 2007/08					**-130**	**1948**	**1986**	**44**	**-38**
Total 2006/07[4]					**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:

(1) For trading zone 180, change of location of water shares should be read as permanent entitlement transfers, and transfer of allocation should be read as temporary transfer of entitlement.

(2) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

(3) The transfer of water shares from zone 9A is based on the transfer for the Ovens River delivery systems.

(4) Comparable transfer information not available for 2006/07.

8.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 8-6. 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. 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 8-6 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[2][3]
North East Water					
Beechworth	1	1,100	0	509	Yes
Bright	1	704	0	654	Yes
Chiltern [4]	1	180	0	28	Yes
Glenrowan	1	90	-5	124	Yes
Harrietville	1	91	0	62	Yes
Myrtleford	1	1,212	0	740	Yes
Ovens (Wangaratta, Oxley, Moyhu)	1	7,932	0	3,747	Yes
Porepunkah	1	166	0	48	Yes
Springhurst	1	36	0	31	Yes
Whitfield	1	34	5	39	Yes
Goulburn-Murray Water					
Ovens River System	1	46,970	0	13,166	Yes
Total annual volume of bulk entitlements 2007/08		**58,515**	**0**	**19,148**	
Total annual volume of bulk entitlements 2006/07		**45,382**	**39**	**16,193**	
Licensed diversions from unregulated streams 2007/08[5]		*24,505*		*14,000*	
Licensed diversions from unregulated streams 2006/07		*24,917*		*4,100*	

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 MDBC's Water Audit Monitoring Report 2007/08.

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

(5) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

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 8-7.

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.

Table 8-7 below shows an increase in the licensed groundwater use in the Ovens basin in 2007/08 compared with 2006/07. However, this is due to a change in the licences reported for the Ovens basin. The combined licensed entitlement volume for the Upper Ovens WSPA and Lower Ovens GMA is greater than the entitlement volume associated with the former Murmungee GMA. This is a result of a change in the geographic area, as extraction volumes are estimated at 60% of the licensed entitlement volume.

Table 8-7 Licensed groundwater volumes, Ovens basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Barnawartha GMA (100%)	All depths	2,100	485	0	291	291	291
Upper Ovens WSPA (100%)[6]	All depths	4,010	3,308	0	1,985	1,985	1,230
Lower Ovens GMA (100%)[7]	All depths	25,200	15,700	0	9,420	9,420	5,845
Total[8]		**31,310**	**19,493**	**0**	**11,696**	**11,696**	**7,366**

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 60% of the licensed entitlement volume.

(6) Groundwater use for 2006/07 for the Upper Ovens WSPA is based on 17% of the reported 2006/07 use for Murmungee GMA.

(7) Groundwater use for 2006/07 for the Lower Ovens GMA is based on 83% of the reported 2006/07 use for Murmungee GMA.

(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 inTable 8-8.

Table 8-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Barnawartha GMA (100%)	10	20
Upper Ovens GMA (100%)	24	48
Lower Ovens GMA (100%)	219	438
Total	**253**	**506**

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 8-7.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The number of bores differs from that reported in 2006/07 which included bores from the state groundwater management system and other unregistered domestic and stock bores.

(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 8-9. Note that in 2006/07 the urban groundwater supply for Chiltern was not reported and the supply to Barnawartha was reported within the Murray basin.

In 2007/08 no groundwater was supplied to the towns of Moyhu, Myrtleford and Springhurst, and the towns of Barnawartha and Wangaratta extracted smaller volumes of groundwater compared with 2006/07. Continued low streamflows near Chiltern, however, resulted in North East Water transferring 150 ML of groundwater associated with its Barnawartha licence to Chiltern.

Table 8-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Barnawartha[(1)]	293	85	94
Moyhu	15	0	0
Myrtleford	75	0	0
Springhurst	20	0	3
Wangaratta[(2)]	150	73	198
Chiltern[(3)]	25	166	n/a
Total	**578**	**325**	**295**

Note:

(1) Barnawartha groundwater use has been previously reported within the Murray basin in previous Victorian Water Accounts. A review of the basin boundaries indicated that the extractions for Barnawartha are located in the Ovens basin.

(2) The licensed volume for Wangaratta was reported incorrectly as 200 ML in the *Victorian Water Accounts 2006-2007* due to inclusion of additional entitlements made available to supplement the town's surface water supply.

(3) Chiltern groundwater use has not been reported in previous Victorian Water Accounts. 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 2007/08. Urban and rural water use was restricted at times (discussed below) while in July, North East Water was required to cart water from Wangaratta to Springhurst and from Yarrawonga to Bundalong.

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 8-10. Groundwater use was unrestricted in the Ovens basin during 2007/08.

Table 8-10 Seasonal allocations and restrictions on water use in Ovens basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Barnawartha	Stage 1 restrictions from July 2007 to April 2008
	Bundalong	Stage 3 restrictions from July 2007 to February 2008
	Springhurst	Stage 4 restrictions from July to August 2007, Stage 2 from September to December 2007, and Stage 1 from January to June 2008
	Oxley, Mohyu	Stage 3 restrictions from July to August 2007 and Stage 1 from September 2007 to February 2008
	Rutherglen, Wahgunyah and Yarrawonga	Stage 4 restrictions from July to December 2007, Stage 3 from January to April 2008 and Stage 2 from May to June 2008.
	Beechworth	Stage 3 restrictions from July to August 2007 and Stage 2 from September 2007 to June 2008.
	Bright, Harrietville, Porepunkah and Wandiligong	Stage 3 restrictions from July to August 2007 and Stage 1 from September 2007 to June 2008
	Chiltern	Stage 2 restrictions from July 2007 to June 2008
	Glenrowan	Stage 3 restrictions from July to August 2007, Stage 2 from September 2007 to February 2008
	Wangaratta	Stage 3 restrictions from July to August 2007, Stage 1 from September 2007 to February 2008
	Whitfield	Stage 3 restrictions from July to August 2007, Stage 2 from September 2007 to February 2008, Stage 1 in March 2008.
	Myrtleford	Stage 3 restrictions from July to August 2007, Stage 2 from September 2007 to March 2008
Unregulated diversions	Roberts Creek	Irrigation ban from July 2007 to June 2008
	Ovens River (downstream of Buffalo) tributaries	Irrigation ban from July to November 2007
	Lake Buffalo	Irrigation ban from July to December 2007
	Barwidgee Creek, Myrtle Creek, 15 Mile Creek including tributaries and Middle Creek	Irrigation ban from January to February 2008 and from April 2008 to June 2008
	Hodgsons Creek	Stage 4 restrictions in January and from April to June 2008

8.10 Recycled water

North East Water operates all wastewater treatment plants in the Ovens basin. Approximately 37% of the wastewater passing through treatment plants in the basin in 2007/08 was recycled, down from the estimated 52% in 2006/07. This reduction is due largely to reduced agricultural, urban and industrial demand for recycled water, given the higher availability of surface water resources. Table 8-11 below shows the volumes of water recycled in the Ovens basin during 2007/08.

Table 8-11 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]		
Barnawartha	8	8	100%	0	8	0	0	0	0
Beechworth	198	58	29%	0	58	0	0	140	0
Bright / Porepunkah	177	20	11%	20	0	0	0	157	0
Chiltern	20	20	100%	0	20	0	0	0	0
Myrtleford	0	0	0%	0	0	0	0	0	0
Rutherglen / Wahgunyah	58	58	100%	33	24	0	0	0	0
Wangaratta	1,310	486	37%	6	480	0	0	824	0
Total 2007/08	**1,771**	**651**	**37%**	**59**	**592**	**0**	**0**	**1,121**	**0**
Total 2006/07	1,817	948	52%	106	842	0	0	778	91

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 such as Barmah-Millewa Forest, Gunbower Forest and Kerang wetlands within that basin. In 2007/08 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 in 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 restricts the volume of water an authority can take depending on streamflows.

North East Water and Goulburn-Murray Water reported that they met all passing flow requirements under their bulk entitlements in 2007/08.

Table 8-12 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 8-12 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

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

For the second year running, inflows into the Broken basin were less than 30% of the long term average.

Despite beginning the year with a zero allocation, inflows over the year were still adequate to enable a 71% allocation by April. This was the highest seasonal allocation in northern Victoria, however Broken entitlement holders did have to wait until September for the first allocation to be made available. The Minister for Water qualified rights to ensure supplies could be made for essential needs while allocations were extremely low.

Towns supplied from the Broken basin began the year on severe restrictions, in line with the uniform restriction policy applied across northern Victoria. By September, restrictions had been eased for Benalla and Dookie as water availability improved in the Broken and Goulburn systems. Towns supplied from the Murray system, such as Katamatite and Tungamah, were severely restricted for at least half the year.

Private diverters on the unregulated tributaries were again severely restricted or banned for a large part of the year.

To improve the health of Broken Creek, nearly 2,000 ML of the Goulburn system water quality reserve was delivered down the river as a drought contingency action.

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, 2007/08

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

Notes:

(1) Urban water systems managed by Goulburn Valley Water in the Broken basin are supplied from the Goulburn and Murray systems.

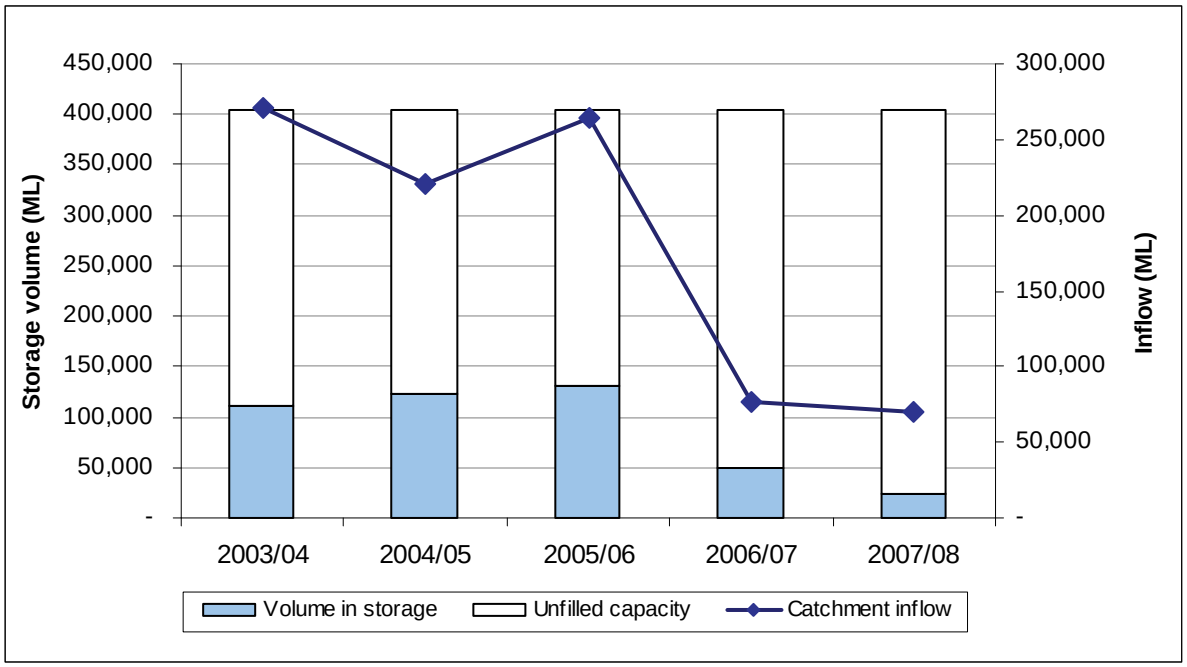
9.3 Rainfall, flows and storages in 2007/08

In 2007/08 rainfall across the Broken basin ranged between 60% and 80% of the long term average. Dry catchment conditions meant total inflows were 20% of the long term average (of 326,000 ML) making it the second consecutive year where inflows were less than 30%.

The amount of water flowing from the Broken basin into the River Murray was 21,800 ML in 2007/08. This represents 33% of the total inflows into the basin, a decline from 39% in 2006/07.

The volume of water held in major storages (greater than 1,000 ML capacity) in the Broken basin fell by 24,100 ML during 2007/08 to 24,500 ML, or 6% of the total storage capacity. This includes Lake Mokoan, Lake Nillahcootie and Loombah-McCall Say Reservoir, all of which are on-stream storages. The low storage levels were the result of two consecutive years of low inflows and high levels of evaporation. Lake Mokoan lost 24,900 ML to evaporation in 2007/08, or approximately 68% of its starting storage volume.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	66,100	28,700
Groundwater[2]	5,100	2,600
Recycled water	390	330

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 9-7 and the estimated domestic and stock use as presented in Table 9-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

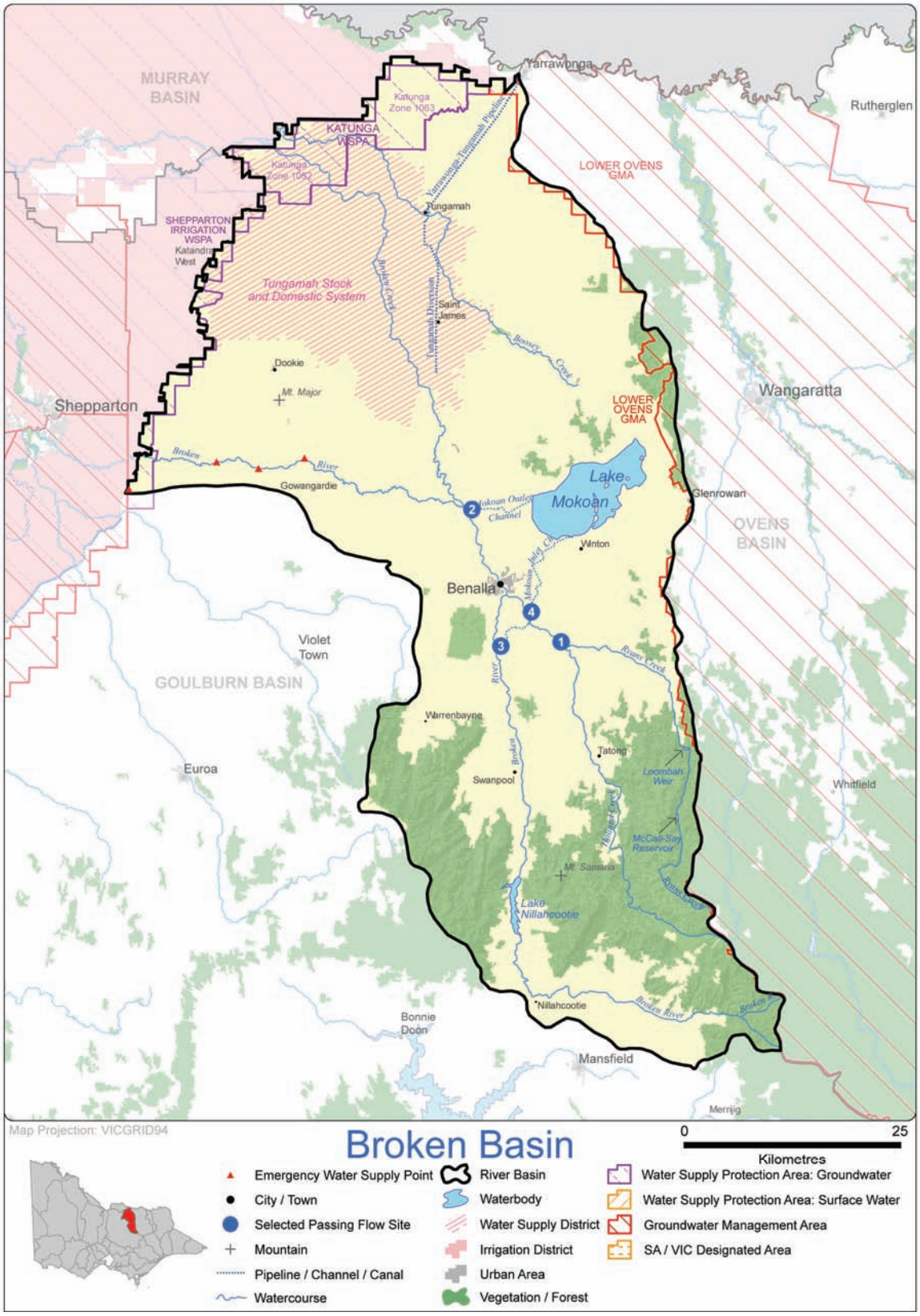
9.4.1 Infrastructure projects to improve water availability

In December 2007, North East Water completed the construction of a 45 kilometre pipeline from Yarrawonga to Devenish to improve the security of supply for the townships of Tungamah, St James and Devenish. The pipeline now supplies these townships from the Murray system.

The decommissioning of Lake Mokoan as an active storage continued throughout 2007/08 and is scheduled for completion in 2009. The construction of a pipeline and pump station to supply Lake Mokoan diverters from the Broken River is underway in conjunction with the Lake Mokoan decommissioning.

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. This includes the combined urban system storages of McCall Say Reservoir and Loombah Weir on Ryans Creek, and the rural water storages of Lake Mokoan and Lake Nillahcootie.

Table 9-3 Balance of surface water in the Broken basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	48,600	130,600
Volume in storage at end of year	24,500	48,600
Change in storage	**-24,100**	**-82,000**
Inflows		
Catchment inflow(1)	66,000	71,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	60	60
Sub-total	**66,100**	**71,800**
Usage		
Urban diversions	1,460	1,580
Licensed diversions from regulated streams(2)	9,560	15,300
Licensed diversions from unregulated streams(3)	1,900	5,500
Environmental water diversions	0	0
Small catchment dams(4)	15,800	15,400
Sub-total	**28,700**	**37,800**
Losses		
Net evaporation losses from major storages	26,300	61,600
Evaporation from small catchment dams(4)	7,200	9,000
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	6,200	17,300
Sub-total	**39,700**	**87,900**
Water passed at outlet of basin		
Broken River at Gowangardie to Goulburn basin	19,700	26,000
Boosey Creek at Tungamah to Murray basin	1,000	1,000
Broken Creek at Katamatite to Murray basin	1,100	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) 2007/08 loss data derived from the Goulburn Simulation Model.

9.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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

A summary of Victorian entitlements transferred in the Broken basin is presented in Table 9-5.

The 2007/08 year experienced a net export of water from the basin, with 2 ML of water shares and 2,777 ML of water allocation being transferred out.

Due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007, transfer data for the 2006/07 year is difficult to compare to 2007/08. In these systems permanent entitlement transfers are comparable to change of location of water shares, while temporary transfers are now referred to as transfer of allocation. It is worth noting, however, that in 2006/07 the temporary market brought a net 75 ML into the basin, while in 2007/08 the transfer of allocation resulted in a net export.

Table 9-5 Transfer of entitlements in the Broken basin

Trading zone	Change of location of water shares					Transfer of allocation			
	Reliability	Bought (ML)[1]	Sold (ML)[1]	Number of trans-actions[1]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
2A Broken – Nillahcootie to Caseys[2]	High				-2	202	408	17	-206
	Low				0				
2B Broken – Caseys to Goulburn	High				0	1,227	1,021	64	206
	Low				0				
6B Lower Broken Creek	High				0	1,415	4,193	246	-2,778
	Low				0				
Total 2007/08					**-2**	**2,845**	**5,622**	**327**	**-2,777**
Total 2006/07 [3]					**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:

(1) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

(2) The transfer of water shares from zone 2A is based on the transfer for the Broken River delivery systems.

(3) Comparable transfer information not available for 2006/07.

9.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 9-6.

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.

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 9-6 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(1)
North East Water					
Loombah-McCall Say	1	2,324	0	1,421	Yes
Tungamah, Devenish and St James	1	135	0	35	Yes
Goulburn-Murray Water					
Broken River System	1	38,988	0	9,311	Yes
Broken River System – Tungamah domestic and stock, urban supplies	1	6,150	0	250	Yes
Environment Minister					
Broken System – Snowy Environmental Reserve (2)	1	990	0	703	Yes
Total annual volume of bulk entitlements 2007/08		**48,587**	**0**	**11,720**	
Total annual volume of bulk entitlements 2006/07		**52,575**	**75**	**17,565**	
Licensed diversions from unregulated streams 2007/08(3)		*9,802*		*1,900*	
Licensed diversions from unregulated streams 2006/07		*10,088*		*5,500*	

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 MDBC's Water Audit Monitoring Report 2006/07.

(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.

(3) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

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 9-7. The Broken basin contains 8% of the Katunga WSPA by surface area. Extractions for the Goorambat GMA were included in the Broken basin groundwater use in 2006/07, however this GMA was considered a low risk/low use management unit and has since been cancelled. Groundwater entitlements and use for unincorporated areas, including those covered by the former Goorambat GMA, are detailed in Appendix A.

Groundwater extractions from the Katunga WSPA were restricted to a 70% allocation during 2007/08. The volume extracted from the Katunga WSPA during 2007/08 was similar to that extracted in 2006/07.

Table 9-7 Licensed groundwater volumes, Broken basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Goorambat GMA (100%)(5)	≤25	n/a	n/a	n/a	n/a	n/a	926
Katunga WSPA (8%)	>25	5,042	5,025	2,518	0	2,518	2,598
Total(6)		**5,042**	**5,025**	**2,518**	**0**	**2,518**	**3,524**

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) The Goorambat GMA is now an unincorporated area and not included in the 2007/08 accounts.

(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 9-8.

Table 9-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Katunga WSPA (8%)	19	38
Total	**19**	**38**

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 9-7.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The number of bores for the Katunga WSPA is less than those reported in 2006/07 which included bores from the state groundwater management system and other unregistered domestic and stock bores.

(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 townships of Goorambat and Tungamah in the Broken basin. The licensed entitlements and metered use for this supply are provided in Table 9-9. Note that in 2006/07 the urban groundwater supply for Tungamah was not reported. There were no groundwater extractions made for Tungamah in either 2006/07 or 2007/08.

Table 9-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Goorambat	24	19	20
Tungamah	90	0	0
Total	**114**	**19**	**20**

9.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Broken basin in 2007/08. These include:

- temporary qualification of rights
- restricting urban and rural water use (discussed below)
- some 1,878 ML of the Goulburn system water quality reserve made available to improve the health of Broken Creek.

The Minister for Water declared one qualification of rights in the Broken basin in 2007/08. Details of this qualification is presented in Table 9-10.

Table 9-10 Qualifications of rights

Qualification type	Qualification description
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%. Dates: 1 July 2007 to 30 June 2008
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%. Dates: 1 July 2007 to 30 June 2008
Modified operating rules	Qualified *Bulk Entitlement (Broken System – Goulburn-Murray Water) Conversion Order 2004* by removing the restriction policy in Schedule 3 that applies to water supplied by Goulburn-Murray Water to primary entitlement holders. Dates: 1 July 2007 to 30 June 2008

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 9-11. Tungamah, Devenish, St James, Dookie and Katamatite were the only towns remaining on urban water restrictions by June 2008.

Table 9-11 Seasonal allocations and restrictions on water use in Broken basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Benalla	Stage 3 restrictions from July to August 2007, Stage 2 from September to December 2007, and Stage 1 from January to February 2008
	Dookie	Stage 4 restrictions from July to September 2007, Stage 2 from September 2007 to October 2007, Stage 1 from October 2007 to June 2008
	Katamatite	Stage 4 restrictions from July to December 2007, Stage 1 from December 2007 to June 2008
	Devenish, St James and Tungamah	Stage 3 restrictions from July 2007 to April 2008, Stage 2 from May to June 2008
Regulated diversions	Broken System	Allocation began the year at 0% of entitlement, increasing to 71% by April 2008
Unregulated diversions	Boosey Creek	Irrigation ban July 2007 to June 2008
	Hollands Creek	Irrigation ban July to August 2007 and from October 2007 to June 2008
	Ryans Creek	Irrigation ban from October to June 2008
	Lima East Creek	Irrigation ban February to June 2008
	Lima Creek	Irrigation ban February to June 2008
	Other streams in basin	Irrigation ban from July to November 2007
Groundwater	Katunga WSPA	Allocation restricted to 70%

9.10 Recycled water

North East Water operates the sole wastewater treatment plant in the Broken basin at Benalla. The volume of wastewater recycled from the Benalla treatment plant reduced from 430 ML in 2006/07 to 331 ML in 2007/08, with a similar reduction in the volume of water produced. Table 9-12 below details the recycling undertaken during 2007/08 at Benalla.

Table 9-12 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]		
Benalla	394	331	84%	0	331	0	0	63	0
Total 2007/08	**394**	**331**	**84%**	**0**	**331**	**0**	**0**	**63**	**0**
Total 2006/07	490	430	88%	0	430	0	0	60	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 endangered flora and fauna species including Murrary 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 such as the Gunbower Forest and Kerang Wetlands within that basin.

In 2007/08 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
- 1,878 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 reported that it met all passing flow requirements in the Broken basin under its bulk entitlements in 2007/08.

Goulburn-Murray Water reported that it failed to comply with the following passing flow requirements: on the Broken River at Moorngag and downstream of Broken Weir; and on Holland's Creek downstream of Holland's Weir. The non-compliances occurred for between three and five days at each location

Table 9-13 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 9-13 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	Failed at times to pass the lesser of 30 ML/day or natural flow from June to November inclusive
	Compliance point	Broken River between Broken Weir and Casey Weir (shown as 3 in Figure 9-2)
	Passing flow compliance	Failed at times to pass the lesser of 22 ML/day or natural flow from December to May inclusive
	Compliance point	Holland Creek downstream of Holland Weir (shown as 4 in Figure 9-2)
	Passing flow compliance	• Failed at times to pass the lesser of 22 ML/day or natural flow when water is diverted from Broken River and/or Holland Creek to Lake Mokoan • 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

Although greater than those experienced in 2006/07, inflows to the Goulburn system in 2007/08 were very low at 37% of the long term average.

As with all northern Victorian systems, the season began with a 0% allocation and ended early to build reserves for supplies in 2008/09. The final seasonal allocation of 57% was boosted by supplying water from below the operating level of Waranga basin.

The Minister for Water qualified rights on the Goulburn system to ensure enough water could be supplied for essential domestic and stock needs while allocations were extremely low. The qualification also reduced passing flows in the lower Goulburn River at McCoys Bridge to retain water in Lake Eildon for these purposes.

All towns supplied from the Goulburn basin started the season with severe restrictions in line with the uniform restriction policy applied across northern Victoria. With the exception of Broadford and Kilmore, restrictions had been eased by September.

Broadford and Kilmore were subjected to Stage 4 restrictions for the entire year due to a severe water shortage in the Sunday Creek system. Supplies in this system were supplemented by transferring water to Kilmore from the Melbourne system at Wallan and by carting water from the Goulburn River.

Although streamflows in unregulated streams in the Goulburn basin improved, licensed diverters on many streams were again placed on severe restrictions throughout 2007/08, particularly in the latter half of the year.

Like the Murray basin, the water market was again very active in the Goulburn basin in 2007/08. However in contrast to the previous year, there was a net transfer of both water shares and allocation out of the basin.

The Goulburn system was connected to Bendigo in September 2007 and to Ballarat in May 2008 via the Goldfields Superpipe. To secure the essential needs of these towns the Minister for Water qualified rights to provide Coliban Water and Central Highlands Water with up to 10,000 ML from water available to maintain water quality in the Goulburn Basin. Coliban Water and Central Highlands Water also purchased water shares from willing entitlement-holders in the system to augment their towns' long term supplies.

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, 2007/08

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 2007/08

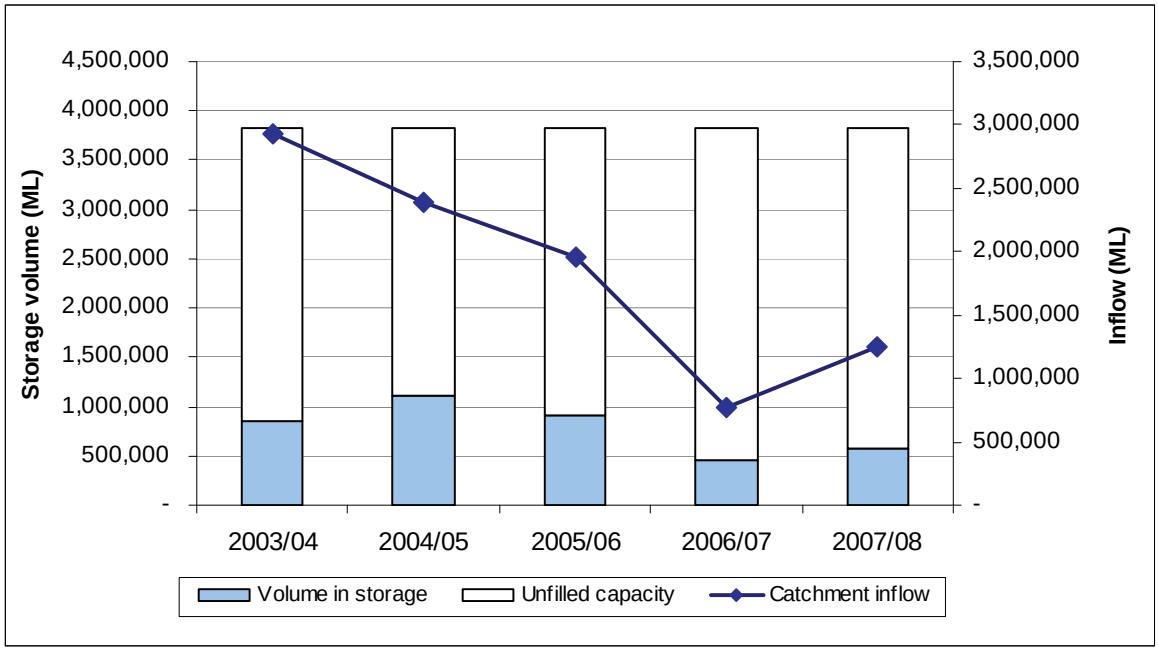
In 2007/08, rainfall across the Goulburn basin ranged between 60% and 80% of the long term average. Inflows were 37% of the long term average (of 3,366,000 ML), an increase from the 23% of average experienced in 2006/07.

The volume of water flowing from the Goulburn basin into the River Murray was 230,200 ML in 2007/08. This is greater than the 165,500 ML that left the basin in 2006/07, although still considerably less than the flows reported in 2005/06 and 2004/05. In 2007/08 outflows from the Goulburn basin were only 19% of catchment inflows compared with 22% in the previous year.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased by 25% during 2007/08 to 574,000 ML, or 15% of the total storage capacity of 3,826,160 ML.

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 increased by 121,000 ML in 2007/08, compared with a fall of more than 390,000 ML in 2006/07.

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 2007/08 was similar to 2006/07 despite the increase in available water resources volume.

Table 10-2 Summary of total water resources and water use in the Goulburn basin, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	1,259,100	778,900
Groundwater[2][3]	154,000	62,200
Recycled water	6,470	5,960

Notes:

(1) For groundwater, the total water resource is the the licensed entitlement volume as presented in Table 10-7 and the estimated domestic and stock use as presented in Table 10-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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

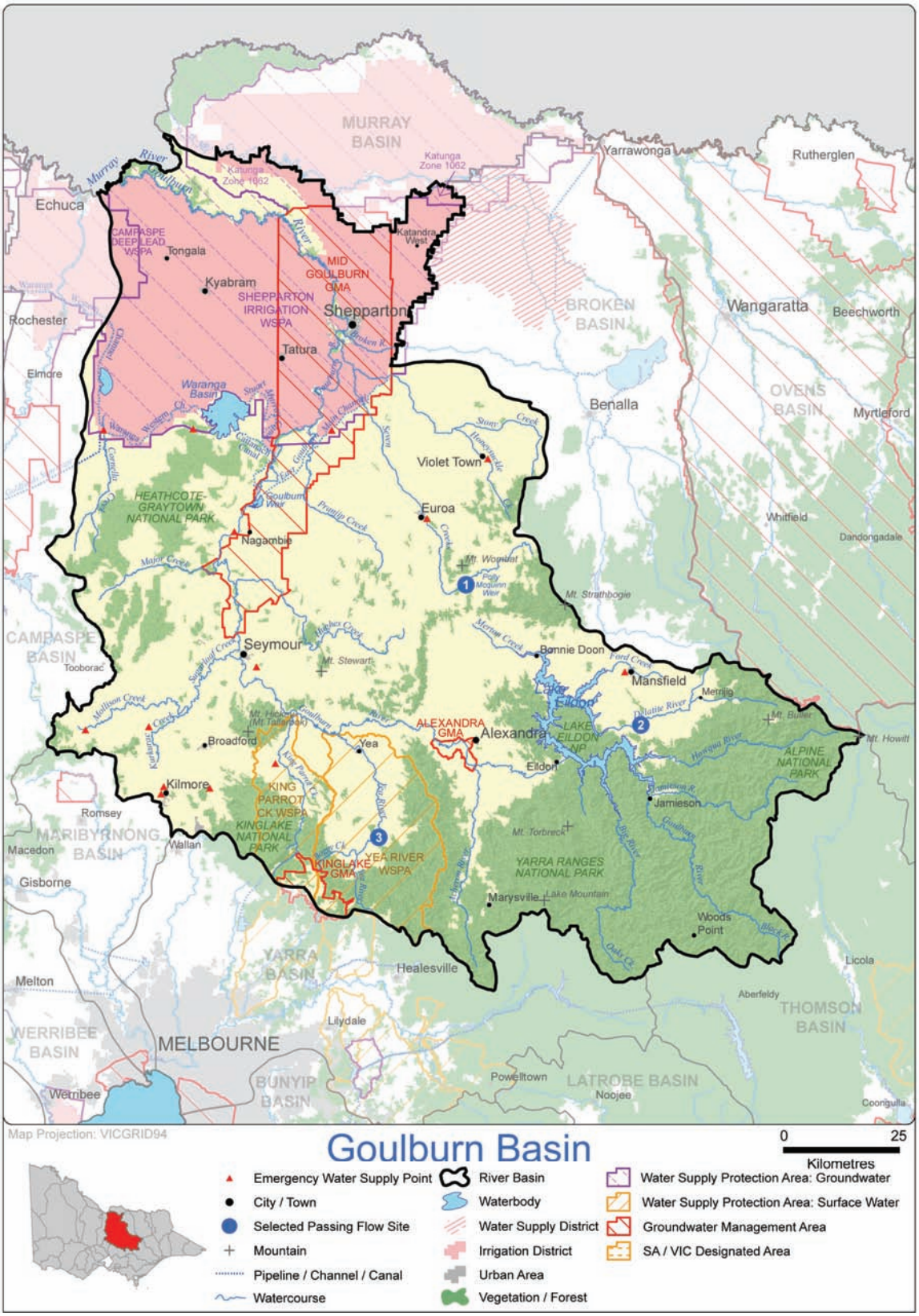
The largest water availability-related infrastructure project completed in the Goulburn basin in 2007/08 was the Goldfields Superpipe. In September 2007, the pipeline commenced supplying Goulburn system water from the Waranga Main Channel at Colbinnabin to Bendigo. The link to Ballarat was subsequently finalised in May 2008.

Furthermore, water supply security for Mansfield was improved with the completion of construction of the Mansfield Ritchie No 2 Reservoir by Goulburn Valley Water.

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, including works to reduce channel outfalls, leakage and seepage, and rationalising the distribution system.

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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	377,800	771,400
Volume in storage at end of year	498,800	377,800
Change in storage	**121,000**	**-393,600**
Inflows		
Catchment inflow(1)	1,241,100	753,300
Inflow from Broken River at Gowangardie	19,700	24,400
Return flow from irrigation	0	0
Treated effluent discharged back to river(2)	670	1,240
Sub-total	**1,261,500**	**778,900**
Usage		
Urban diversions	23,970	27,510
Irrigation district diversions	679,400	748,700
Licensed diversions from regulated streams	10,400	11,600
Licensed diversions from unregulated streams	16,500	8,400
Silver and Wallaby Creeks to Yarra basin	1,100	1,200
Environmental water diversions	0	0
Small catchment dams(3)	47,500	46,500
Sub-total	**778,900**	**843,900**
Losses		
Net evaporation losses from major storages	19,900	28,000
Losses from small catchment dams(3)	10,100	21,700
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	99,000	113,400
Sub-total	**129,000**	**163,100**
Water passed at outlet of basin		
Goulburn River to Campaspe River via Waranga Western Channel	2,400	0
Goulburn River outflow to River Murray	204,900	145,700
Goulburn River outflow to River Murray via Broken Creek	25,300	19,800

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Includes 169 ML of water returned to rivers within the basin from Mount Buller alpine resort in 2007/08. No information was available for Lake Mountain alpine resort in 2007/08, which reported 1.5 ML of water returned to Taggerty Creek in 2006/07.

(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 2007/08 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, 2007/08

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

A summary of Victorian entitlements transferred into and out of the Goulburn basin is presented in Table 10-5. The 2007/08 year saw a net export of water from the basin, with 39,038 ML of water shares and 75,922 ML of water allocation being transferred from the basin.

Due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007, transfer data for the 2006/07 year is difficult to compare to 2007/08. In these systems permanent entitlement transfers are now comparable to change of location of water shares, while temporary transfers are now referred to as transfer of allocation. It is noticeable, however that in 2006/07 the temporary market brought a net 55,655 ML into the basin, while in 2007/08 the transfer of allocation resulted in a net export.

Because entitlements in unregulated systems have not been unbundled, the old terminology still applies in these systems.

Table 10-5 Transfer of entitlements in the Goulburn basin

Trading zone	Change of location of water shares[1]					Transfer of allocation[1]			
	Reliability	Bought (ML)[2]	Sold (ML)[2]	Number of trans-actions[1]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
1A Greater Goulburn[3]	High				-28,091	115,727	179,261	8,213	-63,534
	Low				-11,461				
3 Lower Goulburn[4]	High				102	1,614	14,064	315	-12,450
	Low				412				
Goulburn unregulated	Licence volume				0	59	59	4	0
Yea River unregulated	Licence volume				0	0	8	1	-8
Total 2007/08					**-39,038**	**117,400**	**193,392**	**8,533**	**-75,922**
Total 2006/07[5]					**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Notes:

(1) For the Goulburn and Yea unregulated trading zones, change of location of water shares should be read as permanent entitlement transfer, and transfer of allocation should be read as temporary transfer of entitlement.

(2) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

(3) The transfer of water shares from zone 1A is based on the combined transfers for the Central Goulburn Irrigation Area, Rochester Irrigation Area and Shepparton Irrigation Area delivery systems.

(4) The transfer of water shares from zone 3 is based on the transfers for the Goulburn River delivery system.

(5) Comparable transfer information not available for 2006/07.

10.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 10-6. 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. 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 10-6 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 allocation transfers 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[2][3]
Coliban Water					
Boort	1	425	0	140	Yes
Dingee	1	50	0	7	Yes
Lockington	1	130	2	74	Yes
Macorna	1	40	0	7	Yes
Mitiamo	1	60	0	48	Yes
Mysia	1	15	0	1	Yes
Pyramid Hill	1	300	0	165	Yes
Rochester	1	1,400	6	1,025	Yes
Goulburn Valley Water					
Alexandra	1	916	-540	345	Yes
Bonnie Doon	1	112	-45	59	Yes
Buxton	1	110	0	0	Yes
Colbinabbin	1	89	-55	34	Yes
Corop	1	44	-30	11	Yes
Dookie	1	160	-65	90	Yes
Eildon	1	480	-315	131	Yes
Euroa System	1	1,990	0	676	Yes
Gigarre	1	100	-52	46	Yes
Katandra West	1	64	-16	40	Yes
Kyabram	1	2,000	-808	1,191	Yes
Longwood	1	120	0	52	Yes
Mansfield	2	1,300	0	591	Yes
Marysville	1	462	0	330	Yes
Mooroopna	1	300	-210	81	Yes
Murchison	1	350	-158	184	Yes
Nagambie	1	825	-245	541	Yes
Pyalong	1	75	0	51	Yes
Rushworth	1	530	-225	301	Yes
Seymour	1	5,340	-3,654	1,680	Yes
Shepparton	1	17,970	-5,314	11,265	Yes
Stanhope	1	200	-105	88	Yes
Sunday Creek	10	2,238	0	440	Yes
Tatura	1	2,600	-620	1,979	Yes
Thornton	1	120	0	46	Yes
Tongala	1	1,404	-574	830	Yes
Upper Delatite	1	235	0	60	Yes
Violet Town	1	270	0	0	Yes
Woods Point	1	21	0	25	No
Yea	1	530	0	227	Yes
GWMWater					
Quambatook[4]	1	100	0	36	Yes
Melbourne metropolitan retailers					
Silver and Wallaby Creek	3	22,000	0	1,108	Yes
Environment Minister					
Goulburn System – Snowy Environmental Reserve [5]	1	14,812	0	0	Yes
Goulburn System – Living Murray[8]	1	141,046	0	0	Yes
Goulburn-Murray Water					
Eildon – Goulburn Weir	10	1,919,000	0	689,775	Yes
AGL Hydro Ltd					
Rubicon – Southern Hydro Ltd[6]	1	0	0	0	Yes

Total annual volume of bulk entitlements 2007/08		**2,140,241**	**-13,023**	**713,782**	
Total annual volume of bulk entitlements 2006/07		**1,999,095**	**55,655**	**791,404**	
Licensed diversions from unregulated streams 2007/08[(7)]		*40,259*		*16,500*	
Licensed diversions from unregulated streams 2006/07		*40,059*		*8,400*	

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 MDBA's Water Audit Monitoring Report 2007/08.

(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) Quambatook is supplied from the Goulburn system via the Normanville system. Therefore its volume is included in Goulburn-Murray Water's bulk entitlement volume.

(5) The volume diverted under this bulk entitlement is passed to the Murray as a substitute for Snowy River water formerly released to the Murray.

(6) 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.

(7) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

(8) Added in 2007/08.

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 10-7.

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. The Mid-Goulburn GMA is a new management unit created from the merging of Nagambie GMA and Kialla GMA. I Initially groundwater extraction was to control salinity resulting from rising water levels, a historical legacy of vegetation removal. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Reported groundwater usage in the Goulburn basin reduced slightly in 2007/08 compared with 2006/07, however was still considerably higher than the recorded 2005/06 usage. The recent years' increase in groundwater consumption is linked to reduced availabililty 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. Extractions were reduced most significantly in the Shepparton WSPA: licensed groundwater users access the shallow groundwater system and, as groundwater levels dropped during 2007/08, many users had could not access as much water.

Extractions from the Campaspe Deep Lead WSPA and the Katunga WSPA were restricted to a 70% allocation during 2007/08.

Table 10-7 Licensed groundwater volumes, Goulburn basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Alexandra GMA (100%)	All depths	1,937	1,714	0	1,028	1,028	1,028
Mid-Goulburn GMA (100%)[6]	Zone 1070 - >25 Zone 1071 all depths	14,900	12,330	4,202	0	4,202	6,249
Kinglake GMA (81%)	All depths	1,636	1,510	0	906	906	981
Campaspe Deep Lead WSPA (10%)	>25	4,675	4,560	2,814	0	2,814	3,439
Katunga WSPA (11%)	>25	6,647	6,624	3,319	0	3,319	3,425
Shepparton WSPA (57%)	≤25	126,365	126,365	49,017	0	49,017	62,411
Total[7]		**156,160**	**153,103**	**59,352**	**1,934**	**61,286**	**77,533**

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.

(6) Groundwater use for 2006/07 for the Mid-Goulburn GMA is based on the combined reported 2006/07 use for Nagambie GMA and Kialla GMA.

(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 10-8. Groundwater does not supplement the urban water supply in the Goulburn basin.

Table 10-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Alexandra GMA (100%)	7	14
Mid Goulburn GMA (100%)	47	94
Kinglake GMA (81%)	49	98
Campaspe Deep Lead WSPA (10%)	8	16
Katunga WSPA (11%)	26	52
Shepparton WSPA (57%)	297	594
Total	**434**	**868**

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 10-7.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The number of bores is less than those reported in 2006/07 which included bores from the state groundwater management system and other unregistered domestic and stock bores.

(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 2007/08. These include:

- restricting urban and rural water use (discussed below)
- 10 GL of the water earmarked for maintaining water quality in the Goulburn system was made available to Coliban Water and Central Highlands Water to supplement Bendigo and Ballarat supplies
- 1,878 ML of the water earmarked for maintaining water quality in the Goulburn system was made available to improve the health of Broken Creek
- carting water from Seymour to Broadford
- pumping Waranga Basin dead storage
- two temporary pumping stations installed in 2006/07 were employed again in 2007/08 to access 86 GL of water from the Waranga Basin that cannot be released under gravity.
- temporary qualification of rights.

The Minister for Water declared a qualification of rights in the Goulburn basin in 2007/08. Details of this qualification is presented in Table 10-9.

Table 10-9 Qualifications of rights

Qualification type	Qualification description
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%. Dates: 1 July 2007 to 30 June 2008
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 and removing the restriction rules, to enable the supply of its townships when the Goulburn system allocation was less than 20%. Dates: 1 July 2007 to 30 June 2008
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 when the Goulburn system allocation was less than 20%. Dates: 1 July 2007 to 30 June 2008
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. Dates: 1 July 2007 to 30 June 2008
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%. Dates: 1 July 2007 to 30 June 2008
Passing flow requirement	Goulburn-Murray Water's passing flow requirements at McCoys Bridge gauging station reduced when the Goulburn system seasonal allocation was less than 20%. Dates: 1 July 2007 to 30 June 2008
Volume carried over from 2006/07	Qualified the right to take carry-over water from 2006/07 under the bulk entitlements in the Goulburn system held by Goulburn-Murray Water, GWMWater, Coliban Water, Goulburn Valley Water and the Environment Minister so that a maximum of 30% of the carry-over volume (less 5% losses) could be taken. Dates: 1 July 2007 to 30 June 2008

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 10-10. In general, urban restrictions were moved to lower stages over the course of the year. Irrigation allocations reached 57% by the end of the season, compared with 29% in 2006/07.

Table 10-10 Seasonal allocations and restrictions on water use in Goulburn basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Kyabram, Tatura and Tongala	Stage 4 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007 to June 2008
	Woods Point	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007 to June 2008
	Broadford, Kilmore, Wandong, Heathcote Junction and Clonbinane	Stage 4 restrictions from July 2007 to June 2008
	Euroa, Violet Town	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007
	Colbinabbin	Stage 4 restrictions from July to September 2007, Stage 2 from October 2007 to April 2008
	Sawmill Settlement, Merrijig	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007 to June 2008
	Mansfield	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007 to June 2008
	Longwood	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007 to June 2008
	Bonnie Doon	Stage 3 restrictions from July to August 2007, Stage 2 in September 2007 and Stage 1 from October 2007 to June 2008
	Alexandra, Eildon, Murchison, Nagambie, Rushworth, Seymour/ Mangalore, Shepparton, Mooroopna, Toolamba, Corop, Girgarre, Katandra West, and Stanhope	Stage 4 restrictions between July and August 2007, Stage 2 in September 2007, and Stage 1 from October 2007 to June 2008
	Pyalong	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, Stage 1 from October 2007 to June 2008
	Marysville	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, Stage 1 from October 2007 to June 2008
	Thornton	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, Stage 1 from October 2007 to June 2008
	Yea	Stage 3 restrictions between July and August 2007, Stage 2 in September 2007, Stage 1 from October 2007 to June 2008
	Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill, Rochester	Stage 4 restrictions between July 2007 and January 2008, Stage 3 from January 2008 to June 2008
	Quambatook	Stage 4 restrictions between July 2007 and February 2008, Stage 2 from February to June 2008
Irrigation and regulated diversions	Goulburn System	Allocation began the year at 0% of entitlement, increasing to 57% in April 2008 An additional 7% of allocation was made available by installing pumps in Waranga basin that were able to access water below the operating level of the storage From 1 April 2008, all water resource improvements in the Goulburn system were directed to building up supplies for the 2008/09 season
Unregulated diversions	Sunday Creek	Irrigation ban September 2007 to June 2008
	Faithfulls Creek and Sevens Creek	Irrigation ban July 2007, and January to June 2008
	Hughes Creek	Irrigation ban January to June 2008
	Stony Creek	Stage 5 restrictions February to May 2008
	King Parrot Creek, Yea River and tributaries, Archeron River, Stevenson River and Little Stevenson River	Irrigation ban February to June 2008
	Murrindindi	Stage 1 restrictions in June 2008
	Cummins Creek, Strath Creek, Chyser Creek, Johnstons Creek, Wallaby Creek, Pheasant Creek	Irrigation ban July 2007
Groundwater	Katunga WSPA	Allocation restricted to 70%
	Campaspe Deep Lead WSPA	Allocation restricted to 70%

10.10 Recycled water

Goulburn Valley Water operates all wastewater treatment plants in the Goulburn basin. Approximately 92% of the volume of wastewater passing through treatment plants in the basin was recycled (Table 10-11). This was greater than in 2006/07, although the total volume of recycled water fell due to less wastewater entering the treatment plants. For most treatment plants, 100% of wastewater was recycled.

Table 10-11 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)		
Alexandra	159	72	45%	0	72	0	0	87	0
Avenel	29	29	100%	0	29	0	0	0	0
Bonnie Doon	12	12	100%	0	12	0	0	0	0
Broadford	36	36	100%	10	26	0	0	0	0
Eildon	128	0	0%	0	0	0	0	128	0
Euroa	231	231	100%	60	171	0	0	0	0
Girgarre	0	0	0%	0	0	0	0	0	0
Kilmore	205	205	100%	0	205	0	0	0	0
Kyabram / Merrigum	173	173	100%	0	173	0	0	0	0
Mansfield	201	201	100%	67	135	0	0	0	0
Marysville	47	47	100%	0	47	0	0	0	0
Mooroopna	426	426	100%	0	426	0	0	0	0
Murchison	0	0	0%	0	0	0	0	0	0
Nagambie	137	137	100%	0	137	0	0	0	0
Seymour	445	445	100%	104	342	0	0	0	0
Shepparton	3,236	2,946	91%	0	2,946	0	0	289	0
Stanhope / Rushworth	0	0	0%	0	0	0	0	0	0
Tatura	707	707	100%	0	707	0	0	0	0
Tongala	203	203	100%	0	203	0	0	0	0
Upper Delatite	13	13	100%	0	13	0	0	0	0
Violet Town	22	22	100%	0	22	0	0	0	0
Yea	61	61	100%	31	30	0	0	0	0
Total 2007/08	**6,469**	**5,965**	**92%**	**271**	**5,694**	**0**	**0**	**505**	**0**
Total 2006/07	7,325	6,216	85%	200	6,016	0	0	1,109	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 environment assets such as Gunbower Forest and the Kerang Wetlands within that basin.

In 2007/08 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

- all other water in the basin not allocated for consumptive use, ie water above cap
- the Goulburn River – Living Murray Environmental Entitlement of 141,046 ML held by the Environment Minister.

The Goulburn system Snowy Environmental Reserve was established in 2007/08 to release Goulburn River water to the River Murray as a substitute for Snowy River environmental flows that would formerly have been released to the River Murray.

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 the 2007/08 and therefore releases were 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 failed to meet its passing flow requirements in the Goulburn River at Murchison and at McCoys Bridge during 2007/08. The non-compliance at Murchison occurred on three days in the year, and the non-compliance at McCoys Bridge was a failure to meet the monthly average for June.

Passing flow obligations in the Goulburn River at McCoys Bridge were qualified between 1 July 2007 and 17 September 2007 while allocations were below 20 per cent. The passing flow requirement, which is defined as 400 ML per day, was reduced to 250 ML per day. Flows recovered to normal minimum flows by 23 October 2007.

The Goulburn system water quality provision was also qualified, reducing it by 10,000 ML. This volume of water was made available for Bendigo and Ballarat to secure urban water supplies.

Table 10-12 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 10-12 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

For the third successive year, inflows into the Campaspe basin were less than 25% of the long term average. Levels in the major online storages recovered from 7,300 ML at the start of the year to 28,100 ML by the end of June 2008 and were boosted by the delivery of more than 11,000 ML of water to the Campaspe system from the Goulburn system via the Goldfields Superpipe. The Goldfields Superpipe was completed in September 2007.

Campaspe irrigators again started the season with a 0% allocation, however unlike 2006/07 when no allocation was made, the allocation had increased to 18% by April. As it did for other major northern Victorian systems managed by it, Goulburn-Murray Water shortened the irrigation season and directed all water resource improvements after this date towards building up supplies for the 2008/09 season.

Coliban rural customers received an opening allocation of 30% in September, which increased to 35% by the end of the year.

The Minister for Water qualified rights on the Campaspe system to ensure enough water could be supplied for essential domestic and stock needs while allocations were extremely low. The qualification also reduced passing flows in the Campaspe River to retain water in Lake Eppalock for these purposes and for targeted environmental releases. Similarly, the Minister qualified rights on the Coliban system, which removed environmental flow requirements downstream of Malmsbury Reservoir to retain water for consumptive use and targeted environmental releases.

Up to 2,410 ML of water from the Goulburn inter-valley transfer account was delivered to the Murray River from the Goulburn system via the lower Campaspe River to gain an environmental benefit during the extremely low flow conditions.

Towns supplied from the Campaspe basin, including Bendigo and Castlemaine, were on Stage 4 restrictions the entire year. Towns in the basin supplied from the Goulburn and Murray systems started the year on Stage 4 restrictions, but were reduced to Stage 3 in January. Towns reliant on groundwater were not subject to such severe restrictions. Woodend, which is connected to the Melbourne system, was on Stage 3a restrictions the entire year, in line with Melbourne.

For licensed diverters from unregulated streams, only those supplied by Wanalta Creek were banned.

Groundwater continued to play an important role in rural supplies in the northern part of the basin even though users in the Campaspe Deep Lead WSPA were restricted to 70% of their licensed volume. This restriction would have been harsher had the Minister not qualified rights in this system to ensure farming enterprises in the region could continue.

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, 2007/08

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

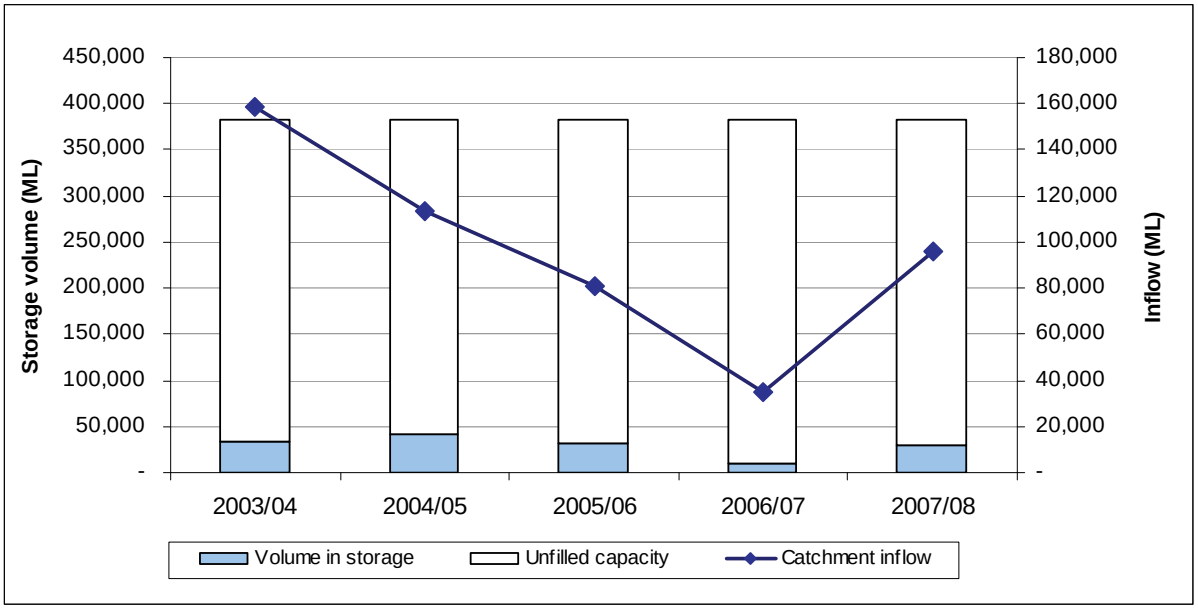
11.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall across the Campaspe basin ranged from 60% to 80% of the long term average. The catchment inflow for the year of 95,900 ML was 31% of the long term average, a significant increase from the 2006/07 inflows of 34,500 ML.

The amount of water flowing from the Campaspe basin into the River Murray was 11,700 ML in 2007/08. This represents 12% of the total inflows into the basin, the same as for 2006/07.

The volume of water held in major storages (greater than 1,000 ML capacity) increased from 7,300 ML at the start of the year to 28,100 ML at the end of the year, boosted by 11,100 ML transferred from the Goulburn system via the Goldfields Superpipe. 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 was higher than in 2006/07 (107,200 ML compared with 34,600 ML), partly as a result of transfers from the Goldfield Superpipe. Demand also increased from 2006/07 levels, with increased allocations in the Campapse and Coliban rural systems. Increased surface water availability in 2007/08 appears to have reduced demand for groundwater from the previous year. Groundwater usage in the Campaspe basin reduced in 2007/08 compared with 2006/07. This is predominantly due to a reduction in extractions from the Shepparton WSPA. Licenced groundwater users in the Shepparton WSPA access the shallow groundwater system, and as groundwater levels dropped during 2007/08, many users could not access as much water. Also, some Shepparton WSPA groundwater licences require shandying with surface water to improve water quality and, as less surface water was available, less groundwater was extracted.

Extractions from the Campaspe Deep Lead WSPA were restricted to a 70% allocation during 2007/08.

Table 11-2 Summary of total water resources and water use in the Campaspe basin 2007/08

Water source	Total water resource (ML)[1][2]	Total use (ML)
Surface water	107,200	55,800
Groundwater[3]	66,800	35,400
Recycled water	1,590	1,440

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 11-7 and the estimated domestic and stock use as presented in Table 11-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

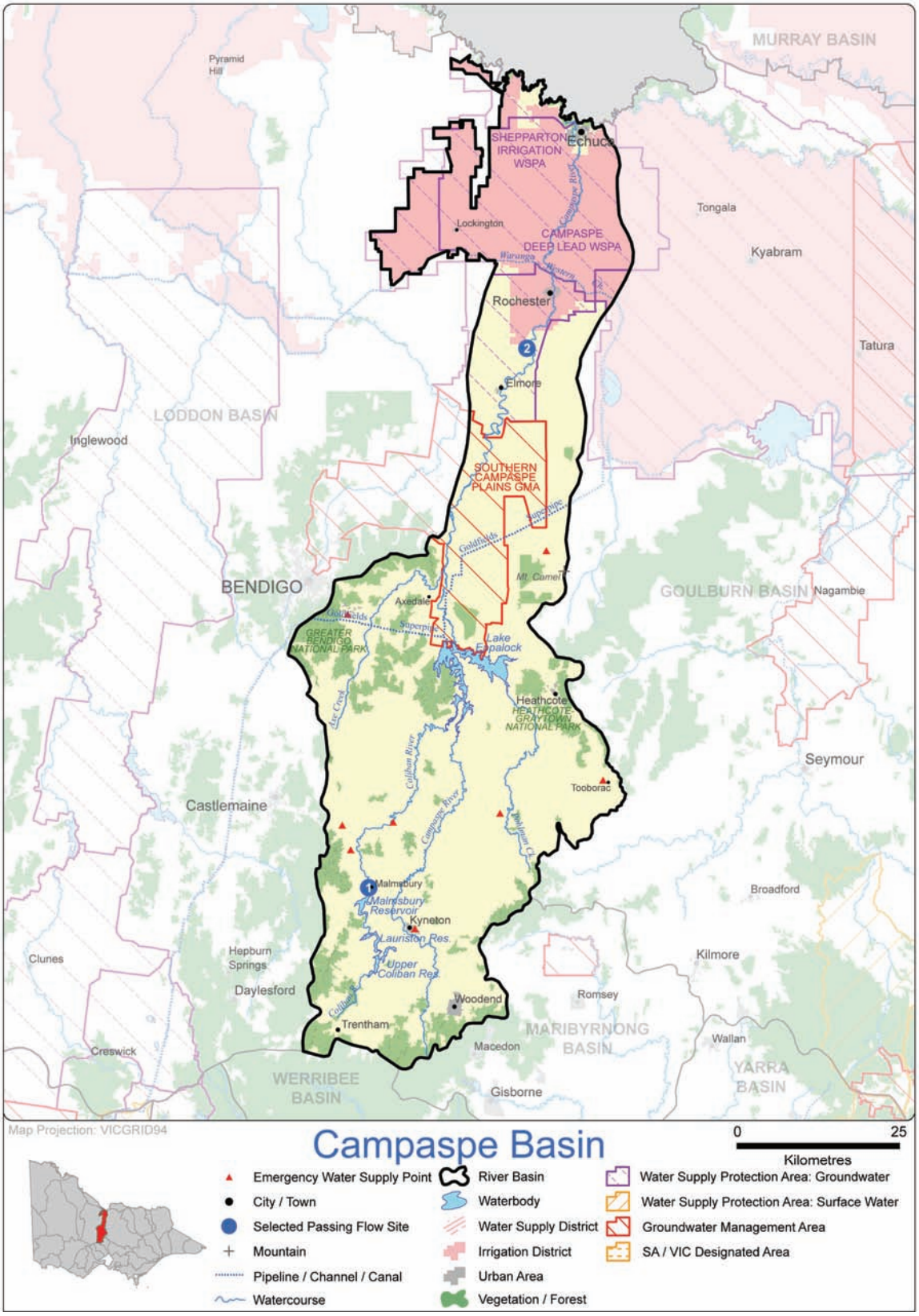
(3) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

11.4.1 Infrastructure projects to improve water availability

The Goldfields Superpipe connecting the Waranga Main Channel at Colbinnabin in the Goulburn basin to Bendigo via Lake Eppalock was commissioned in September 2007. Stage 2 of the pipeline connecting to Ballarat was completed in May 2008.

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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	7,300	29,300
Volume in storage at end of year	28,100	7,300
Change in storage	**20,800**	**-22,000**
Inflows		
Catchment inflow(1)	93,400	34,500
Return flow from irrigation	0	0
Waranga Western Channel to River Murray via Campaspe River	2,410	0
Waranga Western Channel to Goldfields Superpipe	11,100	n/a
Treated wastewater discharged back to river	150	90
Sub-total	**107,100**	**34,600**
Usage		
Urban diversions	11,600	11,470
Coliban Channel rural diversions	8,100	1,600
Campaspe Irrigation District diversions	4,900	600
Licensed diversions from regulated streams	1,100	100
Licensed diversions from unregulated streams	1,300	200
Small catchment dams(2)	28,800	19,100
Campaspe River to Waranga Western Channel	0	0
Sub-total	**55,800**	**33,100**
Losses		
Net evaporation losses from major storages	2,000	3,500
Losses from small catchment dams(2)	14,800	14,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	2,000	1,500
Sub-total	**18,800**	**19,200**
Water passed at outlet of basin		
Campaspe River outflow to River Murray	11,700	4,300

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) 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 2007/08 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, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,000	7,500	n/a
Registered commercial and irrigation	25,300	21,300	n/a
Total	**40,300**	**28,800**	**43,600**

n/a: Information not available.

11.6.3 Water entitlement transfers

Due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007, transfer data for the 2006/07 year is difficult to compare to 2007/08. In these systems permanent entitlement transfers are comparable to change of location of water shares, while temporary transfers are now referred to as transfer of allocation.

A summary of the transfer of entitlements in the Campaspe basin is shown in Table 11-5. There was a net export of water from the basin in 2007/08, with 1,129 ML of high reliability water shares, 186 ML of low reliability water shares and 456 ML of water allocation being transferred from the basin. In 2006/07 there was also a net export of permanent entitlements, however there was a net import of temporary water that year.

In addition to the Campaspe basin transfers summarised in Table 11-5, Coliban Water also purchased 8,440 ML of water shares from Goulburn system irrigators to augment its Campaspe system bulk entitlement. Following purchase, this water was assigned to the non-water user category within the Water Register and therefore does not appear as a trade in to the Campaspe trading zones in Table 11-5.

Table 11-5 Transfer of entitlements in the Campaspe basin

Trading zone	Change of location of water shares					Transfer of allocation			
	Reliability	Bought (ML)[1]	Sold (ML)[1]	Number of trans-actions[1]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
4A Campaspe – Eppalock to Waranga Western Channel	High				-687	1134	1540	122	-406
	Low				-183				
4C Lower Campaspe	High				-442	25	75	8	-50
	Low				-3				
Total 2007/08					**-1315**	**1159**	**1615**	**130**	**-456**
Total 2006/07[4]					**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:

(1) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

(2) The transfer of water shares from zone 4A is based on the transfer for the Campaspe River delivery system.

(3) The transfer of water shares from zone 4C is based on the transfer for the Campaspe Irrigation District delivery system.

(4) Comparable transfer information not available for 2006/07.

n/a: Information not available.

11.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 11-6.

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. 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 11-6 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[2][3]
Coliban Water					
Axedale and Goornong[4]	1	215	0	56	Yes
Part Rochester[4]	10	134	0	0	Yes
Coliban System [5]	3	50,260	4,874	8,987	Yes
Western Water					
Woodend	1	802	0	488	Yes
Goulburn-Murray Water					
Campaspe System	10	83,590	0	5,950	Yes
Environment Minister					
Campaspe River – Living Murray[7]	1	5,085	0	0	Yes
Total annual volume of bulk entitlements 2007/08		**140,086**	**4,874**	**15,481**	
Total annual volume of bulk entitlements 2006/07		**135,001**	**124**	**13,726**	
Licensed diversions from unregulated streams 2007/08[6]		*9,238*		*1,300*	
Licensed diversions from unregulated streams 2006/07		*8,710*		*200*	

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 2007/08.

(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 2007/08 due to a qualification of rights.

(5) Coliban Water purchased 8,440 ML of water shares from Goulburn irrigators in 2007/08 to augment its Campaspe bulk entitlement.

(6) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

(7) Added in 2007/08

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 11-7.

The Campaspe basin contains part of the Campaspe Deep Lead WSPA, the Shepparton WSPA and the Southern Campaspe Plains GMA. The Ellesmere GMA, which was reported in the Campaspe basin 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 within unincorporated areas are detailed in Appendix A.

Groundwater usage in the Campaspe basin reduced in 2007/08 compared with 2006/07. This is predominantly due to a reduction in extractions from the Shepparton WSPA. Licenced groundwater users in the Shepparton WSPA access the shallow groundwater system, and as groundwater levels dropped during 2007/08, many users could not access as much water. Also, some Shepparton WSPA groundwater licences require shandying with surface water to improve water quality and, as less surface water was available, less groundwater was extracted.

Extractions from the Campaspe Deep Lead WSPA were restricted to a 70% allocation during 2007/08.

Table 11-7 Licensed groundwater volumes, Campaspe basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Campaspe Deep Lead WSPA (82%)	>25	38,633	37,690	23,254	0	23,254	28,422
Shepparton WSPA (12%)	≤25	26,427	26,427	10,251	0	10,251	13,052
Southern Campaspe Plains GMA (55%)[6]	All depths	4,897	4,368	1,622	0	1,622	398
Total (7)		**69,957**	**68,486**	**35,128**	**0**	**35,128**	**41,872**

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) Groundwater use for 2006/07 for the Southern Campaspe Plains GMA is based on the reported 2006/07 use for Ellesmere GMA. Whilst many licences included in the former Ellesmere GMA have been incorporated in the Southern Campaspe Plains GMA, the areas covered by the GMAs are not identical, and the Southern Campaspe Plains GMA includes a higher entitlement volume than the former Ellesmere GMA.

(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 11-8.

Table 11-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Southern Campaspe Plains GMA (55%)	7	14
Campaspe Deep Lead WSPA (82%)	69	138
Shepparton WSPA (12%)	62	124
Total	**138**	**276**

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 11-7.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The number of bores is less than those reported in 2006/07 which included bores from the state groundwater management system and other unregistered domestic and stock bores.

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

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 11-9. The volume of groundwater supplied to these towns was less than 2006/07 due to increased availability of surface water.

Table 11-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Elmore[1]	284	281	258
Trentham[2]	48	36	119
Total	**332**	**217**	**377**

Note:

(1) Metered use for Elmore includes 100 ML of traded-in water.

(2) The 2006/07 metered use included 33 ML from a groundwater bore (with a licensed volume of 48 ML) and 86 ML from a spring. The licence for the spring has not yet been finalised.

11.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Campaspe basin in 2007/08. These include:

- temporary qualification of rights
- restricting urban and rural water use (discussed below)
- water carting to Axedale from Bendigo
- purchase of water shares and water allocation from water share owners in the Goulburn system to enable the use of the Goldfields Superpipe to supplement supplies for the Bendigo and Ballarat regions
- 2,409 ML from the Goulburn Valley account made available to improve the environmental habitat of the Camapspe River downstream of the Campaspe Siphon.

The Minister for Water declared one qualification of rights in the Campaspe basin in 2007/08. Details of this qualification are presented in Table 11-10.

Table 11-10 Qualifications of rights

Qualification type	Qualification description
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 Campaspe system seasonal allocation was less than 50%. Commercial and industrial users' rights qualified to enable them to take water for limited purposes when the Campaspe system season allocation was less than 50%. Dates: 1 July 2007 to 30 June 2008
Amended passing flow	Bulk Entitlement (Campaspe System – Goulburn-Murray Water) Conversion Order 2000 and Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999 qualified by removing passing flow requirements below Lake Eppalock and holding the environment's water in Lake Eppalock for later release to target environmental objectives. Dates: 1 July 2007 to 30 June 2008
Amended passing flow	Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999 qualified by removing passing flow requirements on the Coliban River downstream of Malmsbury Reservoir. Witheld passing flows were reallocated for consumptive use (70%) and environmental reserve (30%). Dates: 1 July 2007 to 30 June 2008
Differential access by priority entitlements	Bulk Entitlement (Axedale, Goornong and Rochester) Conversion Order 1999 qualified by removing the supply restriction rules and providing an annual volume of up to 31.5 ML to supply Axedale and Goornong. Coliban Water's obligation to supply Rochester under this bulk entitlement also removed. Dates: 1 July 2007 to Oct 2007 to 70%
Groundwater	Allocations increased for licence holders in the Campaspe Deep Lead water supply protection area to ensure farming enterprises in the region can continue. Dates: 18 December 2007 to 30 June 2008

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 11-11. Most towns in the Campaspe basin remained on water restrictions throughout 2007/08.

Table 11-11 Seasonal allocations and restrictions on water use in Campaspe basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Axedale	Stage 4 restrictions from July 2007 to June 2008
	Echuca	Stage 4 restrictions from July to December 2007, Stage 3 from January to June 2008
	Rochester	Stage 4 restrictions from July to December 2007, Stage 3 from January to June 2008
	Elmore	Stage 1 restrictions from July 2007 to June 2008
	Trentham	Stage 1 restrictions from July to September 2007
	Woodend	Stage 3a restrictions from July 2007 to June 2008
Irrigation and regulated diversions	Campaspe Irrigation District	Allocation began year at 0% of entitlement, increasing to 18% in April 2008
	Coliban rural supply system	Opening allocation of licensed volume of 30% in September 2007, increased to 35% by June 2008.
Licensed diversions on unregulated streams	Wanalta Creek	Irrigation ban September 2007 to June 2008
Groundwater	Campaspe Deep Lead WSPA	Allocation restricted to 70%

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 91% of the wastewater discharged from treatment plants in the basin was recycled, mostly for agricultural use (Table 11-12). This includes recycled water for the Echuca treatment plant, which was previously reported in the Murray basin.

Table 11-12 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]		
Axedale	0	0	0%	0	0	0	0	0	0
Echuca [4]	811	811	100%	0	811	0	0	0	0
Elmore	0	0	0%	0	0	0	0	0	0
Heathcote	85	85	100%	85	0	0	0	0	0
Kyneton	433	282	65%	89	193	0	0	151	0
Lockington[5]	0	0	0%	0	0	0	0	0	0
Rochester	79	79	100%	0	79	0	0	0	0
Woodend	186	186	100%	75	111	0	0	0	0
Total 2007/08	**1,594**	**1,443**	**91%**	**249**	**1,194**	**0**	**0**	**151**	**0**
Total 2006/07	1,525	1,437	94%	278	1,159	0	0	89	-1

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 the 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 within that basin.

In 2007/08 the Campaspe basin EWR comprised the following components:

- the Campaspe River Living Murray environmental entitlement
- water set aside for environment by the temporary qualification of rights described in Table 11-10
- 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)
- 2,409 ML from the Goulburn Valley account made available to improve the environmental habitat of the Camapspe River downstream of the Campaspe Siphon
- 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 11-10, the passing flow requirements on the Coliban River downstream of Malmsbury Reservoir were waived during 2007/08 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. Water saved by this action was held in Lake Eppalock for later release to target environmental objectives.

Table 11-13 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 11-13 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 2007/08 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 2007/08, 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

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

For the second consecutive year, inflows in the Loddon basin were extremely low at 14% of the long term average. Water levels in store barely recovered and, by the end of the year, were holding 6.2% of capacity.

In response to low inflows, water resource management in the regulated Loddon and Bullarook systems focussed on ensuring essential supplies for towns and for domestic and stock use. This required the Minister for Water to qualify rights to make sufficient supplies available at low allocation levels and to reduce environmental flows to retain water in storage.

Maryborough also experienced severe water shortages, requiring the Minister to qualify rights to reduce environmental flows downstream of Tullaroop reservoir to retain water for town supplies. Central Highlands Water also accessed water below the operating level of Tullaroop reservoir to ensure supplies could be delivered to Maryborough.

The Loddon system began the year with a 0% allocation, which had increased to 5% by April 2008. The Bullarook system did not receive an allocation in 2007/08. As with all of the major northern Victorian systems, water resource improvements after April 1 were reserved for the 2008/09 season.

Towns supplied from the Loddon system were subjected to severe restrictions for the entire year due to the severe water shortage. Licensed diverters across most of the basin were banned from taking water for the entire year.

Daylesford was the only local urban system where restrictions were eased during the year. Restrictions were also eased slightly for towns located in the north of the basin because they are supplied from the Goulburn system. Towns supplied by groundwater were not as severely affected by the water shortage and were generally subject to low restrictions during the year.

Groundwater use remained high in response to low surface water availability. Only licensed diverters in the Spring Hill and Campaspe Deep Lead were restricted.

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, 2007/08

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 2007/08

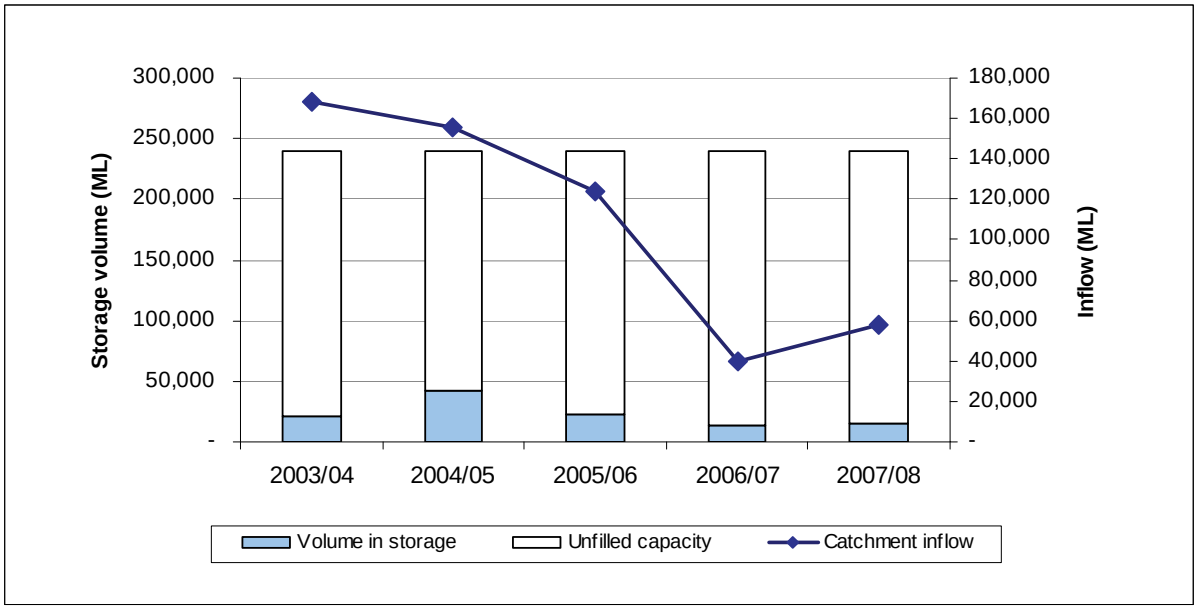
In 2007/08, rainfall across the Loddon basin ranged between 60% and 80% of the long term average. However, after successive years of lower than average rainfall, inflows were only 14% of the long term average of 415,000 ML and were only slightly higher than inflows experienced in in 2006/07.

The amount of water flowing from the Loddon basin into the River Murray was 3,400 ML in 2007/08. This represents 6% of the total inflows into the basin, similar to the 7% in 2006/07.

The volume of water held in major storages (greater than 1,000 ML capacity) increased marginally from 13,600 ML at the beginning of the year to 15,000 ML, or 6% of capacity by the end of the year.

Only volumes for major on-stream storages have been included in the water balance. The volume of water in on-stream storages (including Laanecoorie, Cairn Curran, Tullaroop and Newlyn Reservoirs and Hepburn Lagoon) increased by 300 ML to 11,900 ML. Cairn Curran Reservoir, which comprises nearly two-thirds of the storage capacity in the basin, finished the year with 7,000 ML in storage – or 5% full.

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 2007/08 increased by 7,700 ML compared with the previous year, while groundwater use declined by 3,200 ML.

Table 12-2 Summary of total water resources and water use in the Loddon basin, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	59,900	38,300
Groundwater[2]	57,400	31,800
Recycled water	6,540	2,390

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 12-7 and the estimated domestic and stock use as presented in Table 12-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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 2007/08.

The Catumnal Pipeline Project, which replaced the Catumnal domestic and stock area earthern channel with a pipeline, was completed in March 2008. The loss savings were transferred as water entitlement to Coliban Water.

During 2007/08, Coliban Water continued the construction of a pipeline to transfer 4,300 ML of recycled water from Epsom recycled water plant to Spring Gully Reservoir. The project commenced in August 2006 and is due to be completed in September 2008. Recycled water started flowing to some of Coliban Water's rural customers for the first time in November 2007.

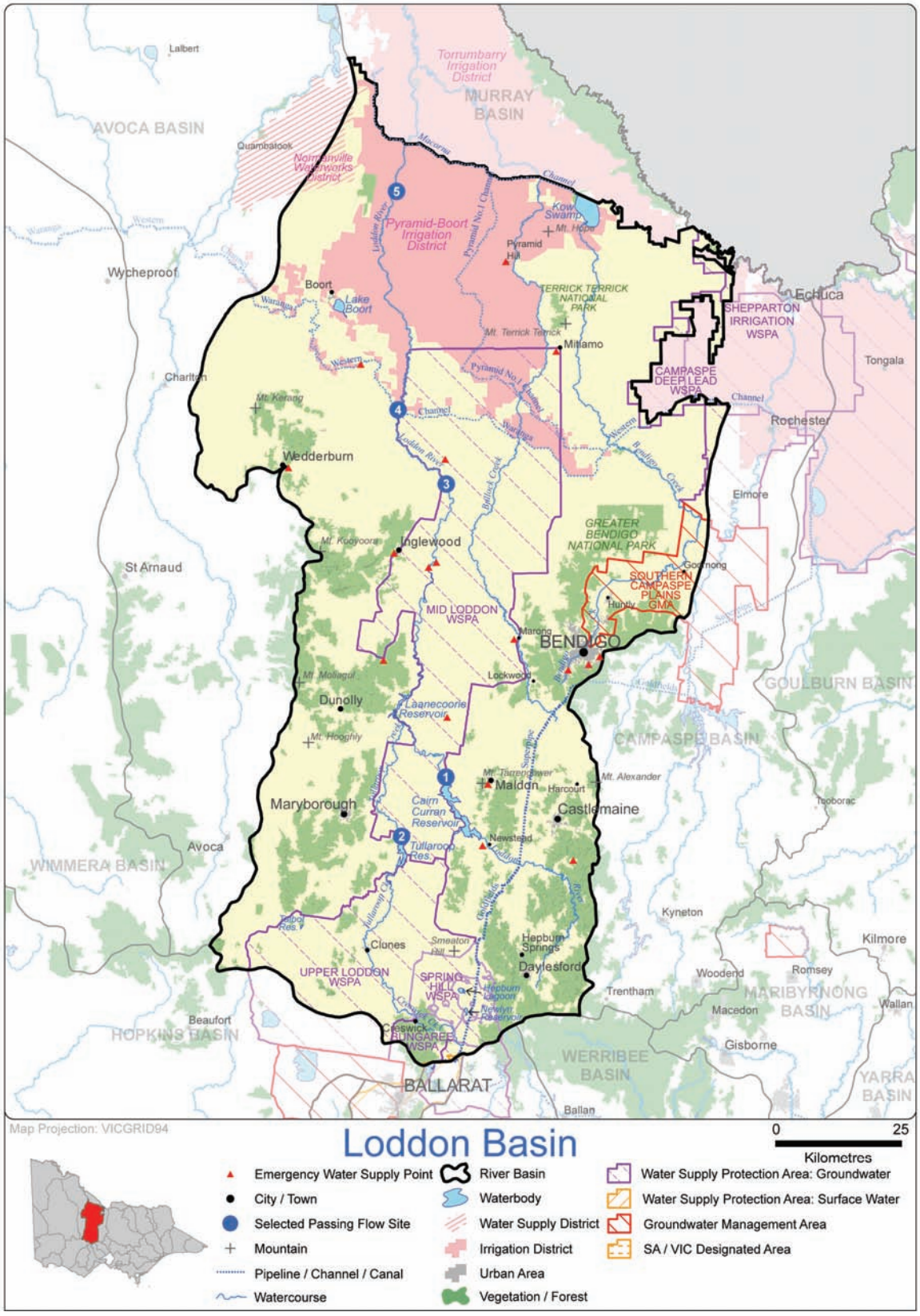
In January 2008, Central Highlands Water completed the Newlyn Reservoir pipeline and pump station which connects Newlyn Reservoir to Cosgrave Reservoir for the purpose of augmenting Ballarat's water supply.

Temporary pumps were installed at Tullaroop Reservoir in March 2008 to pump dead storage and ensure supply to Maryborough while maintaining environmental flow requirements.

Central Highlands Water has committed to the Moolort groundwater project, which will provide an additional 505 ML of water entitlement annually to augment urban water supply. The project is scheduled for completion in August 2008.

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 streams were again very low in 2007/08, with a 5% allocation on the Loddon system. However, diversions from unregulated streams were more than double those for the previous year.

Table 12-3 Balance of surface water in the Loddon basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	11,600	21,100
Volume in storage at end of year	11,900	11,600
Change in storage	**300**	**-9,500**
Inflows		
Catchment inflow(1)	57,900	39,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,960	4,560
Sub-total	**59,900**	**44,500**
Usage		
Urban diversions	2,500	2,680
Licensed diversions and irrigation diversions from regulated streams	500	1,300
Licensed diversions from unregulated streams	13,800	5,100
Small catchment dams(2)	21,500	21,500
Sub-total	**38,300**	**30,600**
Losses		
Net evaporation losses from major storages	5,800	4,500
Losses from small catchment dams(2)	5,500	5,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	6,600	10,600
Sub-total	**17,900**	**20,600**
Water passed at outlet of basin		
Loddon River outflow to River Murray (Appin South)	100	1,300
Wandella Creek at Fairlea(4)	n/a	n/a
Mount Hope Creek at Mitiamo	3,300	1,500
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.

12.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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

Due to the unbundling of water entitlements in the regulated systems of northern Victoria on 1 July 2007, transfer data for the 2006/07 year is difficult to compare to 2007/08. In these systems, permanent entitlement transfers are comparable to change of location of water shares, while temporary transfers are now referred to as transfer of allocation. Because entitlements in the unregulated systems have not been unbundled, the old terminology still applies in these systems.

A summary of the transfer of entitlements into and out of the Loddon basin is shown in Table 11-5. The majority of trading activity in the Loddon basin occurred within zone 1B Boort, with a net export of both water shares and allocation out of the basin in 2007/08.

Table 12-5 Transfer of entitlements in the Loddon basin

Trading zone	Change of location of water shares[1]					Transfer of allocation[1]			
	Reliability	Bought (ML)[2]	Sold (ML)[2]	Number of trans-actions[2]	Net transfer to zone (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to zone (ML)
1B Boort[3]	High				-9,343	13,931	18,888	664	-4,957
	Low				1,680				
5A Loddon - C/Tull to LWP[4]	High				-2	428	391	86	37
	Low				0				
5B Bullarook[5]	High				0	0	0	0	0
	Low				0				
150 Loddon Unregulated	Licence volume				0	0	50	1	-50
151 Lower Loddon Unregulated	Licence volume				0	5	5	1	0
Total 2007/08					**-7,665**	**14,364**	**19,334**	**752**	**-4,970**
Total 2006/07[6]					**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Note:

(1) For trading zones 150 and 151, change of location of water shares should be read as permanent entitlement transfers, and transfer of allocation should be read as temporary transfer of entitlement.

(2) Details of the transactions relating to change of location of water shares were not available for the *Victorian Water Accounts 2007-2008* following the changed arrangements resulting from unbundling. A methodology to enable the provision of this data for the *Victorian Water Accounts 2008-2009* is being developed.

(3) The transfer of water shares from zone 1B is based on the transfer for the Pyramid-Boort delivery system.

(4) The transfer of water shares from zone 5A is based on the transfer for the Loddon River delivery system.

(5) The transfer of water shares from zone 5B is based on the transfer for the Bullarook Creek delivery system.

(6) Comparable transfer information not available for 2006/07.

12.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 12-6. 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.

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

Table 12-6 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(1)
Central Highlands Water					
Creswick	1	500	0	371	Yes
Daylesford	1	916	0	668	Yes
Lexton	1	45	0	17	Yes
Loddon System (part Maryborough)	1	1,200	0	897	Yes
Evansford and Talbot System (part Maryborough)	1	3,000	0	222	Yes
Coliban Water					
Loddon system	1	820	8	295	Yes
Goulburn-Murray Water					
Bullarook Creek(2)	1	n/a	n/a	4	n/a
Loddon	1	126,400	0	512	Yes
Environment Minister					
Loddon River – Environmental Reserve	1	2,000	0	0	Yes
Total annual volume of bulk entitlements 2007/08		**134,621**	**8**	**2,986**	
Total annual volume of bulk entitlements 2006/07		**121,242**	**-110**	**3,932**	
Licensed diversions from unregulated streams 2007/08(3)		*27,949*		*13,800*	
Licensed diversions from unregulated streams 2006/07		*30,596*		*5,100*	

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 2007/08.

(2) This bulk entitlement is yet to be formally legislated.

(3) Increase in bulk entitlement volume from 2006/07 to 2007/08 is a result of improved accounting methods.

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 12-7.

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 and 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 was slightly reduced in volume for 2007/08 compared with 2006/07 volumes. This is believed to be result of higher availability of surface water resources in 2007/08. Groundwater licences in the Spring Hill WSPA and the Campaspe Deep Lead WSPA were subject to restrictions during 2007/08.

Table 12-7 Licensed groundwater volumes, Loddon basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Bungaree WSPA (10%)[6]	All depths	515	520	288	0	288	354
Campaspe Deep Lead WSPA (8%)	>25	3,944	3,848	2,374	0	2,374	2,901
Mid Loddon WSPA (100%)	All depths	37,200	34,014	21,382	0	21,382	22,851
Spring Hill WSPA (100%)	≤70 all zones except Cones (all depths)	5,062	4,909	2,156	0	2,156	2,491
Upper Loddon WSPA (76%)	All depths	10,366	9,987	3,629	0	3,629	4,704
Southern Campaspe Plains GMA (45%)[7]	All depths	3,954	3,527	1,310	0	1,310	970
Total[8]		**61,041**	**56,805**	**31,139**	**0**	**31,138**	**34,271**

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) In non-metered areas, Goulburn-Murray Water has provided an estimate of use.

(6) The licensed entitlement volume for Bungaree WSPA is greater than its PCV because it includes 70 ML per annum of Mineral Water License. The PCV for Bungaree WSPA is currently being revised to include this volume.

(7) Groundwater use for 2006/07 for the Southern Campaspe Plains GMA is based on the reported 2006/07 use for Ellesmere GMA. Whilst many licences included in the former Ellesmere GMA have been incorporated in the Southern Campaspe Plains GMA, the areas covered by the GMAs are not identical, and the Southern Campaspe Plains GMA includes a higher entitlement volume than the former Ellesmere GMA.

(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 12-8.

Table 12-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Bungaree WSPA (10%)	30	60
Campaspe Deep Lead WSPA (8%)	7	14
Mid Loddon WSPA (100%)[4]	93	242
Spring Hill WSPA (100%)	52	104
Upper Loddon WSPA (76%)	93	186
Southern Campaspe Plains GMA (45%)	6	12
Total	**281**	**618**

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 12-7.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The numbers of domestic and stock bores are those in the Victorian Water Register except where data for the groundwater management unit is not included in the register (e.g. Bungaree WSPA) where the numbers are those registered in the state database as being drilled since 1965.

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

(4) Assuming 2.6 ML/bore.

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 12-9.

Table 12-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Clunes	350	234	261
Dean	30	14	17
Forest Hill	350	154	179
Learmonth	100	51	66
Waubra	100	33	34
Total	**930**	**486**	**557**

12.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Loddon basin in 2007/08. These include:

- temporary qualification of rights
- restricting urban and rural water use (discussed below)
- carting water from Bendigo to Raywood, Sebastian and Serpentine
- pumping dead storage from Tullaroop Reservoir to maintain environmental flows
- purchase of water allocations from the Goulburn system to enable the use of the Goldfields Superpipe to supplement supplies for the Bendigo and Ballarat regions.

The Minister for Water declared two qualification of rights in the Loddon basin in 2007/08. Details of these qualifications are presented in Table 9-10 below.

Table 12-10 Qualifications of rights

Qualification type	Qualification description
Differential access by priority entitlement	Rights qualified to enable domestic and stock users to take from the Loddon system the volume of water necessary for essential needs (such as household purposes, fire fighting) when the Loddon system allocation was less than 50%. Commercial and industrial users' rights qualified to enable them to take water for limited purposes when the Loddon system allocation was less than 50%. Dates: 1 July 2007 ongoing to 30 June 2008
Differential access by priority entitlement	Rights qualified to enable domestic and stock users to take water from the Bullarook system the volume of water necessary for essential needs (such as household purposes, fire fighting) when the Bullarook system allocation was less than 50%. Commercial and industrial users' rights qualified to enable them to take water for limited purposes when the Bullarook system allocation was less than 50%. Dates: 1 July 2007 ongoing to 30 June 2008
Amend passing flow requirements	Changed the Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005 and the Bulk Entitlement (Loddon River – Environmental Reserve) Conversion Order 2005 to reduce passing flows downstream of Laanecoorie, Cairn Curran and Tullaroop Reservoirs, and Serpentine and Loddon Weirs. This action extended the period over which flows could be released down the Loddon River to allow domestic and stock customers access to water. The qualification also required Goulburn-Murray Water to record the volume of water that would otherwise be released as environmental flows in a deficit account, which is available for release when allocations reach 100%. Dates: 1 July 2007 ongoing to 30 June 2008
Amend passing flow requirements	Changed the *Bulk Entitlement (Creswick) Conversion Order 2004* to remove the obligation on Central Highlands Water to supply minimum flows in Creswick Creek until the township of Creswick is no longer subject to Stage 4 water restrictions. Dates: 1 July 2007 ongoing to 30 June 2008
Urban rights	Changed *the Bulk Entitlement (Loddon System – Part Maryborough – Central Highlands Water)* Conversion Order 2005 to temporarily allocate 1,200 ML to Maryborough from Tullaroop Reservoir to maintain essential supplies in the Maryborough system. Dates: 1 July 2007 ongoing to 30 June 2008
Urban rights	Changes to the *Bulk Entitlement (Loddon System - Coliban Water) Conversion Order 2005* so that when the allocation in the Loddon System is less than 50%, Coliban Water can take up to 410 ML per annum to supply its townships. Dates: 1 July 2007 ongoing to 30 June 2008
Primary entitlements	Remove the obligation in the *Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005* to supply the East Loddon Waterworks when the allocation is less than 50%. Dates: 1 July 2007 ongoing to 30 June 2008
Groundwater	Allocations increased for licence holders in the Campaspe Deep Lead water supply protection area to ensure farming enterprises in the region can continue. Dates: 18 December 2007 to 30 June 2008

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 in Table 12-11. Most towns on restrictions during 2006/07 continued to be restricted during 2007/08, however in many cases the level of restriction was reduced during the year.

Table 12-11 Seasonal allocations and restrictions on water use in Loddon basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Maryborough system (Maryborough, Creswick, Talbot)	Stage 4 restrictions from July 2007 to June 2008
	Learmonth, Waubra, Dean	Stage 1 restrictions from July 2007 to June 2008
	Forest Hill	Stage 2 restrictions from July to October 2007 and Stage 3 from November 2007 to June 2008
	Clunes	Stage 1 restrictions from April to October 2007 and Stage 2 from November 2007 to June 2008
	Daylesford, Hepburn Springs, Hepburn	Stage 3 restrictions from July to October 2007 and Stage 2 from November 2007 to June 2008.
	Lexton	Stage 3 restrictions from July 2007 to June 2008
	Bendigo and region	Stage 4 restrictions from July 2007 to September 2008
	Bridgewater, Inglewood, Laanecoorie, Bealiba, Dunolly, Tarnagulla, Jarklin and Serpentine	Stage 4 restrictions from July 2007 to June 2008
	Borong, Korong Vale, Wedderburn, Wychitella	Stage 4 restrictions from July 2007 to June 2008
	Boort, Pyramid Hill, Lockington, Mysia, Mitiamo, Dingee, Macorna	Stage 4 restrictions from July to December 2007, Stage 3 from January to June 2008
	Goornong	Stage 4 restrictions from July 2007 to June 2008
Unregulated diversions	Barkers Creek, Lower Loddon River below Fernihurst Weir, Jim Crowe Creek, Campbells Creek, Leitch's Creek, Green Gully Creek, Joyces Creek, Muckleford Creek, Sailers Creek, Upper Loddon River (above Cairn Curran), Lake Meran, Wallaby Creek, Wombat Creek, Coghills Creek, McCallum Creek	Irrigation ban July 2007 to June 2008
	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 2007 to June 2008
Irrigation and regulated diversions	Loddon system	Allocation began the year at 0% of entitlement, increasing to 5% by April 2008
	Coliban rural	Opening allocation of licensed volume of 30% in September 2007, increased to 35% by June 2008
	Bullarook Creek system – Hepburn's Lagoon	Allocation was 0% for the entire season
Groundwater	Campaspe Deep Lead WSPA	Allocations restricted to 70%
	Spring Hill WSPA	Allocations restricted to 80% in zone 1002, and 65% in zone 1003

12.10 Recycled water

Coliban Water and Central Highlands Water operate wastewater treatment plants in the Loddon basin. The volume of water recycled in the basin reduced slightly from 2,520 ML in 2006/07 to 2,389 ML in 2007/08, however due to lower production volumes in 2007/08, the proportion of wastewater recycled increased by 5% (Table 12-12).

Table 12-12 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]		
Bendigo	4,329	1,940	45%	1,000	940	0	0	1,195	1,194
Boort[4]	0	0	0%	0	0	0	0	0	0
Bridgewater / Inglewood	-	-	-	-	-	-	-	-	-
Castlemaine	857	93	11%	93	0	0	0	764	0
Clunes	21	0	0%	0	0	0	0	0	21
Creswick	272	28	10%	28	0	0	0	0	244
Daylesford	354	159	45%	19	140	0	0	0	195
Dunolly[4]	0	0	0%	0	0	0	0	0	0
Kerang	386	0	0%	0	0	0	0	0	386
Maryborough	325	169	52%	114	55	0	0	0	156
Pyramid Hill[4]	0	0	0%	0	0	0	0	0	0
Wedderburn[4]	0	0	0%	0	0	0	0	0	0
Total 2007/08	**6,544**	**2,389**	**37%**	**1,254**	**1,135**	**0**	**0**	**1,959**	**2,196**
Total 2006/07	7,853	2,520	32%	1,519	1,001	0	0	4,562	771

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 within that basin.

In 2007/08 the Loddon basin EWR comprised the following components:

- the Loddon River environmental reserve of 2,000 ML held by the Environment Minister
- water set aside for the environment by the temporary qualification of rights described in Table 9-10
- 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)
- all other 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.

12.11.2 Entitlements for the environment

The environment's formal entitlements in the Loddon basin in 2007/08 comprised the Bulk Entitlement (Loddon River Environmental Reserve) 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 9-10, a number of Loddon passing flow requirements were qualified in 2007/08. Goulburn-Murray Water, Coliban Water and Central Highlands Water reported meeting all qualified passing flow requirements in the Loddon basin in 2007/08.

Table 12-3 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 12-13 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 2007/08, 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 2007/08, 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 2007/08, 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 2007/08, 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 2007/08, 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

Despite improving in 2006/07, inflows into the Avoca basin were again well below the long term average. For another year, no water flowed to the basin's terminal lakes located in the north of the basin.

With the exception of Amphitheatre and Quambatook, towns in the basin are either supplied by groundwater or from surface water from the Wimmera/Glenelg and Murray basins. Towns supplied from surface water from outside the basin were placed on severe restrictions for the entire year due to low water availability. Restrictions were less severe for towns supplied by groundwater.

Amphitheatre and Quambatook, which are supplied from the Goulburn system, were placed on severe restrictions at the start of the year in line with the uniform restriction policy applied across northern Victoria at the start of the year. Restrictions were eased as water availability improved.

Irrigation bans were in force on 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, 2007/08

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.

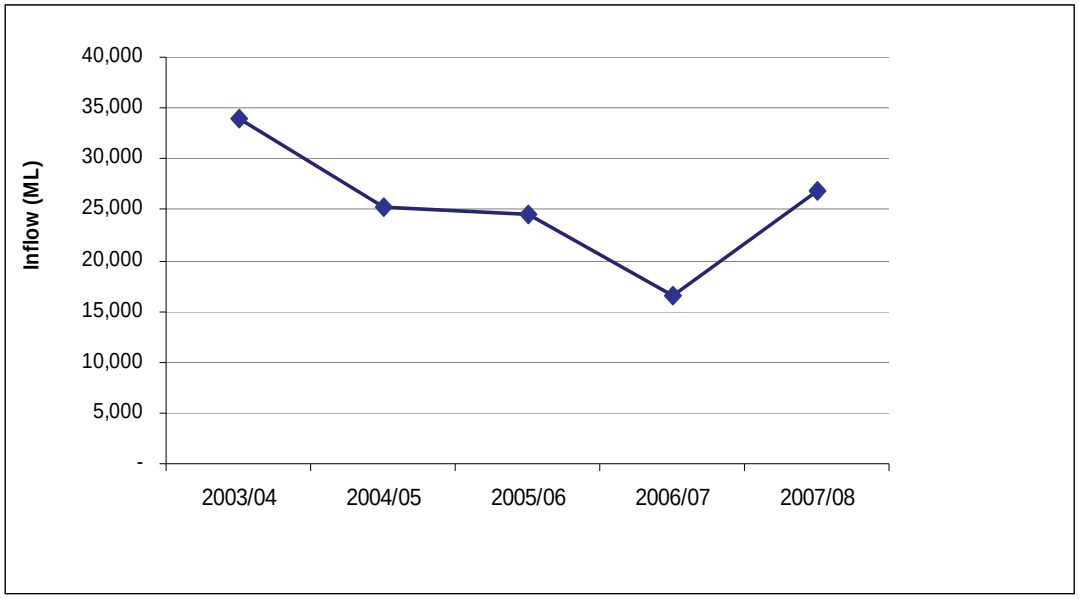
13.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall across the Avoca basin ranged between 40% and 80% of the long term average. The ongoing drought, particularly severe in the west of the state, continued to impact streamflows. However, streamflows did increase slightly to 20% of the long term average (of 136,200 ML) in 2007/08, from 12% of the long term average in 2006/07.

Again 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 2004/05, 2005/06 or 2006/07.

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 2007/08 increased by more than 50% from the previous year, although very little specific information is available on small catchment dams, which are the main supply source in the basin.

Table 13-2 Summary of total water resources and water use in the Avoca basin, 2007/08

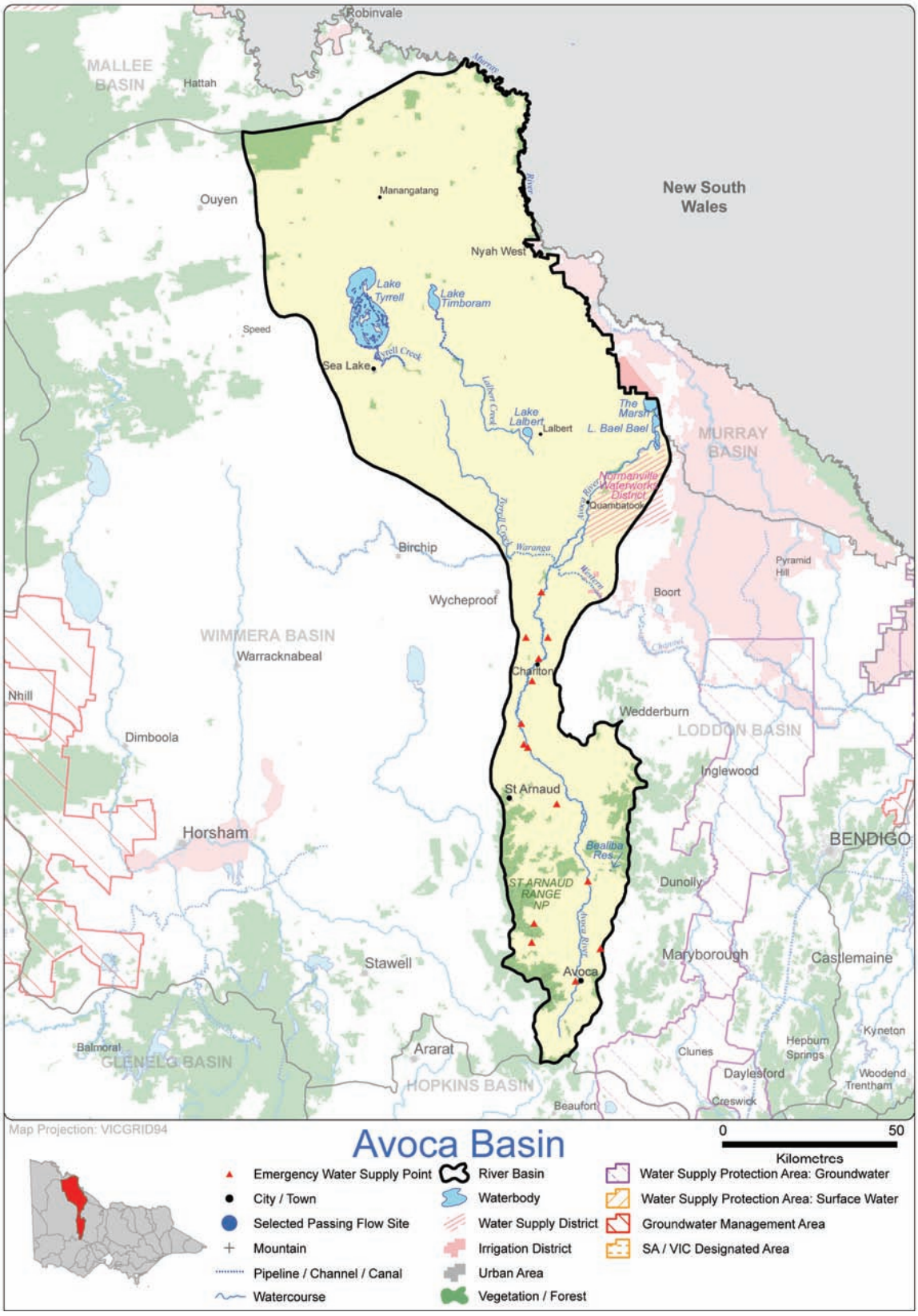
Water source	Total water resource (ML)	Total use (ML)
Surface water	26,900	14,400
Groundwater(1)	250	150
Recycled water	110	90

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. There are no storages greater than 1,000 ML 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	2007/08 (ML)	2006/07 (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	26,900	16,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**26,900**	**16,500**
Usage		
Urban diversions	100	90
Licensed diversions from unregulated streams	1,600	1,600
Small catchment dams[2]	12,700	6,500
Sub-total	**14,400**	**8,200**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams[2]	9,800	6,200
In-stream infiltration to groundwater, flows to floodplain and evaporation [3]	2,700	2,100
Sub-total	**12,500**	**8,300**
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 Avon 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 2006/07.

13.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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 water entitlement transfers within the Avoca basin in 2007/08.

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 2007/08. 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
Central Highlands Water					
Amphitheatre	1	25	0	11	Yes
Avoca[(1)]	1	233	0	50	Yes
Redbank[(1)]	1	20	0	0	Yes
Total annual volume of bulk entitlements 2007/08		**278**	**0**	**61**	
Total annual volume of bulk entitlements 2006/07		**278**	**0**	**12**	
Licensed diversions from unregulated streams 2007/08		*3,621*		*1,600*	
Licensed diversions from unregulated streams 2006/07		*3,621*		*1,600*	

Notes:
(1) Urban water supply for the township of Redbank was sourced from groundwater in 2007/08.

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 and Redbank. 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 2007/08 (ML)	Metered use 2006/07 (ML)
Avoca	200	142	124
Redbank	50	6	6
Total	**250**	**148**	**130**

13.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Avoca basin in 2007/08. These include restricting urban and rural water use (as discussed below), and water carting to GWMWater domestic and stock customers as well as to the townships of Culgoa and Berriwillock. Central Highlands Water also completed construction of a drought relief bore at Amphitheatre to provide a valuable back-up supply for system during drought.

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.

Table 13-7 Seasonal allocations and restrictions on water use in Avoca basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Amphitheatre	Stage 3 restrictions from July to October 2007, Stage 2 from November 2007 to June 2008
	Avoca	Stage 1 restrictions from July to October 2007, Stage 2 from November 2007 to June 2008
	Redbank	Stage 2 restrictions from July 2007 to June 2008
	Berriwillock, Charlton, Culgoa, St Arnaud	Stage 4 restrictions from July 2007 to June 2008
	Lalbert, Manangatang, Sea Lake	Stage 4 restrictions from July 2007 to June 2008.
	Quambatook	Stage 4 restrictions from July 2007 to January 2008, and Stage 2 from February to June 2008
Unregulated licensed diversions	Avoca River, Mosquito Creek, Lake Bael Bael, Lake Lookout, Lake Marmal, Sand Hill Lake, Tchum Lake North	Irrigation ban July 2007 to June 2008
Domestic and stock farm supplies	Wimmera Mallee domestic and stock supply system	Supply to priority house dams where available between July and November 2007. From December 2007 to June 2008, supply to one dam per enterprise in most areas and limited pipeline supply in areas where the pipelining is completed

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. Recycled volumes for the Wycheproof treatment plant were previously reported in the Avoca basin, but are now being reported under the Wimmera basin.

In 2007/08, the prorportion of wastewater recycled in the Avoca basin treatment plants decreased to 85% from 100% in 2006/07, with recycled water used predominately for agricultural purposes. The volume of wastewater produced also declined from 182 ML in 2006/07 (excluding Wycheproof) to 106 ML in 2007/08.

Table 13-8 Volume of recycled water

Treatment plant [4]	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	16	0	0%	0	0	0	0	0	16
St Arnaud	90	90	100%	24	67	0	0	0	0
Total 2007/08	**106**	**90**	**85%**	**24**	**67**	**0**	**0**	**0**	**16**
Total 2006/07	182	182	100%	13	169	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.

(4) The Wycheproof treatment plant was previously reported as being located in the Avoca basin. In the 2007/08 Victorian Water Accounts the volume of recycled water from the Wycheproof treatment plant is reported in the Wimmera basin.

13.11 Water for the environment

13.11.1 Environmental Water Reserve (EWR)

In 2007/08 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 has 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 were subject to severe restrictions for the entire year due to low water availability in adjacent water systems. Restrictions were eased slightly in January for towns supplied by Lower Murray Water.

Rural users in the Wimmera Mallee open channel system (not receiving a piped water supply until 2008/09) were also severely impacted by the water shortage and were provided a very limited supply via the summer channel run. Users on this system who did not receive these supplies continued to rely on the rural water carting program for emergency supplies.

As in 2006/07, groundwater use in the basin was again very high in 2007/08 at nearly 7,000 ML. Use in the largest GMU in the basin in 2007/08, the Murrayville WSPA, was more than double that recorded in 2005/06.

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, 2007/08

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 2007/08

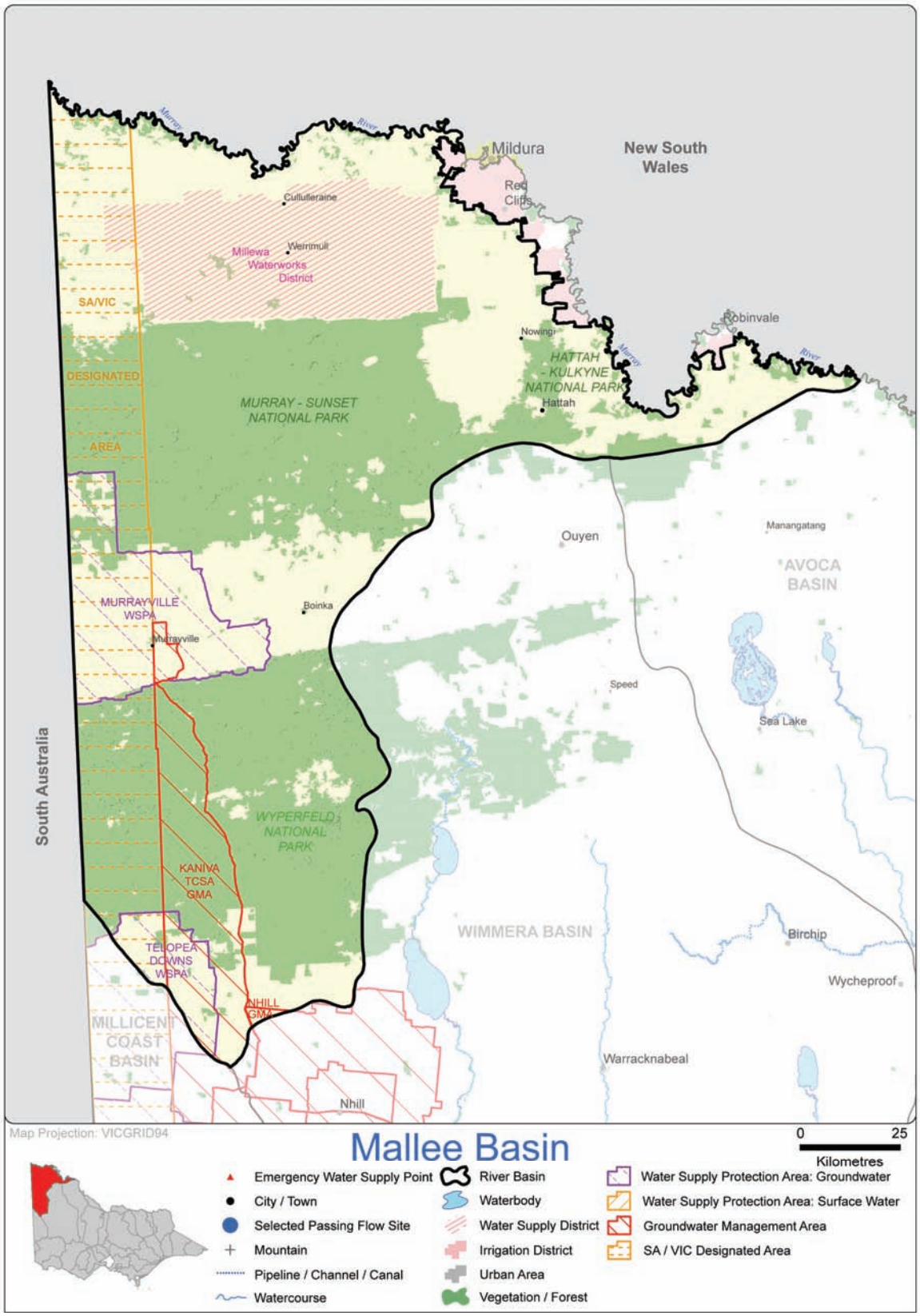
In 2007/08, rainfall across the basin generally ranged between 60% and 80% of the long term average.

The Mallee basin has no well-defined streams other than the River Murray, which runs along the entire northern edge of the basin, and has only a few small tributaries at various points close to the Murray. Since the Murray 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 2007/08.

Table 14-2 Summary of total water resources and water use in the Mallee basin, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	0	0
Groundwater[2]	13,200	7,500
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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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 2007/08.

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 2007/08 in the Mallee basin increased slightly from 2006/07.

Table 14-3 Licensed groundwater volumes, Mallee basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Kaniva TCSA GMA (83%)	Tertiary confined sand aquifer	913	0	0	0	0	0
Murrayville WSPA (100%)	70-200	10,883	9,634	6,212	0	6,212	5,423
Telopea Downs WSPA (39%)	All depths	2.925	2,925	636	0	636	900
Total [5]		**14,721**	**12,559**	**6,848**	**0**	**6,848**	**6,323**

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, 2007/08

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%)	286	572
Telopea Downs WSPA (39%)	41	82
Total	**327**	**654**

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 those in the Victorian Water Register multiplied by 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 2007/08 (ML)	Metered use 2006/07 (ML)
Cowangie	40	14	9
Murrayville	475	151	155
Total	**515**	**165**	**164**

14.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Mallee basin in 2007/08. These include restrictions on urban and rural water usage (as discussed in section 14.9) and GWMWater domestic and stock customers having access to a water carting program to provide essential watering needs.

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

A summary of the 2007/08 restrictions on water use in the Mallee basin is presented in Table 14-6.

Groundwater use was unrestricted in the Mallee basin during 2007/08.

Table 14-6 Seasonal allocations and restrictions on water use in Mallee basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Towns supplied from the Murray by the Northern Mallee Pipeline	Stage 4 restrictions from July 2007 to June 2008
	Towns supplied from Grampians via the Wimmera Mallee channel system	Stage 4 restrictions from July 2007 to June 2008
	Lower Murray Water customers	Stage 4 restrictions from July to December 2007, and Stage 3 from January to June 2008
Domestic and stock farm supplies	Wimmera Mallee domestic and stock supply system	Supply to priority house dams where available between July and November 2007. From December 2007 to June 2008 supply to one dam per enterprise in most areas, and limited pipeline supply in areas where the pipelining is completed

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 2007/08 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 2007/08. 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 2007/08 were 8% of the long term average and less than half the inflows recorded in 2006/07. After falling to their lowest levels since construction, reservoirs ended the year at 6% of capacity.

GWMWater accelerated the Wimmera Mallee Pipeline project during the year, which led to over 3,400 kilometres of pipelines being installed in 2007/08. Approximately 4,200 kilometres have been laid since construction began in 2006, providing supplies to 11 towns and around one-third of the rural customers that will eventually be connected to the new system.

Combined with the new piped water services, GWMWater was able to provide a very limited supply through the open channel systems to towns and rural customers not receiving a piped water supply until 2008/09. These actions helped reduce demand for rural carting in these areas.

The severe water shortage did mean however that GWMWater was unable to deliver water to the summer channel run area south-west of Horsham or provide an irrigation supply to the Wimmera irrigation area. Users on these systems continued to rely on the rural water carting program for emergency supplies. Licensed diverters on unregulated streams across the basin were also banned from taking water the entire year.

All Wimmera and Glenelg Rivers bulk entitlements were qualified in 2007/08 to enable GWMWater to withhold water allocated for the environment in reserve until supply conditions improve. The qualification did, however, allow for 3,659 ML of environmental water to be released down the Wimmera River from Taylors Lake and Rocklands Reservoir. This release travelled approximately 60 kilometres along the 160 kilometre waterway.

All towns supplied by the Wimmera system were on Stage 4 restrictions for the entire year. Only Landsborough, Navarre and Elmhurst were spared the severe restriction levels.

Although the volumes of groundwater use in the basin are low when compared to surface water use, extractions increased n 2007/08 in response to the reduced availability of surface water.

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, 2007/08

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.

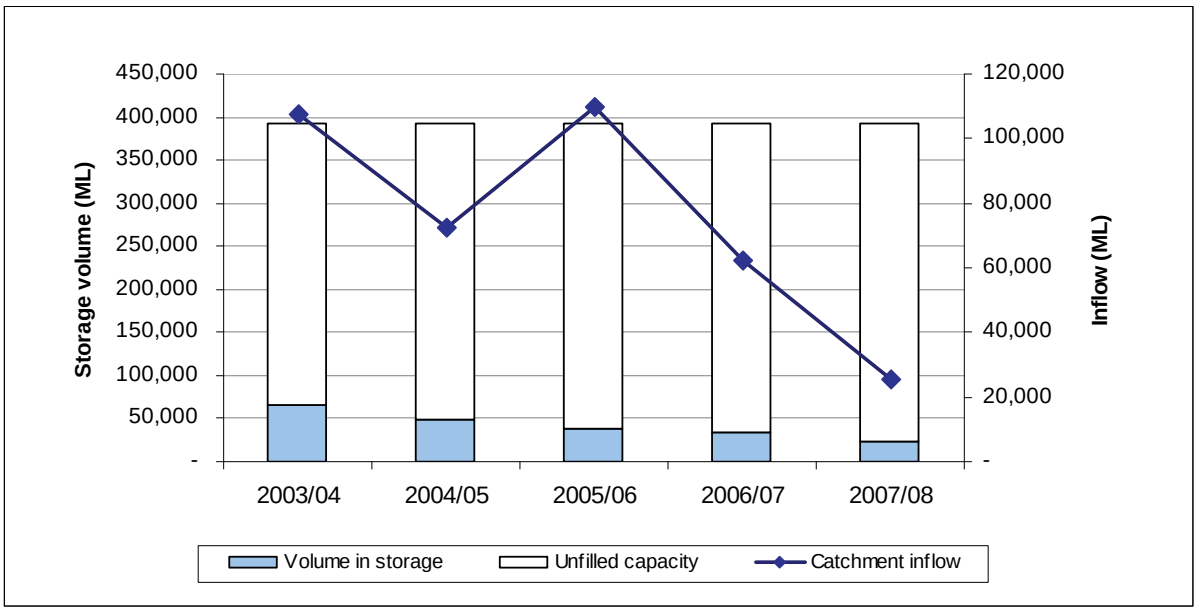
15.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall across the Wimmera basin ranged between 60% and 80% of the long term average. Catchment inflows in 2007/08 were less than half those recorded in 2006/07 and were 8% of the long term average (of 316,400 ML).

The volume of water flowing from the Wimmera basin into the terminal lakes in the basin in 2007/08 was again very low with 60 ML recorded. This represents less than 1% of total inflows into the basin.

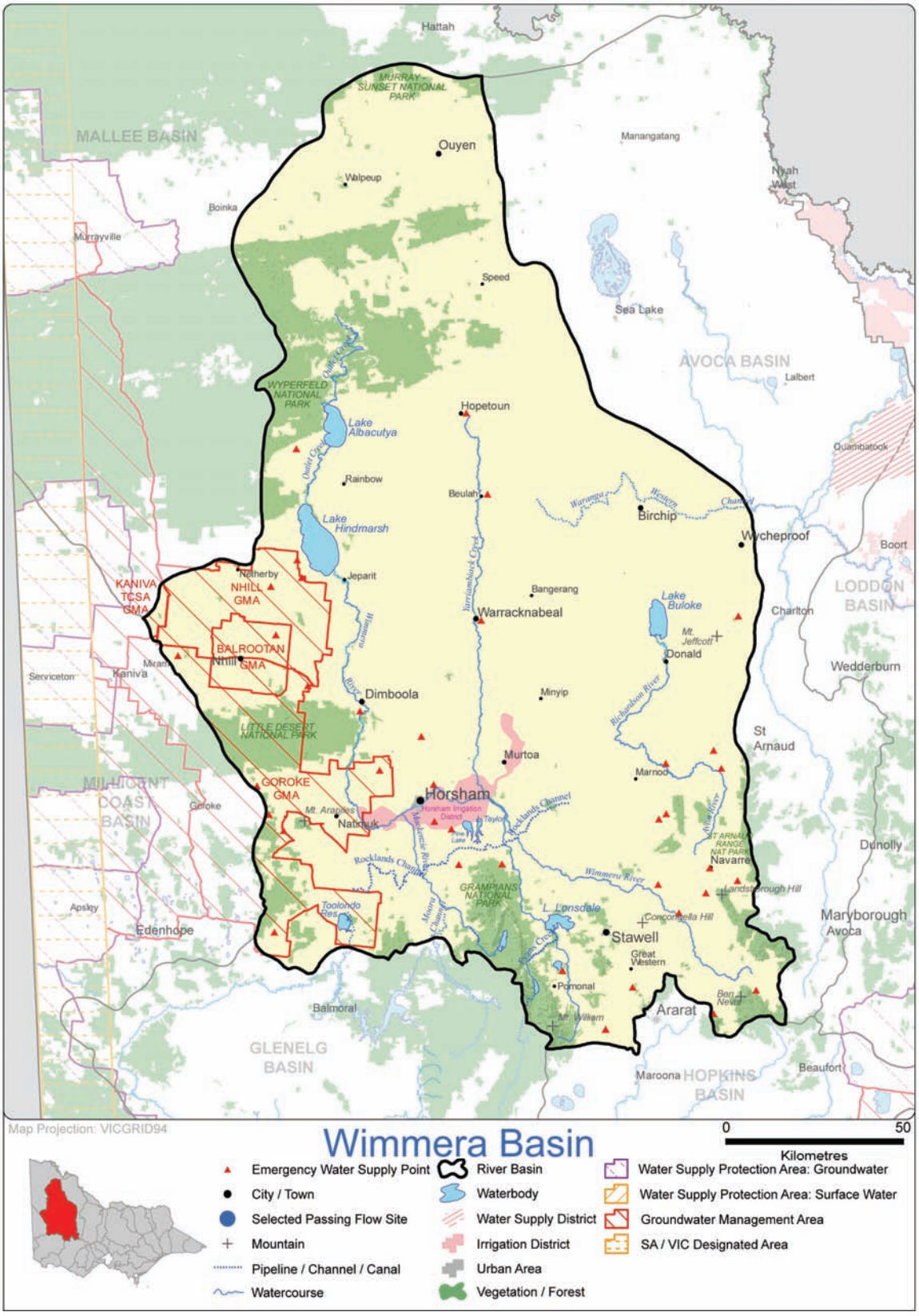
The volume of water held in major storages (greater than 1,000 ML capacity) fell from 34,900 ML at the beginning of the year to 23,900 ML, or 6% of capacity by the end of the year. In the Wimmera basin, storages greater than 1,000 ML capacity include Dock, Pine, Taylors, Fyans, Green and Batyo Lakes, 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, 2007/08

Water source	Total water resource (ML)[2]	Total use (ML)
Surface water	39,800	25,500
Groundwater[1]	1,600	800
Recycled water	1,380	1,380

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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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 continues. This project will ultimately replace 18,000 kilometres of open earthen channels with a pressurised pipeline system. Supply Systems 1, 7 and 5 were fully installed and over 80% of Supply System 2 completed at the end of June 2008.

15.6 Surface water resources

15.6.1 Water balance

A surface water balance for the Wimmera basin is shown in Table 15-3. The extremely dry conditions required storages to be drawn down and the amount of water available for supply was limited to essential urban and rural use.

Table 15-3 Balance of surface water in the Wimmera basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	34,900	38,200
Volume in storage at end of year	23,900	34,900
Change in storage	**-11,000**	**-3,300**
Inflows		
Catchment inflow[1]	25,700	62,400
Transfer from Glenelg basin	14,100	2,500
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**39,800**	**64,900**
Usage		
Urban diversions and use	3,700	12,800
Diversions for irrigation and domestic and stock use	5,600	14,700
Licensed diversions from unregulated streams	1,800	1,800
Small catchment dams[2]	14,400	7,300
Sub-total	**25,500**	**36,600**
Losses		
Net evaporation losses from major storages	15,600	16,100
Losses from small catchment dams[2]	7,100	14,200
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	2,500	1,200
Sub-total	**25,200**	**31,500**
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.

(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 2007/08 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, 2007/08

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**	**21,500**

n/a: Information not available.

15.6.3 Water entitlement transfers

There were no transfers made in the Wimmera basin in 2007/08.

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 2007/08. 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 2007/08 (ML)	Volume diverted 2007/08 (ML)(1)	Bulk entitlement volume compliance?(2)(3)
Coliban Water					
Wimmera and Glenelg(4)	1	450	0	380	Yes
Central Highlands Water					
Landsborough - Navarre	1	60	0	4	Yes
GWMWater					
Wimmera and Glenelg Rivers – Grampians Water(4)	1	16,109	0	5,995	Yes
Wimmera and Glenelg Rivers – Wimmera Mallee Water(4)	1	149,211	0	0	Yes
Wannon Water					
Wimmera and Glenelg Rivers(4)(5)	1	80	0	58	Yes
Environment Minister					
Wimmera and Glenelg Rivers(4)	5	40,563	0	8	Yes
Total annual volume of bulk entitlements 2007/08		**206,473**	**0**	**9,403**	
Total annual volume of bulk entitlements 2006/07		**210,952**	**0**	**8,626**	
Licensed diversions from unregulated streams 2007/08		*2,490*		*1,800*	
Licensed diversions from unregulated streams 2006/07		*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 2006/07.

(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 1November to 31 October in line with GWMWater reporting period.

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.

A large proportion of groundwater use in the Balrootan (Nhill) GMA was metered in 2007/08 providing a better indication of groundwater consumption than the use estimated and reported in 2006/07.

Table 15-6 Licensed groundwater volumes, Wimmera basin 2007/08

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) (5)	Total licensed groundwater use (ML) 2007/08	Total licensed groundwater use (ML) 2006/07
Balrootan (Nhill) GMA (100%)	60-125	1,522	1,522	475	215	690	413
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(6)		**4,115**	**1,522**	**475**	**215**	**690**	**413**

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. Goroke GMA), 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) Estimated use in Balrootan (Nhill) GMA was provided by GWMWater because meter readings had not been received at the time of reporting.

(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 15-7.

Table 15-7 Number of domestic and stock bores and estimated use, 2007/08

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%)	51	102
Goroke GMA (63%)	0	0
Nhill GMA (98%)	0	0
Total	**51**	**102**

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 inTable 15-6.

(2) The numbers of domestic and stock bores are those in the Victorian Water Register, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been.

(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 and Kiata. 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 2007/08 (ML)	Metered use 2006/07 (ML)
Boroka	30	3	0
Kiata	40	3	4
Landsborough	150	4	27
Nhill	1,000	534	546
Total	**1,220**	**544**	**577**

15.8 Drought contingency measures

A range of drought contingency measures was implemented in the Wimmera basin in 2007/08. These include:

- provision of emergency water carting program for GWMWater domestic and stock customers
- restricting urban and rural water use (discussed in section 13.9)
- provision of emergency water supply points for private water carting for farms
- revising normal operations, e.g. no summer channel run for GWMWater customers, and delaying the start of the winter channel run, which was limited to filling town dams only
- emergency piped supply to some towns in supply system 2
- 1,373 ML temporary water right purchased for use in the Murray system.

All Wimmera and Glenelg Rivers bulk entitlements were qualified in 2007/08, which enabled GWMWater to withhold water allocated for the environment, as well as carry-over 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 2007/08. All major towns in the basin, including Stawell and Horsham, were on Stage 4 restrictions the entire year.

Groundwater use was unrestricted in the Wimmera basin during 2007/08.

Table 15-9 Seasonal allocations and restrictions on water use in Wimmera basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	GWMWater customers (Antwerp, Beulah, Birchip, Brim, Clear Lake, Dimboola, Donald, Dooen, Glenorchy, Great Western, Halls Gap, Hopetoun, Horsham, Jeparit, Jung, Lascelles, Marnoo, Minyip, Murtoa, Natimuk, Noradjuha, Nullawil, Pimpinio, Pomonal, Rainbow, Reids Lane, Rupanyup, Stawell, Tarranyurk, Warracknabeal, Watchem, Woomelang, Wycheproof, Yaapeet)	Stage 4 restrictions from July 2007 to June 2008
	Landsborough, Navarre	Stage 1 restrictions from July 2007 to June 2008
	Elmhurst	Stage 2 restrictions from July 2007 to June 2008
Domestic and stock farm supplies	Wimmera Mallee domestic and stock supply system	Supply to priority house dams where available between July and November 2007. From December 2007 to June 2008, supply to one dam per enterprise in most areas and limited pipeline supply in areas where the pipelining is completed
Irrigation diversions	Regulated Wimmera Mallee system	Zero allocation from July 2007 to June 2008
	Avon River	Irrigation ban from July 2007 to June 2008
	Richardson River	Irrigation ban from July 2007 to June 2008
	Burnt Creek, Concongella Creek, Dunmunkle Creek, Fyans Creek, Green Lake, Mackenzie River, Mt Cole Creek, Mt William Creek, Shepherds Creek, Toolondo, 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 2007 to June 2008
Environment	Wimmera and Glenelg Rivers	Qualification of rights to restrict access to environmental carry-over water meant no carry-over water was released

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 15-10). Recycled volumes for one of these treatment plants, Wycheproof, were previously reported under the Avoca basin. Wastewater produced at six other plants is evaporated on-site. Reductions in urban water usage meant that the volume of wastewater available for recycling fell by around 11% compared with 2006/07.

Table 15-10 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]		
Birchip	19	19	100%	0	19	0	0	0	0
Dimboola	81	82	101%	0	81	0	1	0	-1
Donald	41	41	100%	0	41	0	0	0	0
Halls Gap	77	77	100%	0	77	0	0	0	0
Hopetoun[4]	0	0	0%	0	0	0	0	0	0
Horsham	663	663	100%	171	492	0	0	0	0
Jeparit[4]	0	0	0%	0	0	0	0	0	0
Minyip[4]	0	0	0%	0	0	0	0	0	0
Murtoa	21	21	100%	0	21	0	0	0	0
Natimuk[4]	0	0	0%	0	0	0	0	0	0
Nhill	92	92	100%	0	92	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	312	312	100%	167	146	0	0	0	0
Warracknabeal	61	61	100%	61	0	0	0	0	0
Wycheproof[5]	12	12	100%	0	19	0	0	0	0
Total 2007/08	**1,379**	**1,379**	**100%**	**398**	**980**	**0**	**1**	**0**	**0**
Total 2006/07	1,558	1,558	100%	453	1,091	0	15	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) The Wycheproof treatment plant was previously reported as being located in the Avoca basin.

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 2007/08 the Wimmera basin EWR comprised the following components:

- the Wimmera and Glenelg Rivers Flora and Fauna Environmental Reserve bulk entitlement of 40,563 ML
- 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 for the Wimmera basin in 2007/08 comprised the Wimmera and Glenelg Rivers Flora and Fauna bulk entitlement held by the Environment Minister. The Inter Catchment Advisory Group (ICAG) determines the share of environmental allocations between the two catchments. By August 2007 the allocation had increased to 2,845 ML and in September and October 2600 ML were released from Taylors Lake and Rocklands Reservoir to water the Lower Wimmera River. This release reached 60 kilometres of the 160 kilometres of waterway downstream of the release point. Some 4,567 ML of water was carried over from the 2006/07 year, however a qualification of rights restricted access to this water and no carry-over water was released. Construction of the Wimmera Mallee Pipeline will increase the EWR in the Wimmera basin.

15.11.3 Passing flow compliance

As noted in section 15.8 all Wimmera and Glenelg Rivers bulk entitlements were qualified in 2007/08, enabling GWMWater to withhold water allocated for the environment until supply conditions improve.

15.11.4 Streamflow management plans (SFMPs)

No work was undertaken on the proposed SFMP for the upper Wimmera River during 2007/08.

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

Consumptive use in the basin was very low compared to inflows, with more than 99% of inflows passed to Bass Strait in 2007/08.

Despite inflows being 42% of the long term average in 2007/08, water use in the basin was unrestricted.

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, 2007/08

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

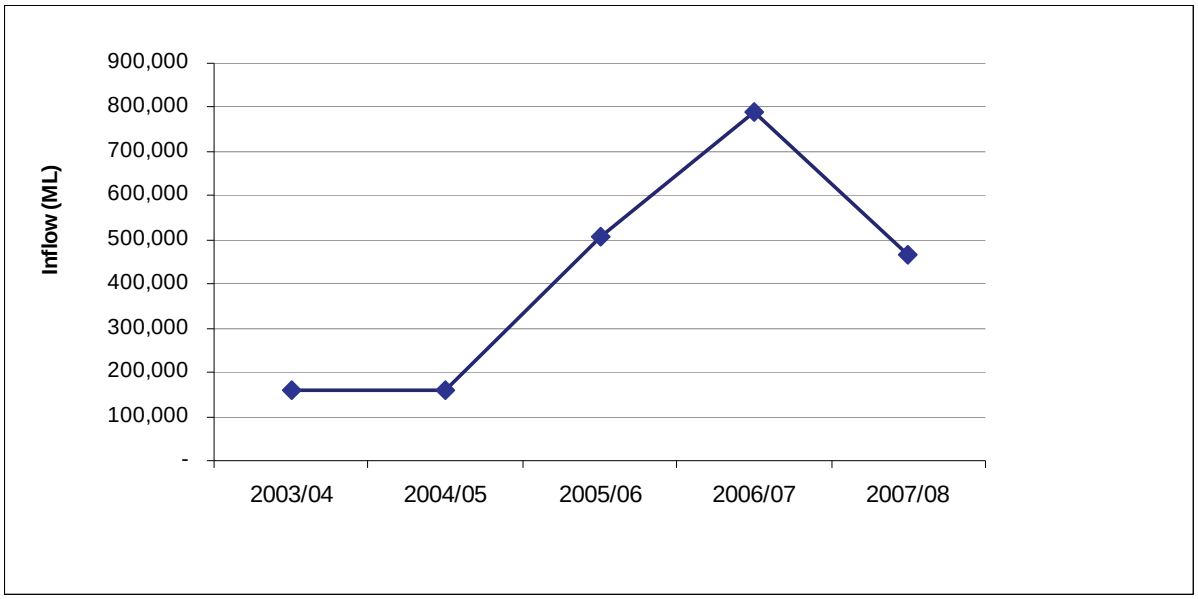
16.3 Rainfall and flows in 2007/08

In 2007/08, rainfall in the East Gippsland basin ranged between 60% and 80% of the long term average. Inflows were 42% of the long term average (of 1,122,000 ML), a significant decline from the 70% recorded in 2006/07.

The amount of water flowing from the East Gippsland basin into Bass Strait was 464,900 ML in 2007/08, compared with 786,900 ML in 2006/07. Basin outflows represented more than 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



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 (0.4% in 2007/08), 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, 2007/08

Water source	Total water resource (ML)	Total use (ML)
Surface water	466,700	1,700
Groundwater(1)	80	40
Recycled water	100	100

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 2007/08 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	2007/08 (ML)	2006/07 (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)	466,700	788,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**466,700**	**788,600**
Usage		
Urban diversions	200	280
Licensed diversions from unregulated streams	400	200
Small catchment dams	1,100	1,100
Sub-total	**1,700**	**1,600**
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	464,900	786,900

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 2007/08 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, 2007/08

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 2007/08.

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 2007/08.

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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Bemm River	1	100	0	25	Yes
Cann River	1	192	0	49	Yes
Mallacoota	1	330	0	126	Yes
Total annual volume of bulk entitlements 2007/08		**622**	**0**	**200**	
Total annual volume of bulk entitlements 2006/07		**622**	**0**	**278**	
Licensed diversions from unregulated streams 2007/08		*922*		*395*	
Licensed diversions from unregulated streams 2006/07		*757*		*200*	

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 80 ML a year. Some 42 ML was extracted from the bore in 2007/08, which was the first time the bore was used in three years.

Table 16-6 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Mallacoota	80	42	0
Total	**80**	**42**	**0**

16.8 Drought contingency measures

No drought contingency measures were implemented in 2007/08.

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

There were no urban or rural restrictions on surface water or groundwater use in 2007/08.

16.10 Recycled water

East Gippsland Water operates the wastewater treatment plants at Mallacoota and Cann River. All the wastewater passing through the Mallacoota treatment plant was recycled for applications including pasture and tree plantations. No water was recycled at the Cann River treatment plant due to the construction of an irrigation area and pump station scheduled to commence operation in 2008/09.

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	0	0	0%	0	0	0	0	0	0
Mallacoota	97	97	100%	0	97	0	0	0	0
Total 2007/08	**97**	**97**	**100%**	**0**	**97**	**0**	**0**	**0**	**0**
Total 2006/07	71	71	100%	0	71	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 2007/08 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 2007/08.

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

In 2007/08, approximately 99% of inflows to the Victorian portion of the Snowy basin flowed into Bass Strait, with low consumptive use in the basin.

Despite inflows being below the long term average, both urban and rural water use was unrestricted throughout the year.

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, 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		
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

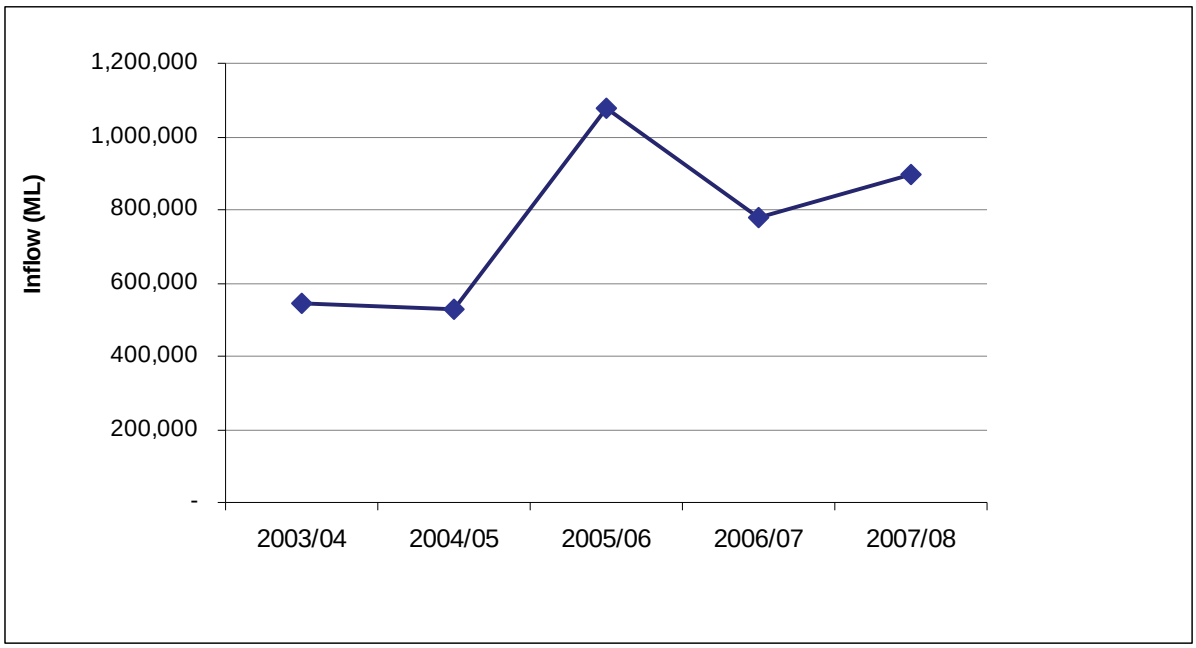
17.3 Rainfall, flows and storage levels in 2007/08

In 2007/08, rainfall in the Snowy basin ranged between 60% and 80% of the long term average. Total inflows to the Victorian portion of the basin were 62% of the long term average (of 1,447,000 ML), compared with 54% in 2006/07. Catchment inflows from Victoria were 19% higher than the previous year, while inflows from New South Wales were 4% higher. 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 888,100 ML in 2007/08. This represents more than 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.

Figure 17-1 Catchment inflows in the Snowy basin



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. There is a very low consumptive use of surface water relative to the available resource in the Victorian portion of the basin. 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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	893,900	5,900
Groundwater[2]	1,200	500
Recycled water	270	270

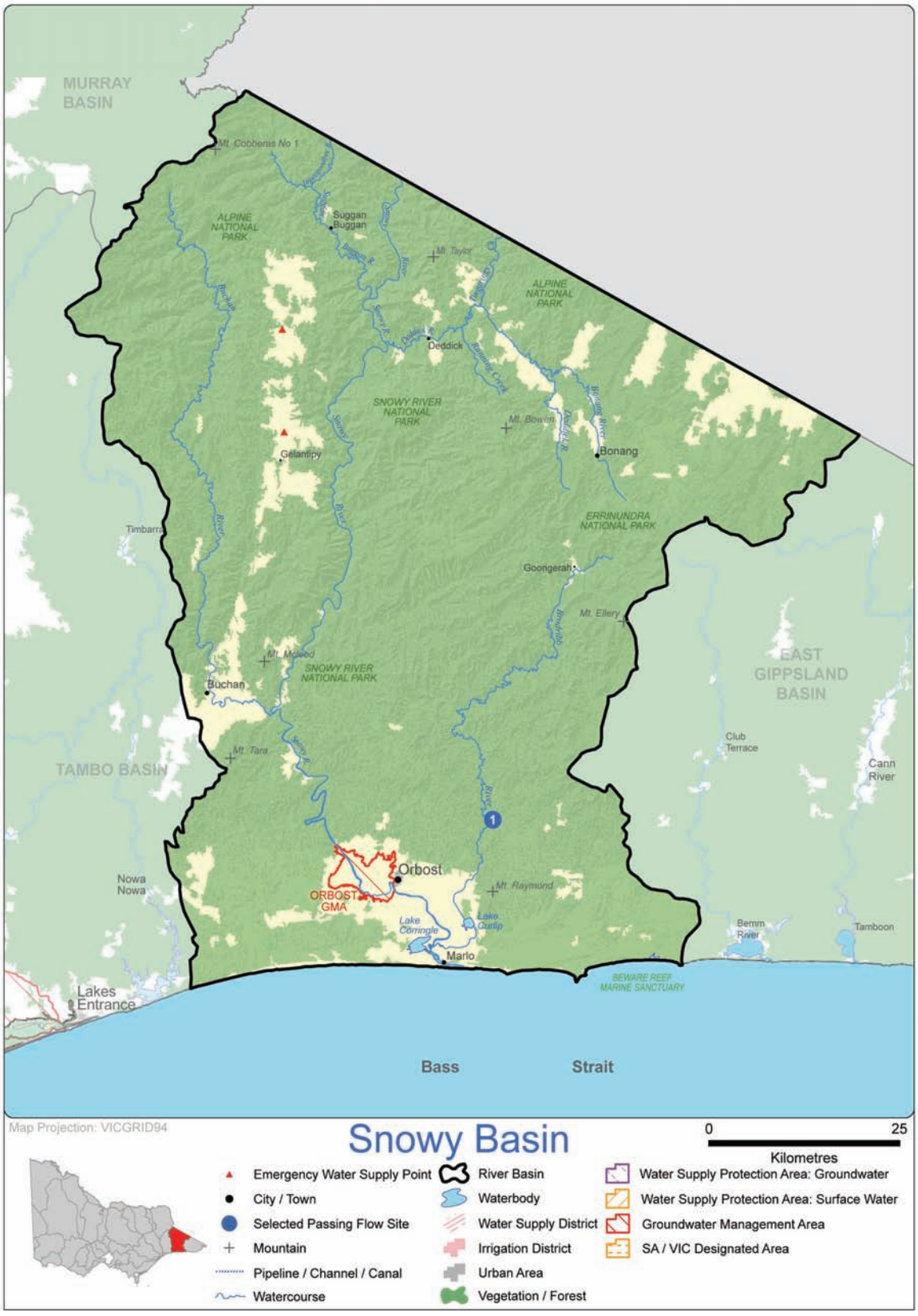
Note:

(1) For groundwater the total water resource is the licensed entitlement volume as presented in Table 17-6. There is no estimated domestic and stock use in the Snowy basin. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume.

(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 in the Victorian portion of the Snowy basin with a capacity greater than 1,000 ML.

Victorian inflows accounted for 75% of the total inflows to the basin, compared with 73% in 2006/07. Diversions in Victoria from the Snowy basin represent less than 1% of total inflows, with small catchment dams the largest source of diversions.

Table 17-3 Balance of surface water in the Snowy basin

Water account component	2007/08 (ML)	2006/07 (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)	672,600	568,300
Catchment inflow from NSW(2)	221,300	212,500
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**893,900**	**780,800**
Usage		
Urban diversions	800	1,060
Licensed diversions from unregulated streams	900	800
Small catchment dams	3,400	3,400
Sub-total	**5,100**	**5,300**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	700	600
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**700**	**600**
Water passed at outlet of basin		
River outflows to the ocean	888,100	774,900

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) Evaporations 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 2007/08 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, 2007/08 at selected sites

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

There were no transfers of water entitlements within the basin or across basin boundaries in 2007/08.

17.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk entitlements is shown in Table 17-5. 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 2007/08.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 17-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Buchan	1	170	0	22	Yes
Orbost	1	2,031	0	774	Yes
Total annual volume of bulk entitlements 2007/08		**2,201**	**0**	**796**	
Total annual volume of bulk entitlements 2006/07		**2,201**	**0**	**1,059**	
Licensed diversions from unregulated streams 2007/08		*3925*		*907*	
Licensed diversions from unregulated streams 2006/07		*3,898*		*800*	

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 17-6.

Table 17-6 Licensed groundwater volumes, Snowy basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Orbost GMA (100%)	20-45	1,200	1,201	488	2	490	540
Total[5]		**1,200**	**1,201**	**488**	**2**	**490**	**540**

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). The PCV is currently under review to reflect all licensed entitlements in the area.

(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 only.

An estimate of domestic and stock groundwater use in the Snowy basin is provided in Table 17-7. Groundwater is not used as an urban supply in the Snowy basin.

Table 17-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Orbost GMA (100%)	4	8
Total	**4**	**8**

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 17-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by 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 2007/08.

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 2007/08.

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 2007/08 all of the wastewater passing through this treatment plant was recycled and used for a number of applications including pasture and tree plantations (Table 17-8).

Table 17-8 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]		
Orbost	268	268	100%	0	268	0	0	0	0
Total 2007/08	**268**	**268**	**100%**	**0**	**268**	**0**	**0**	**0**	**0**
Total 2006/07	198	198	100%	0	198	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 2007/08 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 2008 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.

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 2007/08

Table 17-9 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 17-9 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

Inflows in the Tambo basin were again very low in 2007/08, at 26% of the long term average.

There are no major diversions in the Tambo basin, as larger towns such as Lake Entrance are supplied by the Bairnsdale water system, which sources its water from the Mitchell basin. Close to 95% of the basin's 2007/08 inflows discharged to the Gippsland Lakes.

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, 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		
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

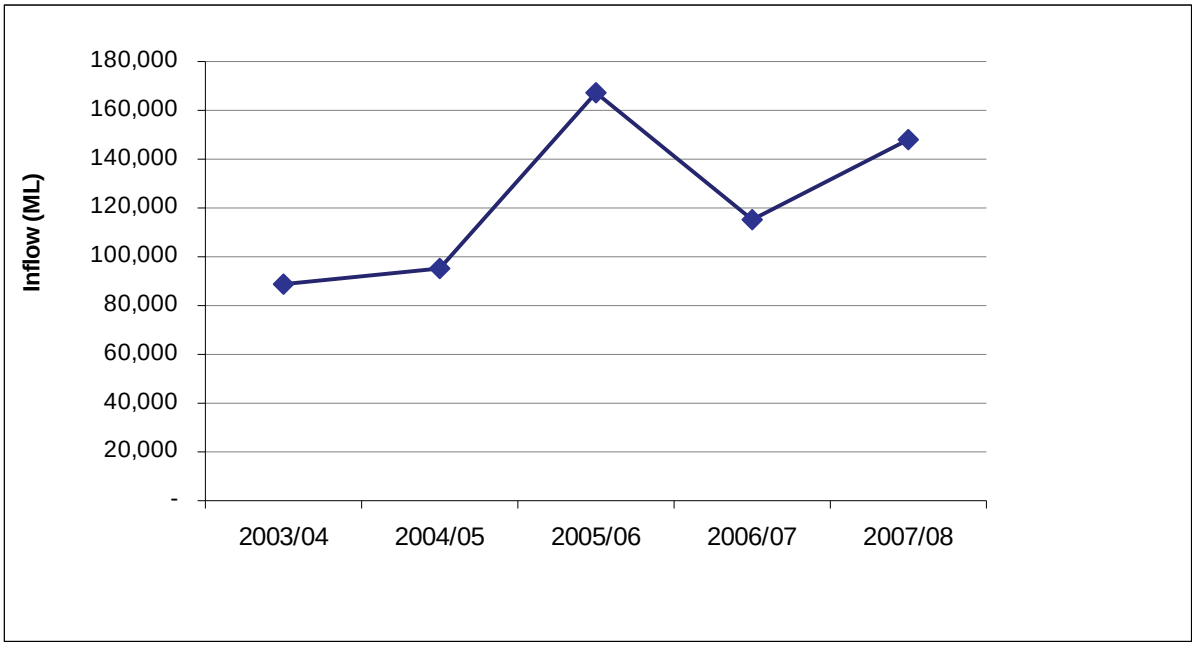
18.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Tambo basin ranged between 60% and 80% of the long term average. As a result of below average rainfall combined with dry catchment conditions, inflows were 26% of the long term average (of 570,000 ML), an improvement from the 20% recorded in 2006/07.

The amount of water flowing from the Tambo basin into the Gippsland Lakes was 139,500 ML in 2007/08, approximately 94% of total inflows to the basin.

There are no major storages located within the Tambo basin.

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, 2007/08

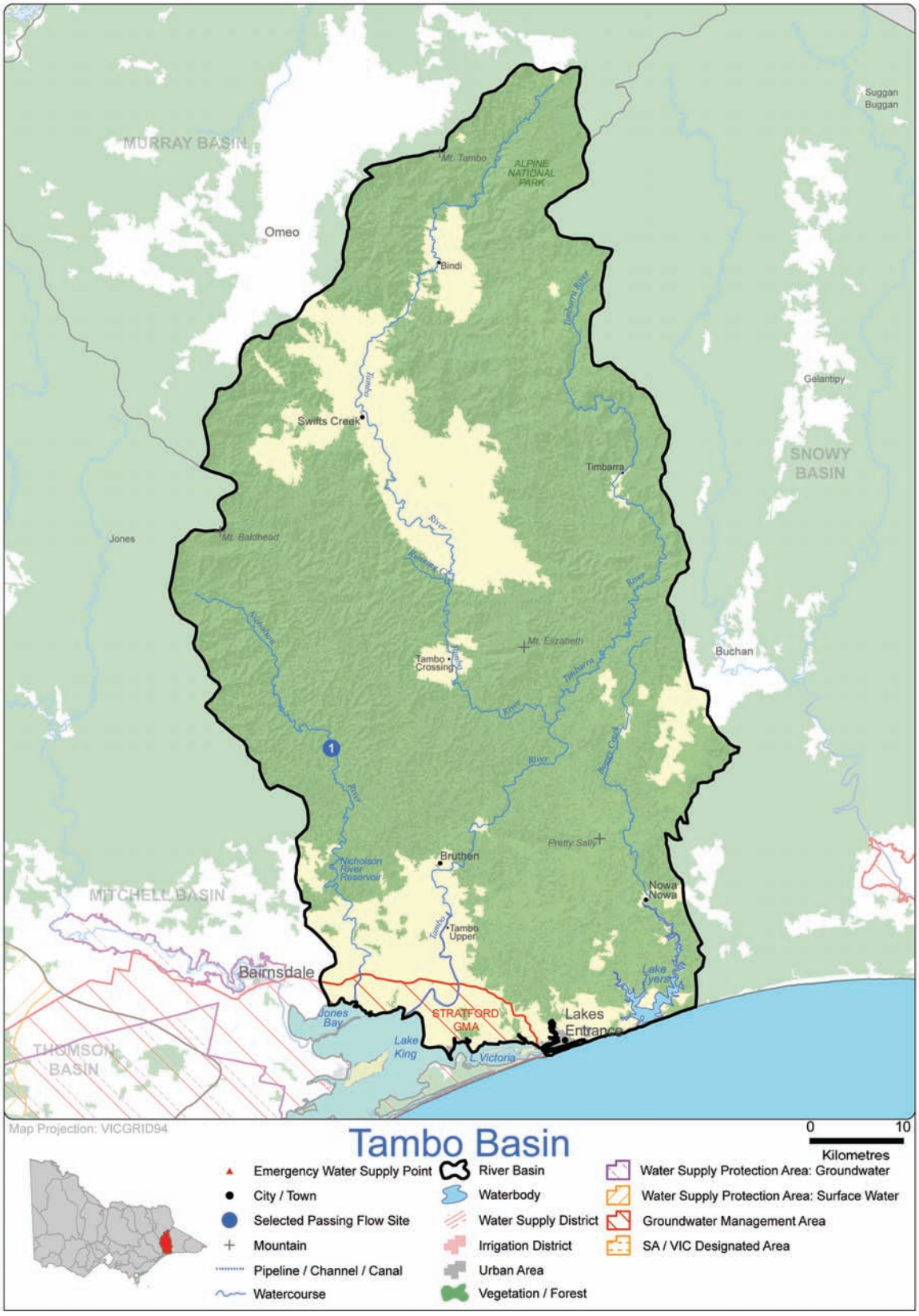
Water source	Total water resource (ML)	Total use (ML)
Surface water	146,700	5,100
Groundwater	0	0
Recycled water	760	760

18.4.1 Infrastructure projects to improve water availability

East Gippland Water commenced two infrastructure projects in the Tambo basin during 2007/08 to reduce losses from their water supply systems. These include a liner and floating cover for the Sunlakes Storage at Lakes Entrance and replacing the open storage at Sarsfield with a closed tank.

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	2007/08 (ML)	2006/07 (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)	146,700	115,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**146,700**	**115,600**
Usage		
Urban diversions	50	60
Licensed diversions from unregulated streams	1,100	1,000
Small catchment dams	3,900	3,700
Sub-total	**5,100**	**4,800**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	2,100	2,000
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**2,100**	**2,000**
Water passed at outlet of basin		
River outflows to the ocean	139,500	108,800

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 2007/08 is not readily available. The values in Table 18-4 below are based on the estimates provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 18-4 Estimated small catchment dam information, 2007/08

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

There were no transfers of water entitlements within the basin or across basin boundaries in 2007/08.

18.6.4 Volume diverted

Table 18-5 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 18-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
East Gippsland Water					
Bruthen	1	313	0	0	Yes
Lakes Entrance	1	2,993	0	0	Yes
Nowa Nowa	1	118	0	6	Yes
Swifts Creek	1	224	0	46	Yes
Total annual volume of bulk entitlements 2007/08		**3,648**	**0**	**52**	
Total annual volume of bulk entitlements 2006/07		**3,648**	**0**	**64**	
Licensed diversions from unregulated streams 2007/08		*4,115*		*1,083*	
Licensed diversions from unregulated streams 2006/07		*4,048*		*1,000*	

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.

18.8 Drought contingency measures

Urban water restrictions in the Tambo basin carried over from 2006/07 to July 2007, before being lifted to permanent water saving rules (refer to section 18.9).

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

The only restrictions on water use in the Tambo basin during 2007/08 were Stage 1 restrictions during July as detailed in Table 18-6. Licensed diversions were unrestricted.

Table 18-6 Seasonal allocations and restrictions on water use in Tambo basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Sarsfield, Bruthen, Nicholson, Johnsonville, Swan Reach, Metung, Kalimna, Lakes Entrance, Lake Tyers Aboriginal Trust, Lake Tyers Beach	Stage 1 restrictions in July 2007

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	603	603	100%	0	603	0	0	0	0
Metung	160	160	100%	0	160	0	0	0	0
Total 2007/08	**763**	**763**	**100%**	**0**	**763**	**0**	**0**	**0**	**0**
Total 2006/07	738	738	100%	0	738	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.

A study is currently underway, led by West Gippsland Catchment Management Authority, to describe the role of freshwater inflows in the health of the Gippsland Lakes, their fringing wetlands and the estuarine reaches of their inflowing rivers. The study will also assess the sensitivity of the Gippsland Lakes ecosystems to existing and possible future changes in freshwater inflows, and the feasibility of determining their environmental water requirements.

In 2007/08 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 2007/08.

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 copmliance 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

Despite being 45% of the long term average, inflows to the Mitchell basin in 2007/08 were nearly double those recorded the previous year. Approximately 96% of these inflows flowed into the Gippsland Lakes.

The larger inflows can be partly attributed to heavy rainfall in late June 2007 which contributed to high basin inflows at the beginning of the reporting year.

Urban and rural water use was mostly unrestricted throughout the year, however Stage 1 restrictions were in place for the Bairnsdale water system in July as a precautionary measure to manage poor water quality in the Mitchell River.

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, 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		
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

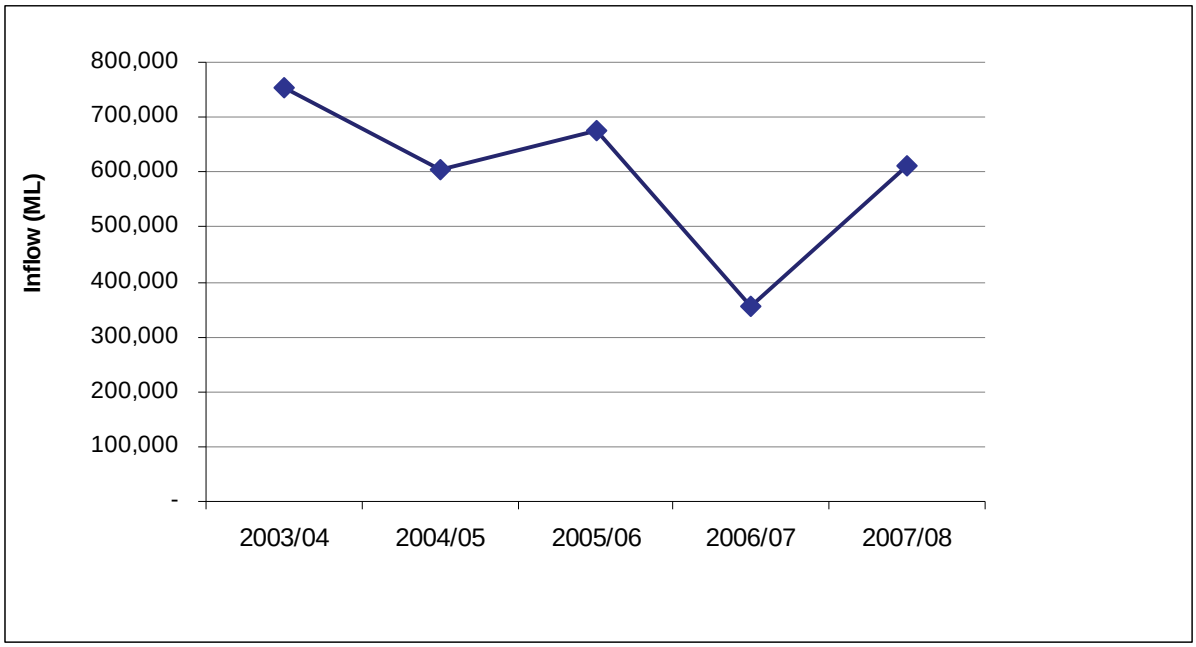
19.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Mitchell basin ranged between 60% and 100% of the long term average. Inflows to the basin were 45% of the long term average (of 1,355,000 ML) compared to 26% in 2006/07. The increased inflows (despite lower rainfalls) in 2007/08 were due in part to heavy rainfall in June 2007 contributing to high basin inflows in July 2007.

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 590,700 ML in 2007/08, a significant increase from the 335,700 ML recorded in 2006/07. This represents 96% of total inflows into the basin, which is similar to recent years. The total volume flowing into the Gippsland Lakes was around half the long term average.

There are no major storages located within the Mitchell basin.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	609,500	17,200
Groundwater[2]	11,800	3,700
Recycled water	1,520	1,520

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 19-6 and the estimated domestic and stock use as presented in Table 19-7. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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 2007/08 included completing the design of a 650 ML off-stream water storage at Woodglen, with tenders invited for its construction.

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 4% 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	2007/08 (ML)	2006/07 (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)	609,500	353,800
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river(2)	70	90
Sub-total	**609,500**	**353,900**
Usage		
Urban diversions	4,690	3,460
Licensed diversions from unregulated streams	8,000	9,000
Small catchment dams	4,500	4,300
Sub-total	**17,200**	**16,800**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	1,100	900
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	500	500
Sub-total	**1,600**	**1,400**
Water passed at outlet of basin		
River outflows to the ocean	590,700	335,700

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Comprised of water returned to rivers within the basin from alpine resorts in 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. No recorded flow data is available for 2007/08, and losses are assumed similar to 2006/07.

19.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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

There were no transfers of water entitlements within the basin or across basin boundaries in 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 19-5. 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 2007/08.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 19-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(1)
East Gippsland Water					
Bairnsdale	1	5,902	0	4,688	Yes
Total annual volume of bulk entitlements 2007/08		**5,902**	**0**	**4,688**	
Total annual volume of bulk entitlements 2006/07		**5,902**	**0**	**3,462**	
Licensed diversions from unregulated streams 2007/08		*16,206*		*7,999*	
Licensed diversions from unregulated streams 2006/07		*22,811*		*9,000*	

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 19-6. 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 use in 2007/08 decreased compared to 2006/07 due to the increased availability of surface water resources.

Table 19-6 Licensed groundwater volumes, Mitchell basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	2,050	2,050	1,787	0	1,787	1,422
Sale WSPA (8%)	25-200	1,697	1,687	758	2	760	1,069
Wy Yung WSPA (100%)	≤25	7,426	7,462	624	7	631	1,895
Total(5)		**11,173**	**11,199**	**3,169**	**9**	**3,178**	**4,386**

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 Wy Yung WSPA is less than licensed entitlement volume and is currently under review.

(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 only.

An estimate of domestic and stock groundwater use is provided in Table 19-7. Groundwater is not used for urban supply within the Mitchell basin.

Table 19-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Stratford GMA (7%)	33	66
Sale WSPA (8%)	93	186
Wy Yung WSPA (100%)	155	310
Total	**281**	**562**

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 19-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by 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 range of drought contingency measures was undertaken by East Gippsland Water in the Mitchell basin in 2007/08. The measures included:

- restricting urban surface water and rural groundwater use (discussed below)
- completing a new emergency water bore field in the Woodglen area
- undertaking works including lining and covers on storages at Lindenow, Eagle Point and Wy Yung to reduce evaporation losses and improve water quality.

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 19-8.

Table 19-8 Seasonal allocations and restrictions on water use in Mitchell basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Walpa, Lindenow, Bairnsdale, Eagle Point, Newlands Arm, Raymond Island and Paynesville	Stage 1 restrictions in July 2007
Groundwater	Sale WSPA	Shortage declared and restrictions on trade implemented between July and November 2007

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 19-9).

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 19-9 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]		
Bairnsdale	1,148	1,148	100%	0	40	1,107	0	0	0
Lindenow	19	19	100%	0	0	19	0	0	0
Paynesville	355	355	100%	0	355	0	0	0	0
Total 2007/08	**1,522**	**1,522**	**100%**	**0**	**395**	**1,127**	**0**	**0**	**0**
Total 2006/07	1,371	1,371	100%	0	270	1,101	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.

The Mitchell, Tambo, Latrobe and Thomson basins are capped at the current level of diversions plus a volume of 2,000 ML. This extra 2,000 ML allows for new diversions in the period until the findings of an investigation of the freshwater needs of the Gippsland Lakes (refer to the Tambo basin chapter) are completed.

In 2007/08 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 2007/08.

Table 19-10 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 19-10 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 follwing 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 • When flow was between 246 and 265 ML/day the entire flow, less 16 ML/day, was passed • 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

In contrast to the rest of Victoria, total inflows in the Thomson basin in 2007/08 were relatively high compared to the long term average.

The high flows were due to several heavy rainfall and flood events in the Macalister River during the year, which resulted in Lake Glenmaggie filling and allocations in the Macalister Irrigation District finishing the season at 200%. This contrasted to a final allocation of 60% in 2006/07.

The floods in early July 2007 caused water quality issues in the Macalister River and forced Gippsland Water to place a number of its towns on Stage 4 restrictions until the water quality improved. The water quality problems were the result of severe erosion in the Macalister catchment after bushfires swept through the catchment in the summer of 2006/07.

In contrast, inflows to the Thomson Reservoir, Melbourne's largest storage, were relatively modest and did not exceed the volume diverted to the Melbourne system. Consequently, levels in the Thomson Reservoir ended the year lower and Melbourne continued to experience water shortages.

To manage Melbourne's continuing water shortage, the Minister for Water qualified rights to reduce the environmental flows in the Thomson River to retain water in storage for Melbourne. Southern Rural Water also transferred 2,000 ML from its drought reserve stored in the Thomson Reservoir to the Werribee and Bacchus March irrigation districts to supplement extreme supply shortages.

With the exception of licensed diverters on Valencia Creek, rural supplies from unregulated streams were unrestricted during the year.

Groundwater use in all the groundwater management areas within the Thomson basin decreased by 48% in 2007/08 compared to the previous year, most likely because of improved surface water availability. A water shortage was declared and trade restricted for the Sale water supply protection area.

The total volume of water diverted from the basin in 2007/08 was similar to that recorded in 2006/07. However, whereas in the previous year a large portion of the basin's water use comprised transfers to Melbourne from the Thomson reservoir, use in 2007/08 was predominantly by irrigators in the Macalister Irrigation District, supplied from Lake Glenmaggie. The volume transferred from the Thomson basin to Melbourne (Yarra basin) was just over half that transferred in 2006/07.

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, 2007/08

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

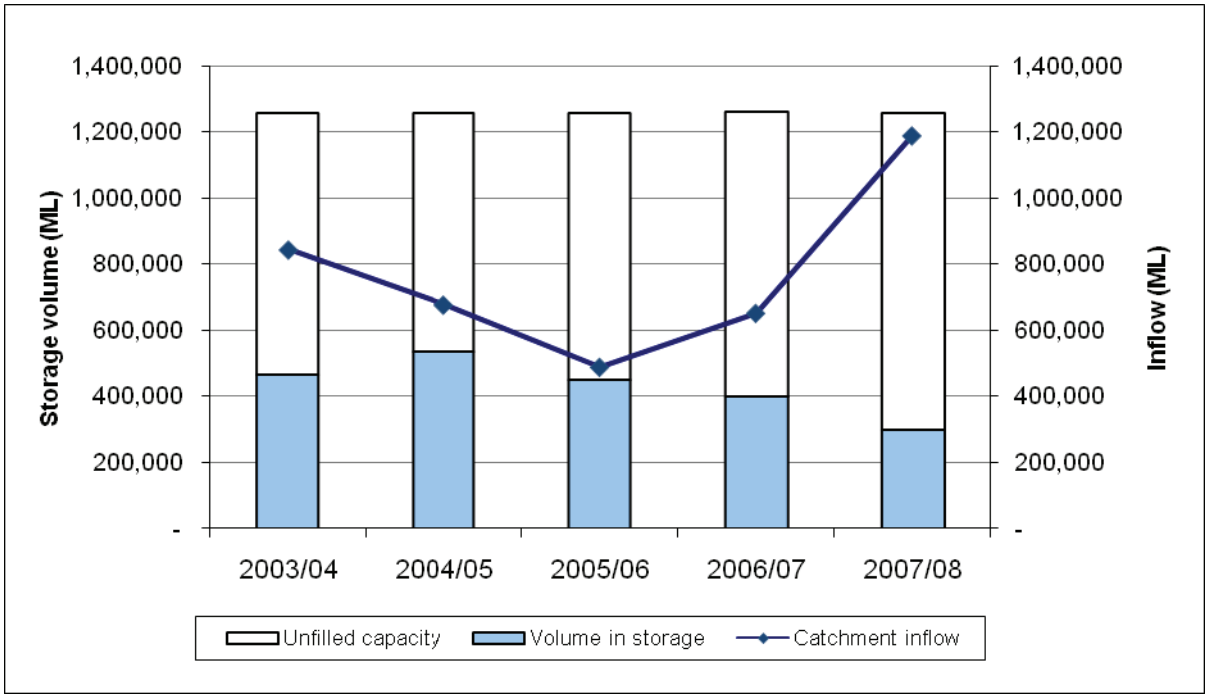
20.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Thomson basin ranged between 60% and 100% of the long term average. Inflows to the Thomson basin amounted to 1,188,000 ML in 2007/08, which is 84% of the long term average (of 1,414,000 ML), compared to 47% of the long term average in 2006/07. The increase in inflow was the result of heavy rainfall and flooding in the Macalister River catchment in the final days of June 2007. As a result of the June 2007 floods, more than 40% of the 2007/08 basin outflows were recorded in July 2007.

The amount of water flowing from the Thomson basin into the Gippsland Lakes was 927,600 ML in 2007/08. This represents 78% of catchment inflows into the basin, compared with 49% in 2006/07. The majority of outflows occurred early in the year as a result of the heavy rains and associated flooding in June 2007.

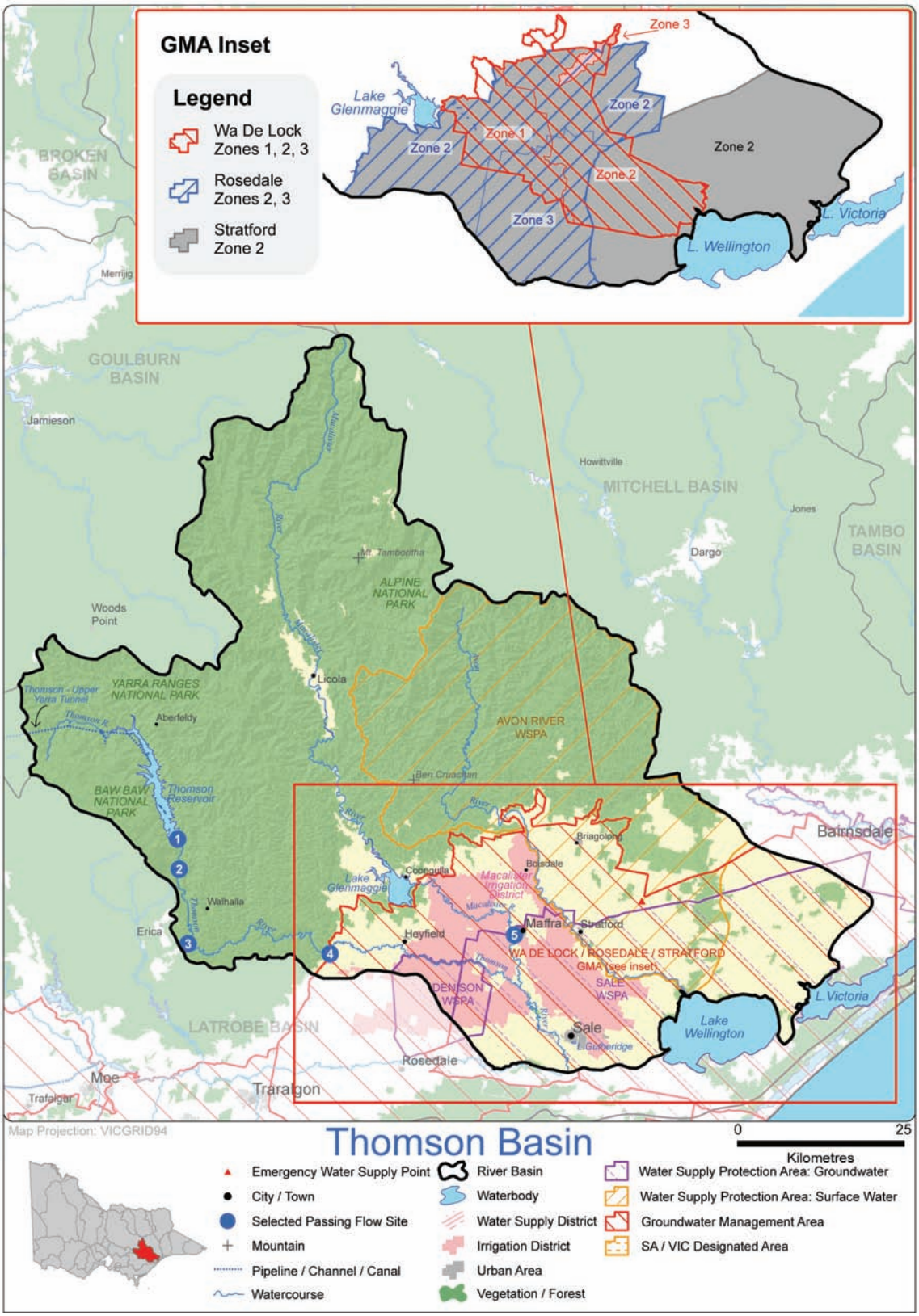
The volume of water held in major storages (greater than 1,000 ML capacity) decreased from 399,000 ML at the start of the year to 299,400 ML, or 24% of capacity, at the end of the year. In the Thomson basin, storages greater than 1,000 ML capacity include Thomson Reservoir and Lake Glenmaggie, both of which are on-stream storages. Following the floods in the Macalister River in June 2007, Lake Glenmaggie began the year full, and was drawn down to 55% in June 2008. Melbourne's biggest water storage, the Thomson Reservoir, began the year 19% full and was gradually drawn down to 18% in June 2008.

Figure 20-1 All major storages and catchment inflows in the Thomson basin



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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	1,213,100	366,800
Groundwater[2]	77,300	36,100
Recycled water	500	450

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 20-7 and the estimated domestic and stock use presented in Table 20-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

20.6 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 225,600 ML was diverted for irrigation purposes in 2007/08, an increase of 71% on the 2006/07 irrigation use. The increased irrigation diversions were the result of increased water availability with allocations lifted from 60% in 2006/07 to 200% in 2007/08. Melbourne Water's diversion from the Thomson Reservoir returned to more normal levels in 2007/08, with 124,500 ML diverted, compared to 219,050 ML in 2006/07. The high transfer in 2006/07 was to mitigate water quality risks posed by bushfire in the surrounding catchments and to supplement Yarra River resources.

Table 20-3 Balance of surface water in the Thomson basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	399,000	450,100
Volume in storage at end of year	299,400	399,000
Change in storage	**-99,600**	**-51,100**
Inflows		
Catchment inflow[1]	1,188,000	665,200
Transfers from other basins	0	0
Return flow from irrigation	25,100	11,700
Treated wastewater discharged back to river	40	40
Sub-total	**1,213,100**	**676,900**
Usage		
Diversions to towns in Thomson River basin	1,920	1,700
Transfers to Yarra River basin for urban use	124,500	219,050
Irrigation district diversions	225,600	131,900
Licensed diversions from unregulated streams	5,800	5,800
Transfers to other basins[2]	2,000	0
Small catchment dams[3]	7,000	6,500
Sub-total	**366,800**	**365,000**
Losses		
Net evaporation losses from major storages	1,100	6,400
Evaporation from small catchment dams[3]	2,500	2,300
In-stream infiltration to groundwater, flows to floodplain and evaporation[4]	14,700	27,700
Sub-total	**18,300**	**36,400**
Water passed at outlet of basin		
River outflows to the Latrobe River	727,000	299,200
River outflows direct to Lake Wellington	200,600	27,400

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Transfer of 1,000 ML to Werribee basin and 1,000 ML to Western Water

(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 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 2007/08 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, 2007/08

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

A summary of entitlements transferred within the Thomson basin is presented in Table 20-5.

Table 20-5 Transfer of entitlements in the Thomson basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Southern Rural Water								
Thomson/ Macalister	1,160	1,160	16	0	3,838	3,838	58	0
Total 2007/08	**1,160**	**1,160**	**16**	**0**	**3,838**	**3,838**	**58**	**0**
Total 2006/07	**371**	**371**	**6**	**0**	**8,491**	**8,491**	**269**	**0**

Note:
(1) Entitlements for which no trades were recorded are not shown.

20.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement in the basin is shown in Table 20-6.

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 20-6 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[2][3]
Gippsland Water					
Thomson/Macalister towns	1	2,335	0	1,924	Yes
Melbourne metropolitan retailers					
Thomson River	15	171,800	0	124,500	Yes
Southern Rural Water					
Thomson/Macalister	5	274,800	0	225,631	Yes
Environment Minister					
Thomson River – Environment	1	10,000	0	4,587	Yes
Total annual volume of bulk entitlements 2007/08		**458,935**	**0**	**356,642**	
Total annual volume of bulk entitlements 2006/07		**458,935**	**0**	**357,261**	
Licensed diversions from unregulated streams 2007/08		*13,816*		*5,784*	
Licensed diversions from unregulated streams 2006/07		*7,102*		*5,800*	

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) 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 2007/08 was 330,800 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 20-7. 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. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in the Thomson basin was slightly reduced in 2007/08 compared with 2006/07. This is predominantly due to the increased availability of surface water resources in 2007/08.

Table 20-7 Licensed groundwater volumes, Thomson basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Rosedale GMA (36%)	Zone 1 50-150, Zone 2 25-350, Zone 3 200-300	7,972	7,952	3,806	10	3,816	2,694
Stratford GMA (45%)	Zone 1 >150, Zone 2 >350	12,318	12,319	10,738	1	10,739	8,548
Wa De Lock GMA (100%)	<=25	30,084	28,456	6,972	222	7,195	10,509
Denison WSPA (53%)	<=25	9,396	9,369	3,191	65	3,256	5,377
Sale WSPA (70%)	25-200	14,829	14,745	6,623	21	6,644	9,338
Total[5]		**74,600**	**72,869**	**31,330**	**319**	**31,648**	**36,465**

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. Stratford licensed entitlement is greater than the PCV which is currently under review.

(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 only.

An estimate of domestic and stock groundwater use is provided in Table 20-8.

Table 20-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Rosedale GMA (36%)	161	322
Stratford GMA (45%)	201	402
Wa De Lock GMA (100%)	795	1,590
Denison WSPA (53%)	242	484
Sale WSPA (70%)	811	1,622
Total	**2,210**	**4,420**

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 20-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by 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 20-9.

Table 20-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Boisdale	36	0	0
Briagolong	160	90	122
Sale	3,500	1,846	1,975
Total	3,696	1,936	2,097

20.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Thomson basin in 2007/08. While water shortage was still an issue, particularly in the Thomson Reservoir, water quality problems were also experienced. The water quality problems were the result of bushfires that swept through the Macalister River catchment in the summer of 2006/07, followed by storms that transported high sediment loads to the Macalister River during June and July 2007.

The contingency measures included:

- restricting urban and rural water use (discussed in section 20.9)
- providing an emergency water supply point north east of Stratford
- carting water from Heyfield to Coongulla because of water quality concerns in Lake Glenmaggie.

The Minister for Water declared three qualification of rights in the Thomson basin in 2007/08. Details of these qualifications are presented in Table 20-10 below.

Table 20-10 Qualifications of rights

Qualification type	Qualification description
Reduced passing flow requirements	Reduced the passing flow requirements in the Bulk Entitlement (Thomson/Macalister – Southern Rural Water) Conversion Order 2001. Qualified passing flows on the Macalister River as an emergency measure to reduce high turbidity levels at Maffra Weir for Gippsland Water's Maffra supply. Dates: 1 July 2007 until 31 August 2007
Volume carried over	Qualified the Bulk Entitlement (Thomson River – Environment) Order 2005 to modify the operating tolerance for releases to the Thomson River from Thomson Reservoir. This qualification provided savings to be retained in storage for Melbourne. Dates: 1 July 2007 ongoing to 30 June 2008
Differential access by priority entitlements	Qualified the Bulk Entitlement (Thomson River – Environment) Order 2005 to reduce environmental flows by up to 10,000 ML/year. This qualification provided 8,000 ML/year savings to be retained in storage for Melbourne and 2,000 ML/year to be returned to the environmental account at the end of the qualification period. Dates: 20 December 2007 ongoing to 30 June 2008
Access to unallocated water provided	Qualified the Bulk Entitlement (Thomson/Macalister – Southern Rural Water) Conversion Order 2001 to allow Southern Rural Water to transfer 2,000 ML of its entitlement to the Werribee Irrigation District for emergency supplies. Dates: 21 December 2007 ongoing to 30 June 2008

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 20-11. Restrictions were eased in late 2007 for Gippsland Water customers from Stage 3 or Stage 4. By January 2008, all towns were subject to permanent water savings measures only.

Irrigation allocations, which only reached 60% in the 2006/07 season, returned to higher levels in 2007/08, commencing at 100% in August 2007 and increasing to 200% in May 2008. The high allocation was due to several heavy rainfall events in the Macalister River during the year, which resulted in high streamflows in the Macalister River and the filling of Lake Glenmaggie.

Table 20-11 Seasonal allocations and restrictions on water use in Thomson basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Glenmaggie, Coongulla	Stage 4 restrictions from July to November 2007 and Stage 2 in December 2007
	Boisdale, Maffra, Stratford	Stage 4 restrictions in July 2007, Stage 2 from August to September 2007
	Glenmaggie Point	Stage 4 restrictions in July 2007
	Rawson, Heyfield, Toongabbie, Cowarr, Briagolong, Sale and Wurruk	Stage 2 restrictions in Julty 2007
Licensed diversions on unregulated streams	Valencia Creek	Stage 1 in October 2007 and an irrigation ban from March to May 2008
Irrigation	Macalister Irrigation District and regulated licensed diversions	Opening allocation 100% from August 2007 and increased to 200% in May 2008
Groundwater	Sale WSPA	Shortage declared and restrictions on trade implemented between July and November 2007

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. A total of 91% of wastewater was recycled in the basin in 2007/08 (Table 20-12).

Table 20-12 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)		
Heyfield	87	87	100%	0	87	0	0	0	0
Maffra	324	324	100%	7	317	0	0	0	0
Rawson	42	0	0%	0	0	0	0	42	0
Stratford	43	43	100%	0	43	0	0	0	0
Total 2007/08	**496**	**454**	**91%**	**7**	**447**	**0**	**0**	**42**	**0**
Total 2006/07	332	295	89%	8	287	0	0	37	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 2007/08 the Thomson basin EWR comprised the following components:

- a bulk entitlement for the environment of 10,000 ML
- 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.

20.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at a number of points in the basin.

Table 20-13 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 2007/08.

Melbourne Water (as storage operator) reported non-compliance with their passing flow requirements under their bulk entitlements in 2007/08. The Coopers Creek site on the Thomson River requires a seven-day average flow 225 ML/day in October. On October 21 and 22 the seven day average flow was less than required. This non-compliance was due to operator error.

Table 20-13 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. As discussed above, Melbourne Water reported non-compliance in October 2007 • 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 occured: • 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. Background work on the technical aspects of the Avon SFMP has begun.

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

The total inflows to the Latrobe basin were 66% of the long term average in 2007/08, almost double those recorded in 2006/07. By the end of the year, the volume of water held in the major Latrobe storage, Blue Rock Lake had increased by nearly 30,000 ML.

Because of improved water availability in the regulated systems, sufficient supplies were available to meet the needs of the power stations without having to access the water market. Irrigators were also able to access substantially more water compared to the previous year.

Water use in towns in the basin was mostly unrestricted after July, once systems recovered from the low inflows of 2006/07.

Licensed diverters' access to supplies from the unregulated systems was also largely unrestricted. However three streams in the west of the basin experienced water shortages over the summer period, resulting in bans.

In contrast to surface water use, groundwater use across the basin halved in 2007/08 compared to 2006/07. This can be attributed to an increase in the availability of surface 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, 2007/08

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).

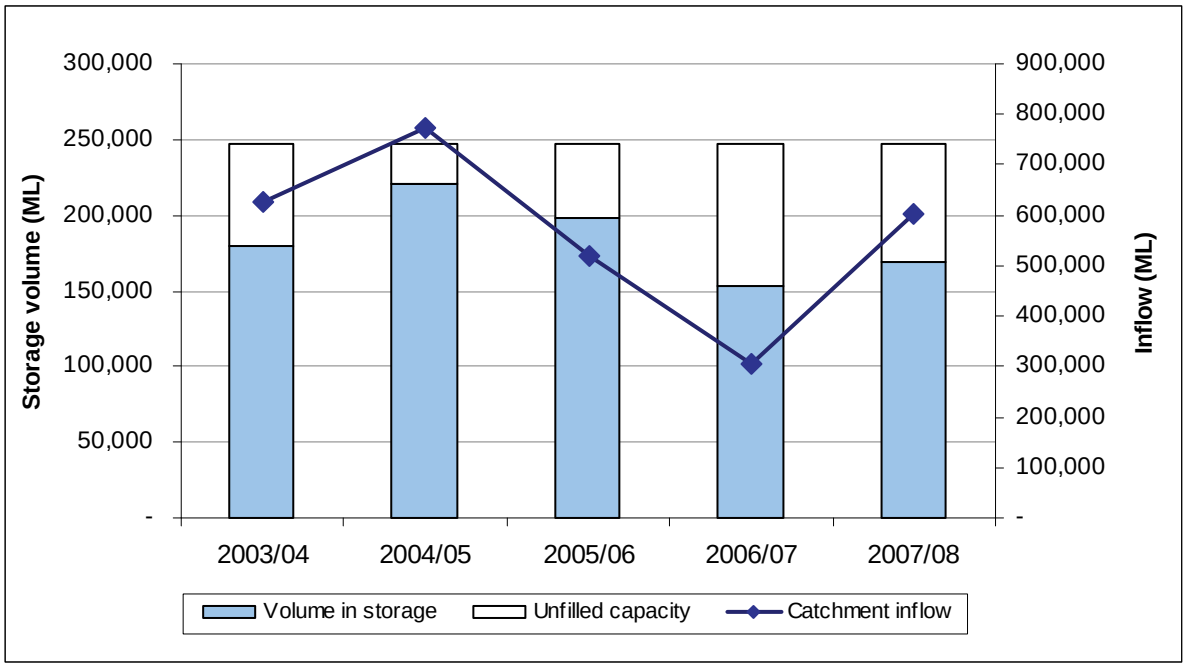
21.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Latrobe basin ranged between 60% and 100% of the long term average. Inflows were 66% of the long term average (of 875,000 ML), a significant increase on the 35% recorded in 2006/07.

The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River) increased to 426,700 ML in 2007/08, more than double the 194,000 ML recorded in 2006/07.

The volume of water held in major storages (greater than 1,000 ML capacity) increased from 153,800 ML at the start of the year to 169,300 ML, or 69% of capacity, at the end of the year. In the Latrobe basin, storages greater than 1,000 ML capacity include Blue Rock Lake, Lake Narracan, and Moondarra Reservoir, all of which are on-stream storages. 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 increased from 116,800 ML at the start of the year to 145,600 ML at year end.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	618,800	162,000
Groundwater[2]	43,500	24,900
Recycled water	22,280	710

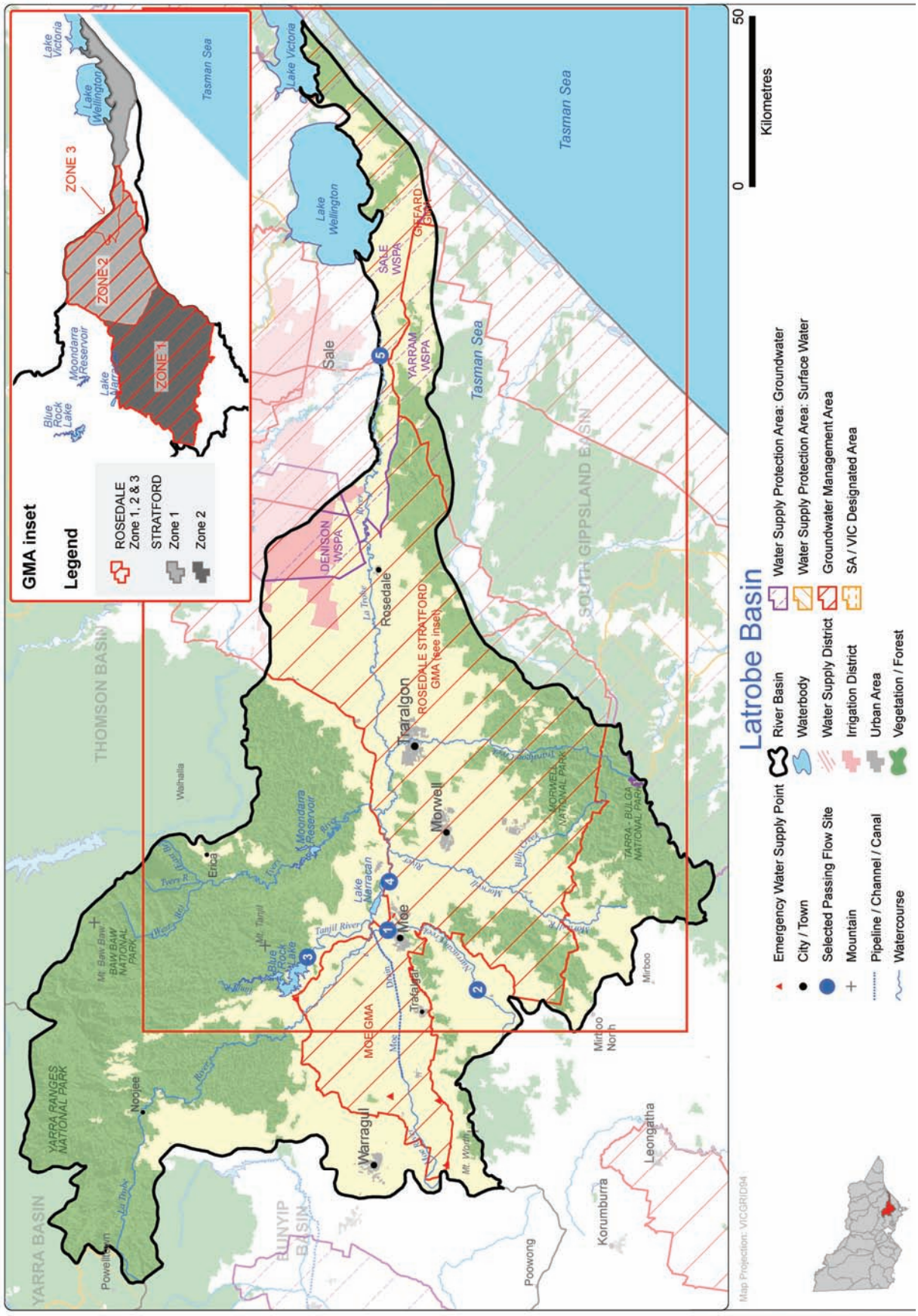
Notes:

(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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

21.5 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 2007/08, these entities accounted for more than half of the surface water diversions in the Latrobe basin, drawing 107,400 ML from river diversions and groundwater and returning approximately 40,500 ML to the Latrobe river system.

Table 21-3 Balance of surface water in the Latrobe basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	153,800	197,600
Volume in storage at end of year	169,300	153,800
Change in storage	**15,500**	**-43,800**
Inflows		
Catchment inflow(1)	575,200	306,500
Transfers from other basins	0	0
Return flow from power stations and major industry	40,500	39,000
Return flow from irrigation	0	0
Treated wastewater discharged back to river	3,060	2,740
Sub-total	**618,800**	**348,200**
Usage		
Urban and industrial diversions	124,490	143,000
Licensed diversions from regulated streams	8,650	7,400
Licensed diversions from unregulated streams	8,400	14,000
Small catchment dams	20,500	20,500
Sub-total	**162,000**	**184,900**
Losses		
Net evaporation losses from major storages	8,900	9,800
Evaporation from small catchment dams(2)	5,700	3,300
In-stream infiltration to groundwater, flows to floodplain and evaporation	0	0
Sub-total	**14,600**	**13,100**
Water passed at outlet of basin		
River outflows to the Gippsland Lakes (excluding Thomson River)	426,700	194,000
River outflows to the Gippsland Lakes (including Thomson River)	1,153,700	493,200

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 2007/08 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, 2007/08

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

A summary of the transfer of entitlements in the Latrobe basin is shown in Table 21-5.

Table 21-5 Transfer of entitlements in the Latrobe basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Gippsland Water								
Boolarra	0	0	0	0	31	0	2	31
Thorpdale	0	0	0	0	5	0	1	5
Southern Rural Water								
Latrobe licensed diverters	0	0	0	0	2,166	2,166	26	0
Total 2007/08	**0**	**0**	**0**	**0**	**2,202**	**2,166**	**29**	**36**
Total 2006/07	**0**	**0**	**0**	**0**	**15,612**	**15,612**	**27**	**0**

Note:
(1) Entitlements for which no trades were recorded are not shown.

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 2007/08. 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[2][3]
Gippsland Water					
Boolarra	1	145	31	85	Yes
CGRWA – Blue Rock	3	15,150	0	5,933	Yes
Erica	1	340	0	111	Yes
Mirboo North	1	270	0	203	Yes
Moe – Narracan Creek	1	3,884	0	1,864	Yes
Moondarra Reservoir	2	62,000	0	49,004	Yes
Noojee[4]	1	73	0	0	Yes
Thorpdale	1	80	5	17	Yes
Southern Rural Water					
Yallourn Energy Ltd for Southern Rural Water (Loy Yang B power station)[5]	1	20,000	0	17,311	Yes
Latrobe licensed diverters[6]	2	13,400	0	8,651	Yes
Great Energy Alliance Corporation Pty Ltd					
Yallourn Energy Ltd for Loy Yang Power Ltd[5]	1	40,000	0	21,560	Yes
TRUenergy					
Yallourn Energy Ltd[5]	1	36,500	0	28,405	Yes
Environment Minister (on behalf of the Treasurer)					
Yallourn Energy Ltd for SECV	1	25,000	0	0	
Total annual volume of bulk entitlements 2007/08		**216,842**	**36**	**133,143**	
Total annual volume of bulk entitlements 2006/07		**192,736**	**0**	**150,411**	
Licensed diversions from unregulated streams 2007/08		*18,073*		*8,446*	
Licensed diversions from unregulated streams 2006/07		*18,044*		*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) 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 utilising the Noojee bulk entitlement because Noojee is supplied via the Neerim South system (i.e. Tarago).

(5) Volumes attributed to the bulk entitlments of the power generator's were incorrectly reported in the *Victorian Water Accounts 2006-2007* and have been corrected in this table.

(6) Volumes attributed to Southern Rural Water's bulk entitlement for licensed diverters was incorrectly reported in the *Victorian Water Accounts 2006-2007* and have been corrected in this table.

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.

The reported groundwater use in the Latrobe basin has increased from 2006/07. This is largely due to higher higher extraction volumes from the Rosedale and Stratford GMAs.

Table 21-7 Licensed groundwater volumes, Latrobe basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Moe GMA (100%)	>25	8,200	3,779	1,296	118	1,414	1,447
Rosedale GMA (58%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	13,003	12,970	6,207	16	6,223	4,394
Stratford GMA (41%)	Zone 1 >150 Zone 2 >350	11,274	11,275	9,828	1	9,829	7,823
Denison WSPA (47%)	≤25	8,347	8,347	2,834	58	2,892	4,776
Sale WSPA (17%)	25-200	3,515	3,495	1,570	5	1,575	2,213
Yarram WSPA (5%)	Zone 1 >200 Zone 2 all depths	1,360	1,360	643	4	647	860
Total [5]		**45,698**	**41,226**	**22,379**	**201**	**22,579**	**21,513**

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. Stratford licensed entitlement is greater than the PCV which is currently under review.

(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 only.

An estimate of domestic and stock groundwater use is provided in Table 21-8. The number of domestic and stock bores in the Rosedale GMA and Stratford GMA has increased significantly from 2006/07 due to a revised calculation of bore numbers by Southern Rural Water.

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, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Moe GMA (100%)	242	484
Rosedale GMA (58%)	263	526
Stratford GMA (41%)	184	368
Denison WSPA (47%)	215	430
Sale WSPA (17%)	192	384
Yarram WSPA (5%)	57	114
Total	**1,153**	**2,306**

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 those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin.

(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 2007/08. These include:

- restricting urban and rural water use (discussed below)
- providing emergency water supply points
- Gippsland Water purchasing entitlement on the market for the Boolarra and Thorpdale supply systems
- Drilling drought relief groundwater bores to augment the Thorpdale supply system

The Minister for Water declared one qualification of rights in the Latorbe basin in 2007/08. The Minister also increased the cap on releases of water from Blue Rock Lake to enable water to be transferred for use by the power stations. The qualification commenced in April 2007 and expired on 31 October 2007.

21.9 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 21-9. Gippsland Water customers, who were subject to water restrictions at the end of 2006/07, had those restrictions lifted in August 2007. A shortage was declared on groundwater from the Sale WSPA and restrictions on trade implemented between July and November 2007.

Table 21-9 Seasonal allocations and restrictions on water use in Latrobe basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	All towns sourcing from the Moondarra System, Narracan Creek and Tanjil River, and Tarago Reservoir and Pederson Weir	Stage 2 restrictions in July 2007
	Boolarra, Thorpdale, Erica	Stage 2 restrictions in July 2007
Irrigation and regulated diversions	Macalister Irrigation District(1)	Opening allocation 100% from August 2007, increasing to 200% in May 2008
	Latrobe system – river diverters	100% of licensed volume subject to availability of unregulated river flows from July 2007 to June 2008
	Lower Latrobe River	No unregulated flow available. Limited to 20% allocation from Blue Rock regulated flows (approximately 20%) from July to November 2007
Licensed diversions from unregulated streams	Morwell River	Stage 1 restriction from February to May 2008
	Moe River	Irrigation ban for March 2008
	Ten Mile Creek	Irrigation ban from February to May 2008
Groundwater	Sale WSPA	Shortage declared and restrictions on trade implemented between July and November 2007

Note:

(1) The Macalister Irrigation District is supplied from the Thomson basin.

21.10 Recycled water

Gippsland Water treats over 20,000 ML per year of wastewater in the Latrobe basin, the majority of which (over 80%) is highly saline and unsuitable for recycling, and is discharged to Bass Strait. The volume of water recycled in 2007/08 was similar to that for 2006/07 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	69	69	99%	29	40	0	0	0	0
Moe	1,713	0	0%	0	0	0	0	1,713	0
Morwell	632	632	100%	0	0	632	0	0	0
Dutson Downs (regional outfall sewer)	9,813	0	0%	0	0	0	0	0	9,813
Saline wastewater outfall pipeline	8,697	0	0%	0	0	0	0	0	8,697
Warragul	1,345	0	0%	0	0	0	0	1,345	0
Willow Grove	9	9	100%	0	9	0	0	0	0
Total 2007/08	**22,279**	**710**	**3%**	**29**	**49**	**632**	**0**	**3,058**	**18,510**
Total 2006/07	20,859	660	3%	31	74	556	0	2,743	17,455

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 2007/08 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 2007/08.

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

Figure 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 Figure 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 Figure 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 Figure 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 Figure 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 Figure 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)

Technical studies are underway for the development of an SFMP for the upper Latrobe River.

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

Despite being substantially higher than those experienced in 2006/07, inflows to the South Gippsland basin were 47% of the long term average in 2007/08.

The extreme low flow conditions of the previous year demonstrated that South Gippsland's towns are vulnerable to severe water shortages. Although volumes in store had increased from 14% to 39% by the end of the year, a number of systems continued to rely on qualifications. These were put in place to allow water corporations to increase their storages by pumping additional water over winter while avoiding additional environmental impacts of pumping during summer.

Severe restrictions remained on many urban systems for the first part of the year while storages recovered. Restrictions were also placed on licensed diverters on a number of unregulated streams from February 2008 due to low autumn flows.

Groundwater use in 2007/08 declined from the previous year due to the higher availability of surface water resources.

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 most of the South Gippsland basin
Melbourne Water				Manages waterways in the far west of the South Gippsland basin

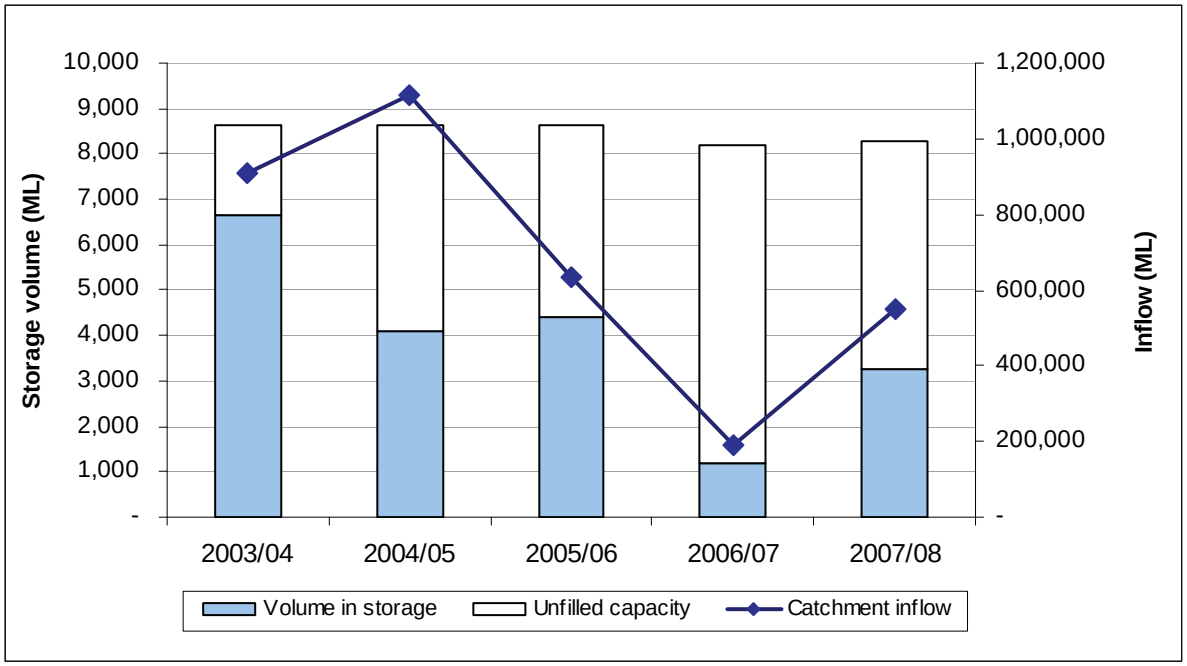
22.3 Rainfall, flow and storages in 2007/08

In 2007/08, rainfall across the South Gippsland basin ranged between 60% and 100% of the long term average. Inflows were 47% of the long term average (of 1,157,000 ML), a considerable increase from 2006/07 when inflows were 16% of the long term average.

The amount of water flowing from the South Gippsland basin into Westernport and Bass Strait was 494,700 ML in 2007/08. This represents 90% of the total inflows into the basin, compared with 77% in 2006/07.

The volume of water held in major storages (greater than 1,000 ML capacity) increased from 1,200 ML at the start of the year to 3,300 ML, or 39% of capacity, at the end of the year. In the South Gippsland basin, storages greater than 1,000 ML capacity include Lance, Western, and Candowie Reservoirs, all of which are on-stream storages. Hyland Reservoir, with a capacity of 670 ML has been included as a major storage in the South Gippsland basin due to its importance to Leongatha.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	541,600	38,600
Groundwater[2]	40,800	23,200
Recycled water	4,490	360

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 22-6 and the estimated domestic and stock use as presented in Table 22-7. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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

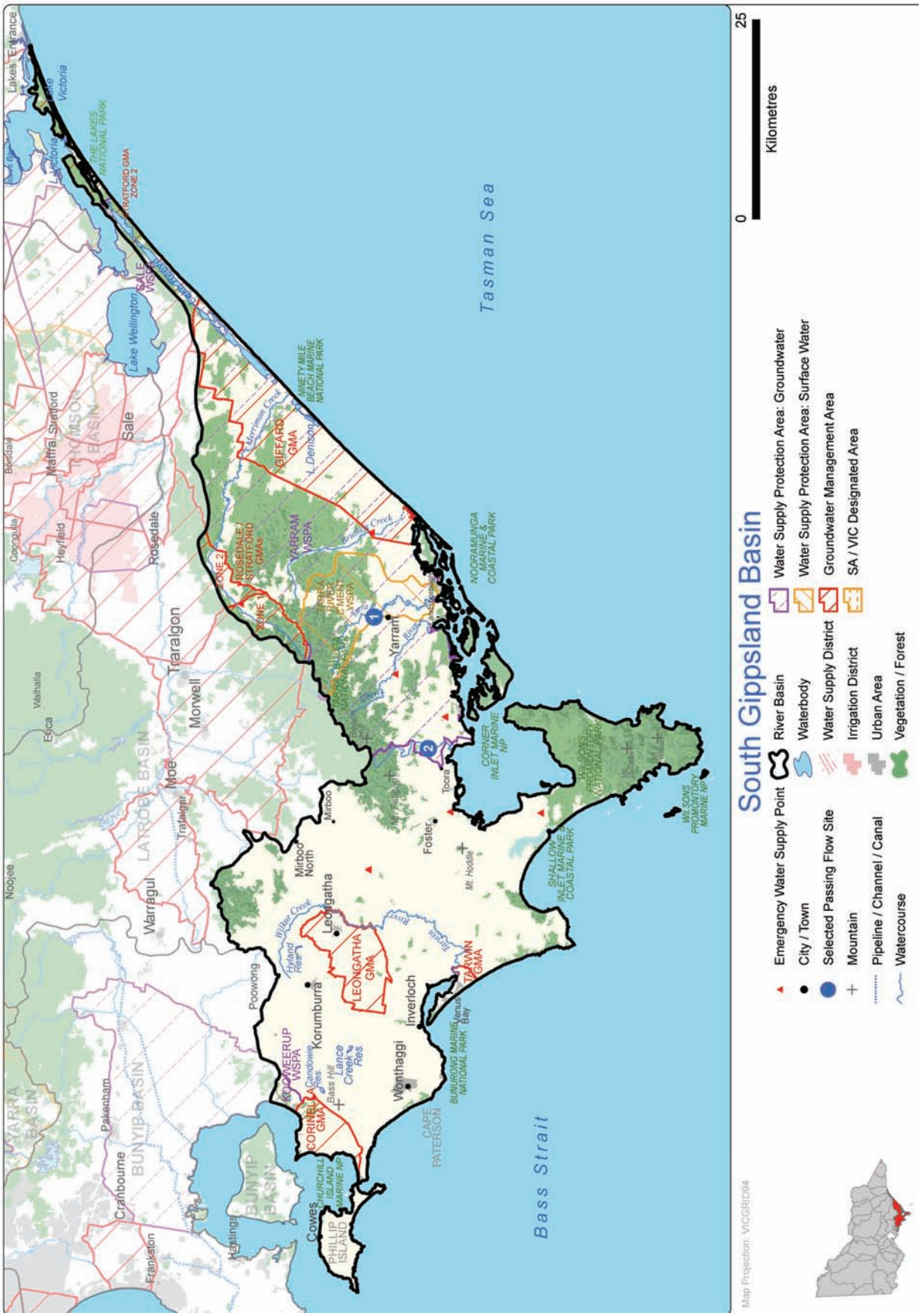
A number of infrastructure projects were undertaken in the South Gippsland basin during 2007/08 to improve water availability.

Westernport Water completed two projects to increase the security of supply from Candowie Reservoir. The first project included constructing a new pump station on Bass River to divert water into Candowie Reservoir during high flows. The second involved constructing a bore and a pipeline to take water from the Corinella aquifer and transfer it to Candowie Reservoir.

South Gippsland Water installed a temporary water treatment plant to treat bore water at Yarram Golf Club to supplement the potable water supply to Yarram township when streamflows in Tarra River are lower than the daily demand.

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 in Table 22-3.

Diversions make up a relatively small proportion of total inflows, with less than 10% of basin inflows diverted for consumptive use in 2007/08. 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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	1,200	4,400
Volume in storage at end of year	3,300	1,200
Change in storage	**2,100**	**-3,200**
Inflows		
Catchment inflow(1)	538,300	191,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	3,290	1,570
Sub-total	**541,600**	**192,700**
Usage		
Urban diversions	8,510	7,820
Licensed diversions from unregulated streams	5,800	7,600
Small catchment dams	24,300	24,100
Sub-total	**38,600**	**39,500**
Losses		
Net evaporation losses from major storages	1,100	300
Evaporation from small catchment dams(2)	5,100	8,900
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**6,200**	**9,200**
Water passed at outlet of basin		
River outflows to Bass Strait and Westernport	494,700	147,200

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 2007/08 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, 2007/08

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

There were no transfers of water entitlements within the basin or across basin boundaries in 2007/08.

22.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 22-5. 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 2007/08.

Licensed diversions from unregulated streams were almost double the urban diversions in 2007/08. Note that in 2007/08, diversions from unregulated streams have been estimated based on recorded and estimated diversion data, while in previous years the estimate was based on irrigation demand modelling and climate information.

Table 22-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
Gippsland Water					
Seaspray	1	61	0	47	Yes
South Gippsland Water					
Devon North, Alberton, Yarram and Port Albert	1	853	0	511	Yes
Dumbalk	1	100	0	23	Yes
Fish Creek	1	251	0	140	Yes
Foster	1	326	0	199	Yes
Korumburra	1	1,000	0	620	Yes
Leongatha	1	2,476	0	1509	Yes
Loch, Poowong and Nyora	1	420	0	260	Yes
Meeniyan(1)	1	1,800	0	269	Yes
Toora, Port Franklin, Welshpool and Port Welshpool	1	1,617	0	601	Yes
Wonthaggi – Inverloch(2)	1	3,800	0	1,660	Yes
Westernport Water					
Westernport	1	2,911	0	2,011	Yes
Bass River	n/a	n/a	0	659	n/a
Total annual volume of bulk entitlements 2007/08		**15,615**	**0**	**8,509**	
Total annual volume of bulk entitlements 2006/07		**15,615**	**0**	**7,816**	
Licensed diversions from unregulated streams 2007/08(2)		*13,243*		*5,777*	
Licensed diversions from unregulated streams 2006/07		*13,181*		*7,600*	

Notes:

(1) Entitlement temporarily increased (normally 100 ML) by a qualification of rights to enable South Gippsland Water to supply Leongatha and Korumburra from the Tarwin River West Branch.

(2) Volume diverted includes 466 ML of water taken from the Powlett River under a qualification of rights.

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 22-6.

The South Gippsland basin contains all of the Corinella GMA and Leongatha GMA, most of the Yarram WSPA, Tarwin GMA and Giffard GMA, 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 2007/08 water accounts.

Groundwater use in 2007/08 was less than in 2006/07 due to the higher availability of surface water resources.

Westernport Water extracted 31 ML from the Corinella aquifer during 2007/08 as part of a groundwater assessment program. No licence was required for this testing.

Table 22-6 Licensed groundwater volumes, South Gippsland basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Corinella GMA (100%)	All depths	2,550	296	70	8	79	61
Giffard GMA (100%)	50-200	5,665	5,670	3,199	6	3,205	3,719
Leongatha GMA (100%)	All depths	6,500	1,361	559	41	600	625
Rosedale GMA (6%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	1,337	1,334	638	2	640	452
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	2,001	2,001	1,744	0	1,744	1,388
Tarwin GMA (100%)	≤25	1,300	37	0	2	2	12
Sale WSPA (6%)	25-200	1,171	1,165	523	2	525	737
Yarram WSPA (95%)	Zone 1 >200 Zone 2 All depths	23,957	23,957	11,335	66	11,400	15,149
Total[5]		**44,482**	**35,820**	**18,068**	**127**	**18,195**	**22,144**

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 Giffard GMA is less than licensed entitlement volume and is currently under review.

(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 only.

An estimate of domestic and stock groundwater use is provided in Table 22-7. The number of domestic and stock bores in the Rosedale GMA and Stratford GMA have increased significantly from 2006/07 due to a revised calculation of bore numbers by Southern Rural Water.

Table 22-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)
Corinella GMA (100%)	169	338
Giffard GMA (100%)	191	382
Leongatha GMA (100%)	139	278
Rosedale GMA (6%)	27	54
Stratford GMA (7%)	33	66
Tarwin GMA (100%)	858	1,716
Sale WSPA (6%)	64	128
Yarram WSPA (95%)	1,010	2,020
Total[3]	**2,491**	**4,982**

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 those registered in the state database as being drilled since 1965. 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 22-8.

Table 22-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Leongatha	400	166	384
Yarram	60	0	0
Total	**460**	**166**	**384**

22.8 Drought contingency measures

A range of drought contingency measures was undertaken in the South Gippsland basin in 2007/08 including restricting urban and rural water use (discussed below) and providing emergency water supply points. The Minister for Water declared five qualifications of rights in the South Gippsland basin in 2007/08 to ensure essential urban needs could be met. Details of these qualifications are presented in Table 22-9.

Table 22-9 Qualifications of rights

Qualification Type	Qualification description
Extended pumping/diversion times	Changed the Bulk Entitlement (Meeniyan) Conversion Order 1997 to allow a temporary increase in entitlement volume and rate of extraction from Tarwin River. This qualification provided an emergency water supply to Leongatha and Korumburra. Dates: 1 July to 18 October 2007, and 13 June to 30 June 2008
Extended pumping/diversion times	Changed Temporary Licence 9026456 from Coalition Creek. This qualification extended the period of the temporary licence and increased the total volume, extraction rate and maximum daily volume of water that can be taken from Coalition Creek to maintain an emergency supply to Leongatha. Dates: 1 July to 18 October 2007
Reduced passing flow requirements	Changed Temporary Licence 9031555 from Powlett River. This qualification extended the period of the temporary licence, and altered passing flows to maintain emergency supply to Wonthaggi. Dates: 1 July to 18 October 2007 and 13 June to 30 June 2008
Reduced passing flow requirements	Changed Licence 9026826 from Bass River. This qualification reduced the passing flow requirements on the Bass River to enable water to be diverted to Candowie Reservoir for emergency supplies for Westernport townships. Dates: 1 July to 1 September 2007

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 22-10.

Table 22-10 Seasonal allocations and restrictions on water use in South Gippsland basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Seaspray, Mirboo North	Stage 2 restrictions in July 2007
	Koonwarra, Leongatha, Leongatha South	Stage 4 restrictions from July to September 2007, and Stage 2 from October 2007 to January 2008
	Cape Paterson, Inverloch, Wonthaggi	Stage 4 restrictions from July to October 2007, and Stage 2 from October 2007 to June 2008
	Fish Creek	Stage 2 restrictions from July to August 2007
	Korumburra	Stage 3 restrictions for July 2007 only
	All Westernport Water customers	Stage 4 restrictions from July to August 2007 and Stage 2 from September 2007 to June 2008
Licensed diversions from unregulated streams	Bruthen Creek	Irrigation ban February to June 2008
	Tarra River	Stage 1 restrictions October 2007 and an irrigation ban from February to May 2008
	Jack River, Greigs Creek	Irrigation ban February to June 2008
Groundwater	Sale WSPA	Shortage declared and restrictions on trade implemented between July and November 2007

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 8% of wastewater was reused, compared to 10% in 2006/07 (Table 22-11).

Table 22-11 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]		
Coronet Bay	127	116	92%	0	116	0	0	0	11
Cowes	925	96	10%	80	11	0	5	0	829
Foster	114	0	0%	0	0	0	0	114	0
Korumburra	625	1	0%	1	0	0	0	625	0
Leongatha domestic	405	0	0%	0	0	0	0	405	0
Leongatha trade waste	1,192	0	0%	0	0	0	0	1,192	0
Toora	32	3	8%	3	0	0	0	30	0
Welshpool	0	0	0%	0	0	0	0	0	0
Wonthaggi/Cape Paterson/Inverloch	948	23	2%	0	23	0	0	925	0
Yarram (Tarraville)	118	118	100%	0	118	0	0	0	0
Total 2007/08	**4,487**	**357**	**8%**	**84**	**268**	**0**	**5**	**3,291**	**840**
Total 2006/07	3,692	365	10%	88	269	0	8	1,570	1,757

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)

There are important environmental assets dependent 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 the freshwater inputs from the South Gippsland basin to ecologically function.

In 2007/08 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 that they met all passing flow requirements under their bulk entitlements in 2007/08. Westernport Water's bulk entitlement does not contain any passing flow requirements.

Table 22-12 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 22-12 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 flowas 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)

Technical studies are underway for development of an SFMP for the Tarra River.

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 into the Bunyip basin in 2007/08 were 74% of the long term average and a 51% increase in the flows experienced in 2006/07. As a result, most urban and rural users supplied from the basin were unrestricted throughout the year. Urban communities on the Mornington Peninsula, however, were on Stage 3a restrictions because their water is supplied from the Melbourne system.

The volume of water flowing into Port Phillip Bay, Westernport and Bass Strait from the Bunyip basin amounted to 90% of the total inflows. Diversions from the basin will however increase substantially when the Tarago Reservoir is connected to Melbourne's water supply system in 2009.

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, 2007/08

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.

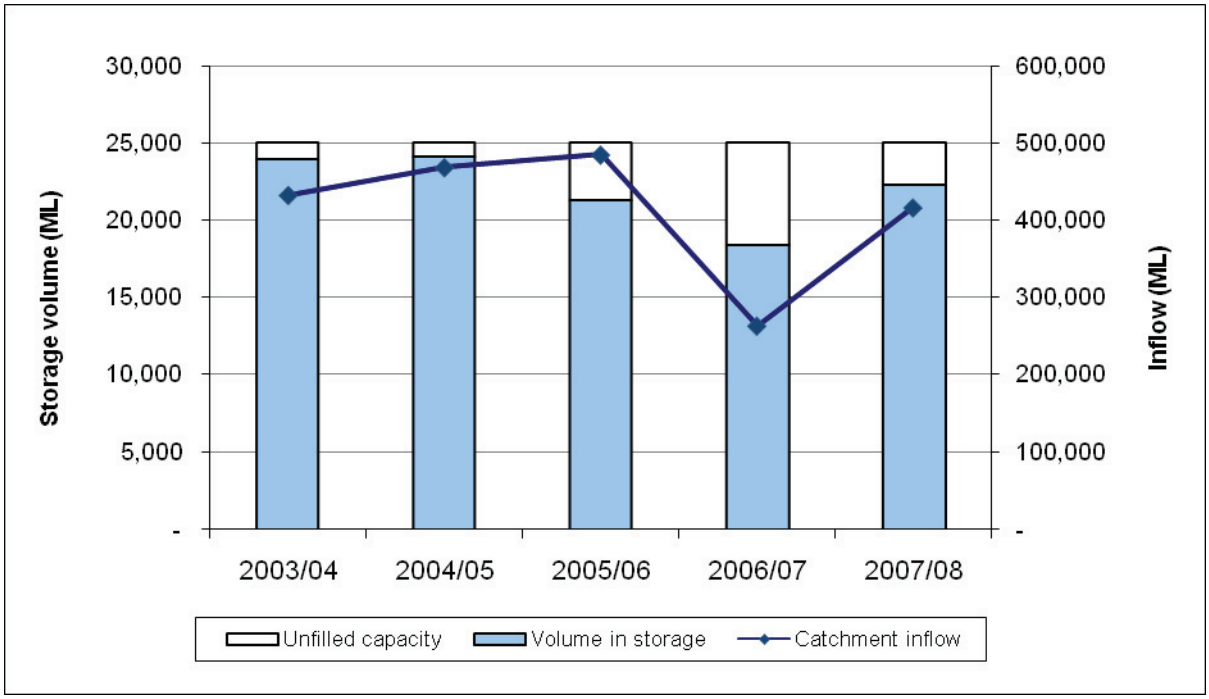
23.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Bunyip basin ranged between 60% and 100% of the long term average. Catchment inflows were 398,300 ML which equals 74% of the long term average (of 541,000 ML). This was a substantial increase from the 2006/07 inflow of 265,900 ML (49%).

The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport and Bass Strait was 372,600 ML in 2007/08. This represents 89% of the catchment inflows into the basin, compared to 91% in 2006/07.

The Tarago Reservoir is the only major storage (greater than 1,000 ML) in the Bunyip basin. Storages in the Bunyip basin ended the year at 89% of total capacity, an increase from 74% at the start of the year.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	407,500	29,000
Groundwater[2]	28,800	16,000
Recycled water	139,470	23,890

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 23-6 and the estimated domestic and stock use as presented in Table 23-7. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

23.5 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. While the Tarago Reservoir operated by Melbourne Water is in the basin, it is not currently used for Melbourne's metropolitan water supply. A new treatment plant is currently being constructed that will permit the reconnection of Tarago Reservoir to Melbourne's water supply by the end of 2009. The 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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	18,400	21,300
Volume in storage at end of year	22,300	18,400
Change in storage	**3,900**	**-2,900**
Inflows		
Catchment inflow(1)	398,300	265,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	9,210	8,480
Sub-total	**407,500**	**274,400**
Usage		
Urban diversions	3,290	3,350
Licensed diversions from regulated streams	3,000	3,000
Licensed diversions from unregulated streams	7,200	10,400
Small catchment dams	15,500	15,400
Sub-total	**29,000**	**32,200**
Losses		
Net evaporation losses from major storages(2)	-100	400
Evaporation from small catchment dams(3)	600	1,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	1,500	1,400
Sub-total	**2,000**	**3,400**
Water passed at outlet of basin		
River outflows to the ocean and Port Phillip Bay and Westernport	372,600	241,700

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 2007/08 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, 2007/08

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

There were no transfers of water entitlements within the basin or across basin boundaries in 2007/08.

23.6.4 Volume diverted

The volume of water diverted in 2007/08 is shown in Table 23-5.

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 23-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
Gippsland Water					
Tarago/Bunyip	n/a	n/a	0	3,287	n/a
Melbourne Water					
Tarago/Bunyip	n/a	n/a	0	0	n/a
Southern Rural Water					
Tarago/Bunyip	n/a	n/a	0	3,000(1)	n/a
Total annual volume of bulk entitlements 2007/08		**n/a**		**6,287**	
Total annual volume of bulk entitlements 2006/07		**n/a**		**6,348**	
Licensed diversions from unregulated streams 2007/08		*14,391*		*7,155*	
Licensed diversions from unregulated streams 2006/07		*17,984*		*10,400*	

Note:

(1) The Tarago system bulk entitlements were not finalised during 2007/08, however Gippsland Water extracted over 3,000 ML from the Tarago reservoir under agreement with Melbourne Water.

n/a: Bulk entitlement conversion order was not finalised for 2007/08.

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 23-6.

The Bunyip basin contains the whole Frankston GMA, Nepean GMA, most of the Koo-Wee-Rup WSPA as well as part of the Moorabbin GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Reported groundwater use in the Bunyip basin was less in 2007/08 compared with 2006/07. This is believed to be a result of the extreme dry conditions experienced in 2006/07, and the 2007/08 groundwater use is comparable to the use reported in 2005/06.

Table 23-6 Licensed groundwater volumes, Bunyip basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Frankston GMA (100%)	All depths	3,200	1,077	239	2	241	319
Moorabbin GMA (61%)	All depths	1,660	1,627	719	12	731	1,222
Nepean GMA (100%)	All depths	6,013	6,012	3,285	13	3,298	3,645
Koo-Wee-Rup WSPA (100%)	All depths	12,915	12,824	4,349	187	4,536	6,452
Total [5]		**23,788**	**21,539**	**8,591**	**214**	**8,805**	**11,638**

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 only.

An estimate of domestic and stock groundwater use is provided in Table 23-7. The number of domestic and stock bores in the Bunyip basin was higher in 2007/08 than reported in 2006/07. This is predominantly due to a revised calculation of the number bores in each management unit.

The estimated domestic and stock use, however, was lower in 2007/08 than reported in 2006/07 due to a lower extraction rate for Nepean GMA (in previous reports use was assumed to be 2 ML per bore, however due to the typically low demands from Nepean bores, it is now believed to be closer to 0.5 ML per bore). The lower use volume per bore is due to most domestic and stock bores being used for house and garden purposes in what are urbanised areas rather than stock supply areas.

Table 23-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[4][5]
Frankston GMA (100%)	209	418
Moorabbin GMA (61%)	157	314
Nepean GMA (100%)[3]	1,966	983
Koo-Wee-Rup WSPA (100%)	2,750	5,500
Total	**5,082**	**7,215**

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 those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in 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.

(5) The number of domestic and stock bores in Koo-Wee-Rup WSPA has been revised in 2007/08 by Southern Rural Water who indicated that the number of bores recorded in recent years was too low.

Groundwater is not used for urban supply in the Bunyip basin.

23.8 Drought contingency measures

A number of drought contingency measures continued to be implemented in the Bunyip basin during 2007/08. These included restricting urban and rural water use (discussed below in section 23.9) and providing access to emergency water supply points.

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 23-8.

Groundwater use was unrestricted in the Bunyip basin during 2007/08.

Table 23-8 Seasonal allocations and restrictions on water use in Bunyip basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	All towns serviced by Gippsland Water (e.g. Drouin, Neerim South, Rokeby, Robin Hood and Warragul)	Stage 2 restrictions in July 2007
	South East Water customers	Stage 3a restrictions from July 2007 to June 2008
Licensed diversions from unregulated streams	Monbulk Creek	Stage 1 restrictions from April to June 2008

23.10 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin. Overall, 7% of wastewater was recycled for off-site purposes.

The largest treatment plant is the Eastern Treatment Plant operated by Melbourne Water, which recycled 17% of its total wastewater volume of 127,506 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 23-9 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)
				To retailers	Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Blind Bight	198	198	79%	0	156	0	0	43	0	0
Boneo	3,295	67	1%	0	44	0	0	23	3,228	0
Drouin	316	190	60%	0	0	190	0	0	126	0
Eastern Treatment Plant	127,506	21,136	6%	7,881	0	0	0	13,255	0	106,370
Koo-Wee-Rup	81	51	63%	0	0	51	0	0	30	0
Lang Lang	35	35	100%	0	35	0	0	0	0	0
Longwarry	109	109	100%	0	0	109	0	0	0	0
Mt Martha	5,098	660	1%	0	63	0	0	597	4,438	0
Neerim South	50	0	0%	0	0	0	0	0	50	0
Pakenham	1,522	1,146	75%	0	457	683	0	6	376	0
Somers	1,265	303	24%	0	254	47	0	1	962	0
Total 2007/08	**139,475**	**23,895**	**7%**	**7,881**	**1,009**	**1,080**	**0**	**13,924**	**9,211**	**106,370**
Total 2006/07	137,821	26,699	9%	10,424	151	2,148	0	13,976	8,478	103,582

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 2007/08 the Bunyip basin EWR comprised:

- all other water in the basin not allocated for consumptive use, i.e. water above the cap
- water set aside for the environment through the operations of licensed diversions in passing flow conditions.

23.11.2 Passing flow compliance

Melbourne Water operates Tarago Reservoir to provide a passing flow below the reservoir. However, there were no bulk entitlements to take water in the Bunyip basin in 2007/08 and therefore no statutory passing flow requirements.

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

For the second consecutive year inflows to the Yarra basin were below 40% of the long term average. As with the Thomson River catchment, the rainfall events that caused severe flooding in parts of Gippsland had little impact in the Yarra basin.

Stage 3a restrictions continued all year for the Melbourne system, which resulted in a significant decrease in urban demands compared to 2006/07. The Minister for Water also delayed the introduction of the new environmental flow regime for the Yarra River and reduced environmental flows to retain water in store for Melbourne's supplies.

These actions enabled Melbourne's system storages, including its share of the Thomson reservoir, to finish the year slightly higher than where they began.

The continuing low flows also resulted in licensed diverters in most of the Yarra River's tributaries being placed on irrigation bans and restrictions during the year. This was the third consecutive year of such severe restrictions.

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, 2007/08

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 2007/08

In 2007/08 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, which were very similar to inflows experienced in 2006/07.

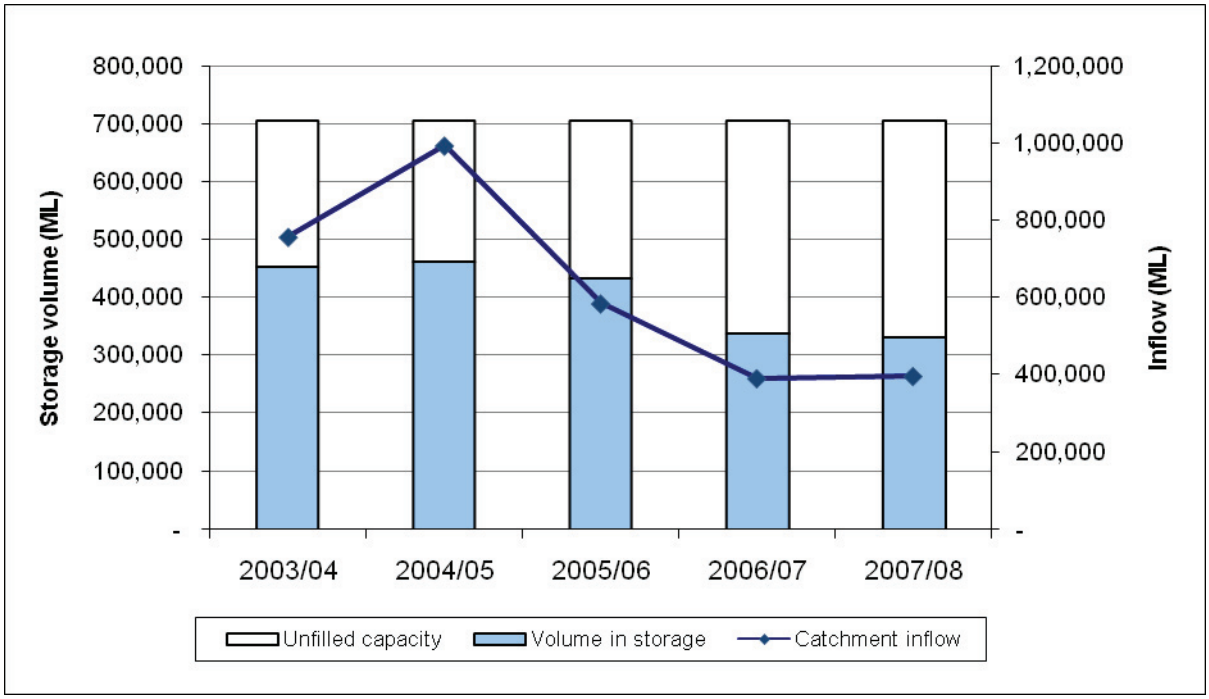
The amount of water flowing from the Yarra basin into Port Phillip Bay was 153,100 ML in 2007/08. This represents 40% of the catchment inflows to the basin, compared with 22% in 2006/07.

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 remained low in 2007/08 and were at 330,000 ML by the end of June 2008. This represents 47% of the total storage capacity of 705,000 ML within the Yarra basin. This is a reduction of 6,000 ML from 2006/07. The major on-stream storages in the basin, which comprise 36% of the basin's total storage capacity, experienced a 6% decrease in storage levels.

While low inflows persisted, a 1 in 150 year storm event in the Upper Yarra Reservoir catchment in July 2007 caused high turbidity in the Upper Yarra Reservoir from July to November 2007. This resulted in the use of Upper Yarra Reservoir water being minimised and the issue of a notice to Upper Yarra Valley township residents to boil their water. Figure 24-1 incorporates 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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	519,500	369,500
Groundwater[2]	5,000	1,900
Recycled water	9,070	2,090

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 24-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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

Melbourne Water is undertaking membrane lining of aqueducts to reduce leakage. In 2007/08 some 3.7 kilometres of aqueduct was lined.

Melbourne Water began construction of the Tarago water treatment plant. The project reconnects Tarago Reservoir, which was decommissioned due to water quality issues, to the Melbourne Water supply system.

In June 2007, the government announced it would expand Victoria's water grid by connecting Melbourne's water supplies with the Goulburn River via the Sugarloaf Pipeline as part of the northern Victoria Irrigation Renewal Project. The project is due for completion by the end of 2010. It also announced a desalination plant to be built near Wonthaggi by the end of 2011.

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.

The 2007/08 year saw a net transfer of water into the Yarra basin. Melbourne Water transferred 124,500 ML from the Thomson basin and 1,100 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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	115,300	110,200
Volume in storage at end of year	108,500	115,300
Change in storage	**-6,800**	**5,100**
Inflows		
Catchment inflow(1)	386,900	388,200
Transfers from other basins	125,600	220,400
Return flow from irrigation	0	0
Treated wastewater discharged back to river	7,000	6,440
Sub-total	**519,500**	**615,000**
Usage		
Urban diversions(2)	341,070	422,680
Licensed diversions from unregulated streams	12,500	33,200
Small catchment dams(3)	15,900	15,100
Transfers to the Werribee system	0	0
Sub-total	**369,500**	**471,000**
Losses		
Net evaporation losses from major storages	2,500	1,400
Evaporation from small catchment dams(3)	1,200	1,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**3,700**	**2,800**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	153,100	136,100

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 do not equate to the sum of the three individual Melbourne bulk entitlements, due to a different calculation method.

(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 2007/08 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, 2007/08

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

There were no transfers of entitlements within the basin or across basin boundaries in 2007/08.

24.6.4 Volume diverted

The Melbourne metropolitan retailers, City West Water, South East Water and Yarra Valley Water, were granted a pooled bulk entitlement on the Yarra River in 2006. Western Water was also granted a bulk entitlement on the Yarra River. The volume of water diverted by Western Water and the Melbourne retailers is shown in Table 24-5.

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 2007/08.

Water use from licensed diverters was low because most of the Yarra River's tributaries were on irrigation bans and restrictions during the year.

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

Table 24-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(2)
Melbourne metropolitan retailers					
Yarra River	15	400,000	0	205,200	Yes
Western Water					
Yarra River	1	11,250	0	10,272	Yes
Total annual volume taken in 2007/08		**411,250**	**0**	**215,472**	
Total annual volume taken in 2006/07		**411,250**	**0**	**90,448**	
Licensed diversions from unregulated streams 2007/08		*45,559*		*12,517*	
Licensed diversions from unregulated streams 2006/07		*45,284*		*33,200*	

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 2007/08 was 330,800 ML.

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 24-6.

The Yarra basin contains the whole Wandin Yallock WSPA as well as part of the Kinglake GMA and Moorabbin GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Yarra basin was less in 2007/08 compared with 2006/07. The difference is believed to be a result of the extremely dry conditions experienced in 2006/07. The 2007/08 groundwater use is comparable to the use reported in 2005/06.

Table 24-6 Licensed groundwater volumes, Yarra basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Kinglake GMA (19%)	All depths	379	350	0	210(5)	210	228
Moorabbin GMA (39%)	All depths	1,040	1,020	451	8	458	766
Wandin Yallock WSPA (100%)	All depths	2,924	2,924	563	2	564	792
Total(6)		**4,344**	**4,294**	**1,013**	**219**	**1,232**	**1,785**

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) Goulburn-Murray Water has estimated use in the Kinglake GMA at 60% of licensed entitlement.

(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 24-7. Groundwater is not used to augment urban supplies in the Yarra basin.

Table 24-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Kinglake GMA (19%)	11	22
Moorabbin GMA (39%)	98	196
Wandin Yallock WSPA (100%)	236	472
Total	**345**	**690**

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 24-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, except where the groundwater management unit is included in the Victorian Water Register (e.g. Kinglake GMA) where the numbers are based on the register. 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 range of drought contingency measures was implemented in the Yarra basin in 2007/08. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points (as indicated in Figure 24-2)
- changing the draw-down limit on Sugarloaf Reservoir, gaining access to an additional 20,000 ML of storage
- membrane lining to reduce leakage from aqueducts (3.2 kilometres of Maroondah and 560 metres of Correnderk aqueducts)
- deferral of tank cleaning program.

Two qualifications of rights were in place in the Yarra basin in 2007/08. In October 2007, the Minister revoked the existing qualification, which was declared in the previous year, and replaced it with a new one. Details of these qualifications are presented in Table 24-8.

Table 24-8 Qualifications of rights

Qualification type	Qualification description
Passing flow	Delayed the introduction of the new environmental flow regime for the Yarra River to retain water in storages for supply to Melbourne. Date: From 16 April 2007 to 20 October 2007
Passing flow	Delayed 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. Date: From 20 October 2007 to 30 June 2008

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 24-9. Urban customers faced Stage 3a level of water restrictions throughout the year and many unregulated streams had irrigation bans in place, particularly over summer.

Groundwater use was unrestricted in the Yarra basin during 2007/08.

Table 24-9 Seasonal allocations and restrictions on water use in Yarra basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Yarra Valley Water, South East Water and City West Water customers	Stage 3a restrictions from July 2007 to June 2008
Licensed diversions from unregulated streams	Darebin Creek	Irrigation ban August 2007 and March and May 2008
	Diamond Creek	Irrigation ban August to November 2007, January to June 2008
	Hoddles Creek	Irrigation ban from October 2007 to June 2008
	Yarra River	Restrictions in October and November 2007, January to June 2008
	Little Yarra River	Restrictions from August to September 2007 and from April to May 2008. Irrigation bans from October to November 2007 and from January to March 2008
	Don River	Irrigation ban from October to November 2007 and from January to April 2008
	Pauls Creek	Irrigation ban July 2007 to June 2008
	Plenty River	Irrigation ban August to December 2007 and February to June 2008
	Steels/Dixons Creek	Irrigation ban July 2007 to June 2008
	Wandin Yallock Creek	Irrigation ban August to October 2007
	Woori Yallock Creek	Restrictions in August 2007, November 2007 and March 2008. Irrigation ban from September to October 2007, from January to February 2008, and from April to May 2008
	Mullum Mullum Creek	Irrigation ban August 2007, October 2007, January 2008
	Olinda Creek	Irrigation ban April 2008
	Moonee Ponds Creek	Irrigation ban November 2007
	Watsons Creek	Irrigation ban November to December 2007
	Watts River	Irrigation ban February 2008
	Stringybark Creek	Irrigation ban February 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 24-10.

Wastewater was reused at four of the plants in 2007/08. Although the volume of wastewater entering the treatment plants increased, the volume of recycled water reduced. Overall, around 6% of wastewater was reused in the basin, which is a reduction from the percentage recycled in 2006/07 (9%). This was mostly due to a reduction in agricultural reuse.

Table 24-10 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]		
Brushy Creek	3,979	753	2%	85	0	0	668	3,226	0
Craigieburn	957	157	12%	110	0	0	47	800	0
Healesville	321	58	0%	0	0	0	58	263	0
Lilydale	2,469	555	0%	6	0	0	549	1,914	0
Monbulk	13	0	0%	0	0	0	0	13	0
Upper Yarra	680	181	0%	0	0	0	181	500	0
Wallan	403	240	60%	0	240	0	0	164	0
Whittlesea	250	151	48%	121	-	0	31	99	0
Total 2007/08	**9,073**	**2,094**	**6%**	**322**	**240**	**0**	**1,533**	**6,978**	**0**
Total 2006/07	8,073	1,612	9%	0	741	0	871	6,438	23

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 2007/08 the Yarra basin EWR comprised:

- an environmental entitlement of 17,000 ML
- 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 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 2007/08. No flushing flows were released by Melbourne Water due to the qualification of rights.

Table 24-11 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 24-11 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 2007/08, 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 2007/08, 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 2007/08, with Melbourne Water meeting the qualified requirements • Flows of 245 ML/day were passed downstream of Yering Gorge Pump Station

24.11.3 Streamflow management plans

At the start of the year streamflow management plans (SFMPs) existed for Diamond Creek and Hoddles Creek within the Yarra basin.

SFMPs for the Plenty River, Stringybark Creek, Olinda Creek and Pauls, Steels and Dixons Creeks were approved by the Minister for Water.

During 2006/07 WSPAs were declared for Little Yarra, Don Rivers and Woori Yallock Creek, enabling the development of SFMPs for these catchments.

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

The Maribyrnong basin continued to experience extremely dry conditions in 2007/08. Inflows into the basin were 23% of the long term average, slightly higher than those experienced in 2006/07.

Water levels remained extremely low in Rosslynne Reservoir, which was barely used for consumptive use commitments.

As such, local surface water resources were only available from local Macedon storages or from the Melbourne system. Southern Rural Water did not release any water to entitlement holders on the Maribyrnong River because of the extremely low inflows, however irrigators located on the Kilo flats had access to potable mains supply from the Melbourne system.

With the exception of Lancefield, Western Water also supplemented its towns' supplies from the Melbourne system because local sources were not sufficient to meet demands. As such, Stage 3a restrictions were in force during the year in line with the restrictions applied for Melbourne.

The temporary amendment to Southern Rural Water's Maribyrnong bulk entitlement, which reduces environmental releases from Rosslynne Reservoir to retain water in store, continued throughout the year.

Use under licensed diversions from unregulated streams increased slightly due to minor improvements in streamflows throughout the year, however most streams were subject to lengthy periods of ban.

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, 2007/08

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

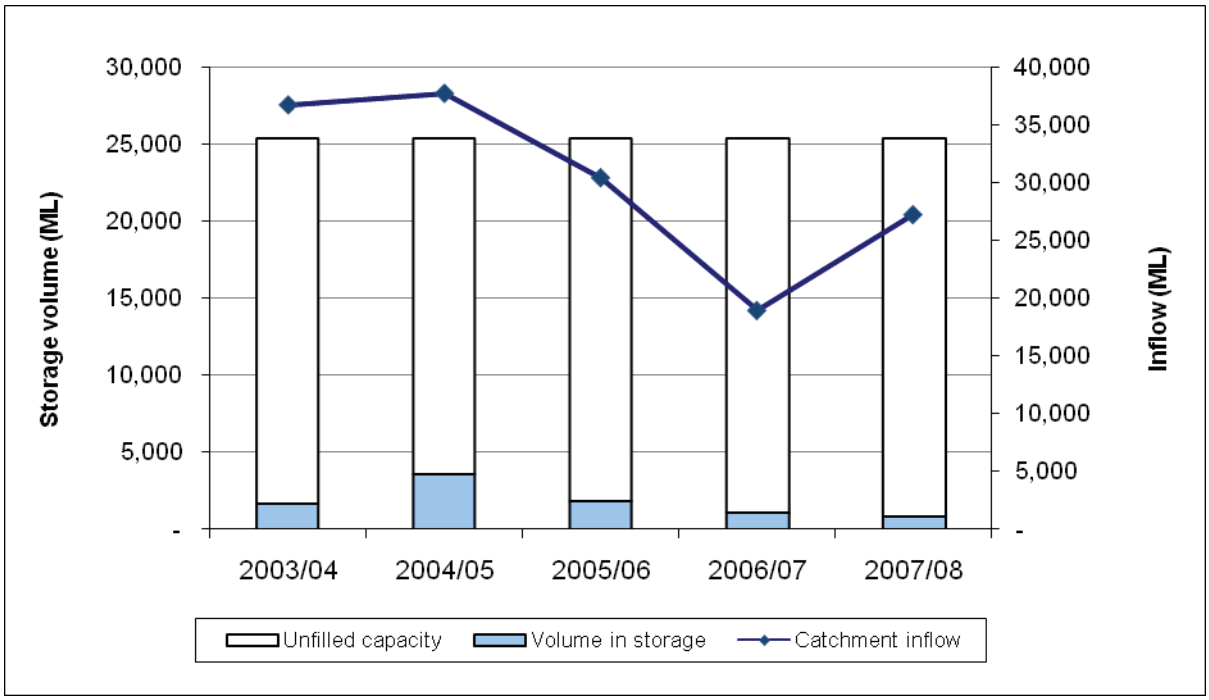
25.3 Rainfall, flows and storages in 2007/08

In 2007/08 the majority of the Maribyrnong basin experienced rainfall between 60% and 80% of the long term average.

Inflows into the Maribyrnong basin were 23% of the long term average (of 113,000 ML) in 2007/08. This was higher than 2006/07 inflows, which were 17% of the long term average. Usage in 2007/08 was fairly similar to that in 2006/07, resulting in an increase in water flowing into Port Phillip Bay: 11,000 ML in 2007/08. This represents 40% of the catchment inflows into the basin, compared with 22% in 2006/07, with the increase largely as a result of increased inflows into the basin.

Rosslynne Reservoir, with a capacity of 25,368 ML, is the only large storage greater than 1,000 ML located within the basin. The storage volume, at 4% of total capacity at the start of 2007/08, decreased during 2007/08 and was 3% full at the end of June 2008.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	26,900	9,400
Groundwater[2]	1,700	600
Recycled water	2,340	1,360

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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

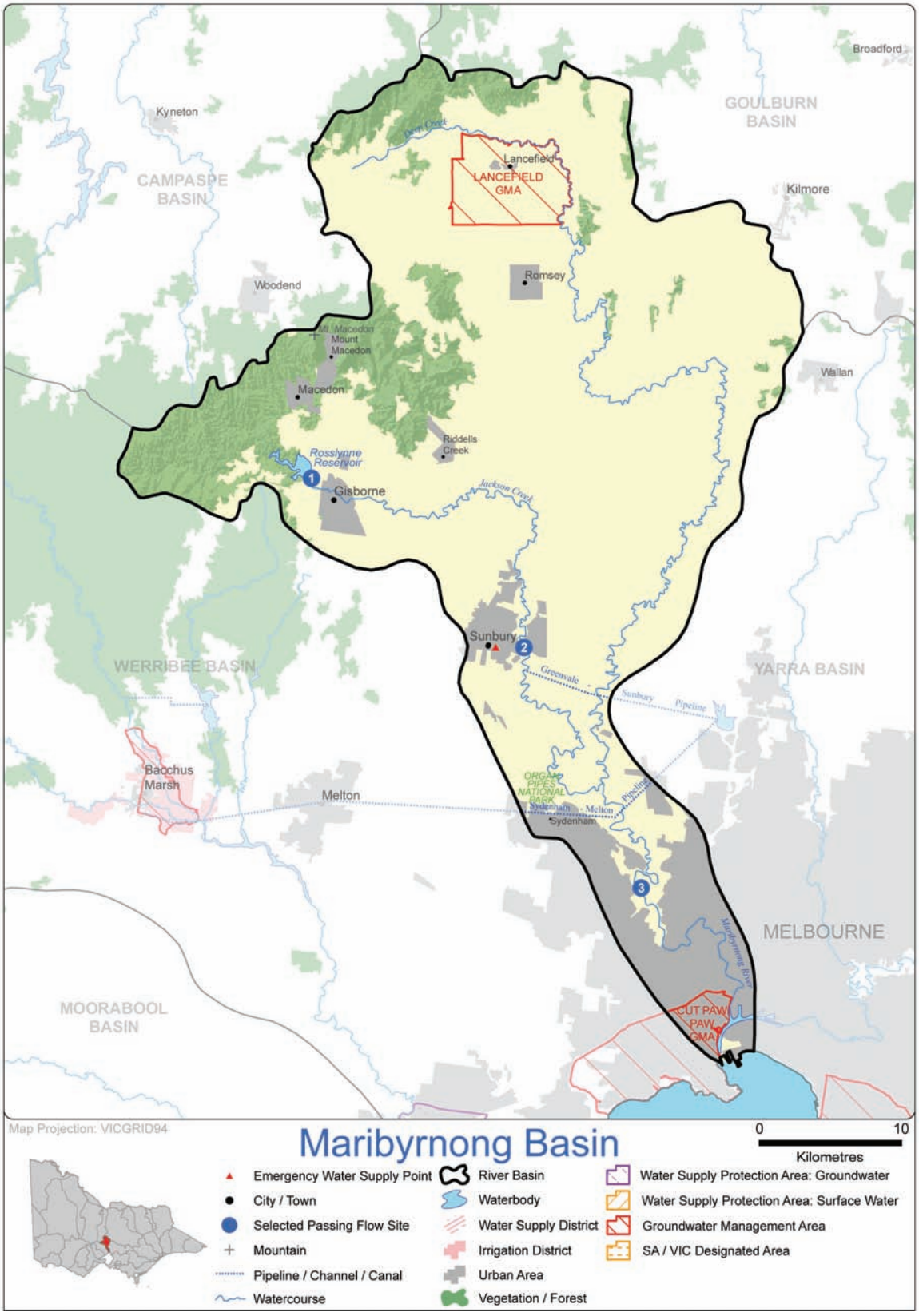
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

25.4.1 Infrastructure projects to improve water availability

Western Water completed construction of the Lancefield Filtration Plant in 2007/08. This plant can treat both bore and surface water, improving Lancefield water quality and increasing flexibility in supply source.

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.

Supply to urban areas within the Maribyrnong basin does 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 Yarra and Thomson 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. By far the largest diversion of water in the Maribyrnong basin in 2007/08 was by small catchment dams, comprising approximately 76% of the total diversions.

Table 25-3 Balance of surface water in the Maribyrnong basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	1,100	1,800
Volume in storage at end of year	900	1,100
Change in storage	**-200**	**-700**
Inflows		
Catchment inflow(1)	25,900	19,600
Transfers from other basins(2)	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	970	1,100
Sub-total	**26,900**	**20,700**
Usage		
Urban diversions	920	600
Licensed diversions from regulated streams	200	100
Licensed diversions from unregulated streams	500	1,300
Small catchment dams(4)	7,800	5,600
Sub-total	**9,400**	**7,600**
Losses		
Net evaporation losses from major storages(3)	300	400
Evaporation from small catchment dams(4)	4,800	6,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	1,600	2,300
Sub-total	**6,700**	**9,200**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	11,000	4,600

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Transfers from the Melbourne system to Sunbury are not shown as they were provided directly into the urban supply system and did not affect streamflows in the Maribyrnong basin.

(3) Net evaporation estimated based on comparison of inflows in 2005/06.

(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 2007/08 is not readily available. The values in Table 25-4 are based on the estimates from the Department of Sustainability and Environment per Chapter 5.

Table 25-4 Estimated small catchment dam information, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,800	2,900	n/a
Registered commercial and irrigation	5,800	4,900	n/a
Total	**11,600**	**7,800**	**12,600**

n/a: Information not available.

25.6.3 Water entitlement transfers

No transfers of entitlements were made within the basin or across basin boundaries in 2007/08.

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 2007/08. 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.

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. The Western Water and Southern Rural Water Maribyrnong bulk entitlement period was decreased from five years in 2006/07 to one year in 2007/08. 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance? (2)
Western Water					
Gisborne – Barringo Creek	1	320	0	11	Yes
Lancefield	1	315	0	35	Yes
Macedon and Mt Macedon(3)	1	645	0	312	Yes
Riddells Creek	1	300	0	44	Yes
Romsey	1	460	0	324	Yes
Maribyrnong (Rosslynne Reservoir)	1	6,100	0	189	Yes
Melbourne Water					
Maribyrnong(4)	5	1,396	0	246	Yes
Southern Rural Water					
Maribyrnong	1	382	0	0	Yes
Total annual volume of bulk entitlements 2007/08		**9,918**	**0**	**1,161**	
Total annual volume of bulk entitlements 2006/07		**9,682**	**0**	**727**	
Licensed diversions from unregulated streams 2007/08		*2,022*		*499*	
Licensed diversions from unregulated streams 2006/07		*1,787*		*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) 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 5800 ML to 6980 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 entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Maribyrnong basin was higher in 2007/08 compared with 2006/07. A number of new licences were issued in both the Cut Paw Paw GMA and the Lancefield GMA during 2007/08. A combination of these new licences and increased demand on existing bores contributed to the higher groundwater use in 2007/08

Table 25-6 Licensed groundwater volumes, Maribyrnong basin 2007/08

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	56	0.5	56	37
Lancefield GMA (100%)	All depths	1,485	1,390	360	2	363	273
Total[5]		**2,333**	**1,555**	**416**	**3**	**419**	**311**

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 only.

An estimate of domestic and stock groundwater use is provided in Table 25-7. The number of domestic and stock bores in the Maribyrnong basin increased from 76 in 2006/07 to 84 in 2007/08.

Table 25-7 Number of domestic and stock bores and estimated use, 2007/08

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%)	0	0
Lancefield GMA (100%)	84	168
Total	**84**	**168**

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 those registered in the state database as being drilled since 1965, multiplied by the surface water percentage in the basin.
(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 2007/08 (ML)	Metered use 2006/07 (ML)
Lancefield	585	150	143

25.8 Drought contingency measures

Drought contingency measures undertaken in the Maribyrnong basin in 2007/08 included restricting urban and rural water use (discussed in section 25.9).

One qualification of rights was in place in the Maribyrnong basin in 2007/08, as presented in Table 25-9.

Table 25-9 Qualifications of rights

Qualification type	Qualification description
Reduced passing flow requirements	Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Further Amendment Order 2006 was signed by the Minister for Water in October 2006. It was in effect over the entire 2007/08 year and had the effect of reducing environmental flow releases from Rosslynne Reservoir.

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. Urban restrictions became more severe as the year progressed and many unregulated streams continued irrigation bans from 2006/07 or introduced new bans in 2007/08.

Groundwater use was unrestricted in the Maribyrnong basin during 2007/08.

Table 25-10 Seasonal allocations and restrictions on water use in Maribyrnong basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	City West Water customers and Western Water customers (except in Lancefield)	Stage 3a restrictions from July 2007 to June 2008
	Sunbury and Bulla	Stage 3a restrictions from July 2007 to April 2008.
	Romsey, Macedon, Mt Macedon, Riddells Creek and Gisborne	Stage 3a restrictions from July 2007 to June 2008.
	Lancefield	Stage 3 restrictions from July to November 2007, Stage 2 from December 2007 to June 2008
Licensed diversions from unregulated streams	Barringo Creek, Bolinda Creek, Deep Creek	Irrigation ban November 2007 to June 2008
	Riddells Creek	Irrigation ban November 2007 to June 2008
	Witch Creek	Irrigation ban November 2007 to June 2008
	Jacksons Creek	0% of licensed volume
	Maribyrnong River	Irrigation ban on winter fill licences in August and September 2007 and on summer and winter fill licences from October to December 2007. Irrigation ban on all licences from January to June 2008
Irrigation and regulated diversions (Southern Rural Water)	Jacksons Creek	0% of licensed volume between November 2007 and June 2008
Irrigation and regulated diversions (Melbourne Water)	Maribyrnong River	No releases from Rosslynne reservoir were made for entitlement holders on the Maribyrnong River in 2007/08

25.10 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall, 51% of the wastewater was reused in 2007/08, primarily for agricultural purposes such as wineries and vegetable producers. Recycled use increased marginally on the 46% experienced in 2006/07.

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	390	125	20%	77	0	0	48	265	0
Riddells Creek	60	60	100%	0	60	0	0	0	0
Romsey	244	244	100%	0	244	0	0	0	0
Sunbury	1,643	936	49%	341	469	0	126	708	0
Total 2007/08	**2,337**	**1,365**	**51%**	**419**	**772**	**0**	**174**	**972**	**0**
Total 2006/07	2,387	1,289	46%	374	735	0	180	1,098	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 2007/08 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.

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)

Technical studies and administrative processes are underway 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

Although inflows to the Werribee basin in 2007/08 increased by 53% compared with 2006/07, they were still low at 23% of the long term average.

Storage volumes started the year very low at 8.5%, which meant that very little water was available for use in the basin. Irrigators in the Bacchus Marsh and Werribee irrigation districts received an 8% 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.

Southern Rural Water implemented a number of drought contingency measures to help supplement rural supplies in the basin. The corporation transferred 2,000 ML from its drought reserve stored in the Thomson Reservoir to the Werribee and Bacchus Marsh irrigation districts, pumped dead storage from Pykes Creek reservoir, and continued with a qualification of rights which gave it access to the remaining 800 ML of unallocated water in Lake Merrimu. Many irrigators in the Werribee irrigation district also continued to rely on the recycled water scheme from the Western Treatment Plant.

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 also severely restricted.

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, 2007/08

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

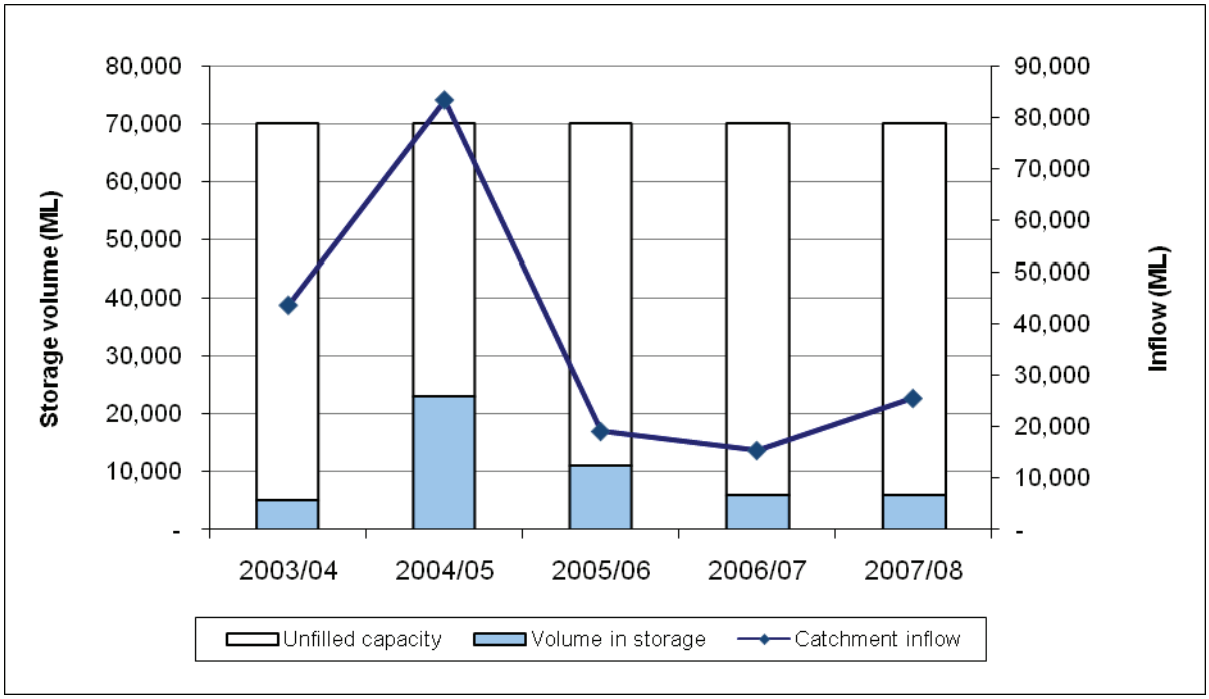
26.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Werribee basin ranged between 60% and 80% of the long term average. Inflows into the Werribee basin were 23% of the long term average (of 102,000 ML). While this inflow was still low, it was an increase of 66% compared with 2006/07 (15% of the average).

In 2007/08 some 500 ML of water flowed from the Werribee basin into Port Phillip Bay representing 2% of the catchment inflows into the basin. The year's inflows were 45% lower than 2006/07 when the outflow of 900 ML (or 6% of catchment inflows) reached Port Phillip Bay.

The three major storages (greater than 1,000 ML) in the Werribee basin include the Melton, Merrimu and Pykes Creek reservoirs. Storage volumes remained constant throughout 2007/08.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	24,600	12,900
Groundwater[2]	6,200	300
Recycled water	144,630	60,660

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 26-7 and Table 26-8. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

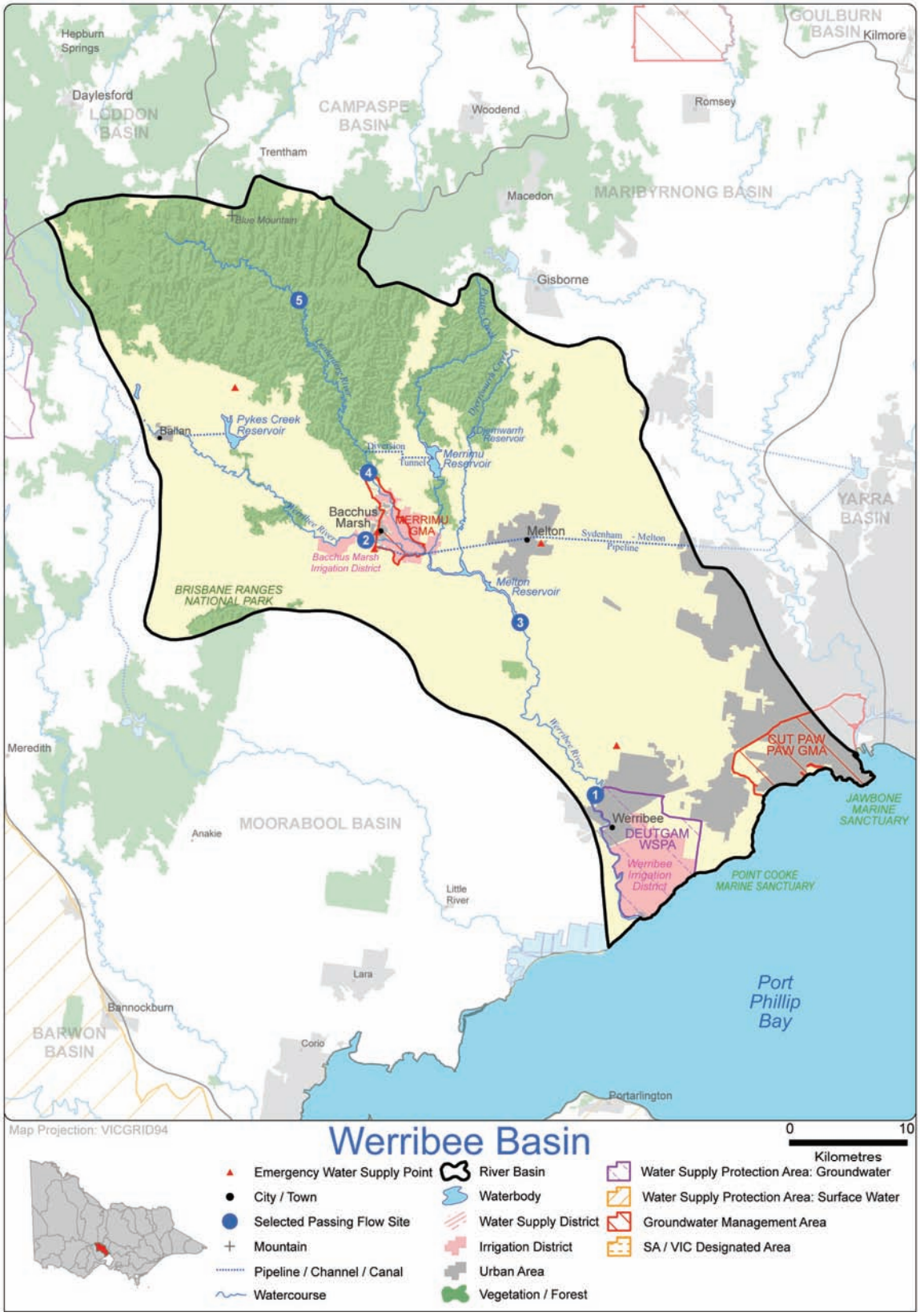
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

26.4.1 Infrastructure projects to improve water availability

No long term infrastructure projects were undertaken in 2007/08.

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. 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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	6,000	10,900
Volume in storage at end of year	6,000	6,000
Change in storage	**0**	**-4,900**
Inflows		
Catchment inflow(1)	23,600	15,400
Transfers from other basins(2)	1,000	0
Return flow from irrigation(3)	0	200
Treated wastewater discharged back to river	0	0
Sub-total	**24,600**	**15,600**
Usage		
Urban diversions	500	100
Irrigation district diversions	2,800	3,400
Licensed diversions from unregulated streams	300	500
Small catchment dams(4)	9,300	4,900
Sub-total	**12,900**	**8,900**
Losses		
Net evaporation losses from major storages(5)	100	2,600
Evaporation from small catchment dams(4)	5,400	2,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(6)	5,700	5,600
Sub-total	**11,200**	**10,700**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	500	900

Notes:
(1) Inflows have been calculated from outflows plus diversions.
(2) Transfer from the Thomson basin.
(3) Estimate not available.
(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) No estimates provided for Melton, Merrimu and Pykes Creek reservoirs.
(6) 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 2007/08 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, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,900	2,900	n/a
Registered commercial and irrigation	7,600	6,400	n/a
Total	**13,500**	**9,300**	**14,700**

n/a: Information not available.

26.6.3 Water entitlement transfers

A summary of entitlements transferred into and out of the Werribee basin is presented in Table 26-5.

In 2007/08, some 702 ML of entitlement was temporarily transferred in 28 transactions within Southern Rural Water's Werribee and Bacchus Marsh irrigation districts. A total of 144 ML of entitlement was permanently transferred in three transactions.

Table 26-5 Transfer of entitlements in the Werribee basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Southern Rural Water								
Werribee system	144	144	3	-	702	702	28	-
Total 2007/08	**144**	**144**	**3**	**-**	**702**	**702**	**28**	**-**
Total 2006/07	**-**	**-**	**-**	**-**	**963**	**963**	**61**	**-**

Note:
(1) Entitlements for which no trades were recorded are not shown.

26.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 26-6. 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. The Western Water and Southern Rural Water Werribee bulk entitlement period was decreased from 5 years in 2006/07 to 1 year in 2007/08.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

Table 26-6 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
Central Highlands Water					
Ballan[2]	1	451	0	0	Yes
Blackwood and Barry's Reef	1	140	0	30	Yes
Western Water					
Myrniong	1	58	0	33	Yes
Werribee system – urban	1	8,500	0	451	Yes
Southern Rural Water					
Werribee system	1	27,040	0	2,763	Yes
Total annual volume of bulk entitlements 2007/08		**36,189**	**0**	**3,277**	
Total annual volume of bulk entitlements 2006/07		**36,189**		**3,542**	
Licensed diversions from unregulated streams 2007/08		*1,616*		*261*	
Licensed diversions from unregulated streams 2006/07		*1,185*		*500*	

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) Although no water was diverted under this bulk entitlement, a small amount of unmetered water was taken from the Colebrook Reservoir for emergency supply to Blackwood.

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 26-7.

The Werribee basin contains the whole Deutgam WSPA and Merrimu GMA as well as part of 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 increased in 2007/08 compared with 2006/07. However, across the basin, licensed groundwater reduced by 80% of that extracted in 2006/07. In previous years, most extractions in the Werribee basin were from the Deutgam WSPA. However in 2007/08 rights, including for domestic and stock use with some minor exemptions, were qualified to ban all extractions from the Deutgam WSPA to protect the groundwater quality from the impacts of sea water intrusion..

Table 26-7 Licensed groundwater volumes, Werribee basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Cut Paw Paw GMA (77%)	>50	2,802	545	184	2	185	124
Merrimu GMA (100%)	≤30	450	451	12	1	13	79
Deutgam WSPA (100%)	≤30	5,100	5,090	53	18	72	1,093
Total[6]		**8,352**	**6,086**	**248**	**21**	**269**	**1,295**

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. Merrimu PCV is greater than the licensed entitlement and is currently under review.

(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 only.

(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 26-8. The estimated domestic and stock use in 2007/08 is considerably less than 2006/07 due to the ban on domestic and stock extractions in the Deutgam WSPA during 2007/08.

Table 26-8 Number of domestic and stock bores and estimated use, 2007/08

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%)	2	4
Merrimu GMA (100%)	31	62
Deutgam WSPA (100%)	338	0
Total	**371**	**66**

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 26-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in 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 not used to supplement urban supplies in the Werribee basin.

26.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Werribee basin in 2007/08. These included:

- restricting urban and rural water use (discussed in section 26.9)
- providing access to emergency water supply points
- water carting from Colebrook Reservoir to Blackwood and from Bacchus Marsh to Myrniong
- use of unallocated water in Lake Merrimu for Bacchus Marsh irrigators
- transfer of 1,000 ML of Western Water entitlement in Merrimu Reservoir to Southern Rural Water in exchange for the same volume in Thomson Reservoir
- transfer of 1,000 ML from Thomson Reservoir to Werribee Irrigation District via Melbourne's water supply system
- pumping dead storage from Pykes Creek Reservoir
- carry-over of irrigation allocation from the previous year
- use of recycled water for irrigation at Werribee.

The Minister for Water declared three qualifications of rights in the Werribee basin in 2007/08. Details of these qualifications are presented in Table 26-9.

Table 26-9 Qualifications of rights

Qualification type	Qualification description
Access to unallocated water	Changed the Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997 to allow Southern Rural Water to take 1,200 ML of unallocated water in Lake Merrimu to maintain the viability of critical businesses relying on water from the Bacchus Marsh irrigation system Date: From 8 March 2007 to 30 September 2007
Access to unallocated water	Changed the Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997 to allow Southern Rural Water continued access to the remaining 490 ML of the 1,200 ML of unallocated water in Lake Merrimu (not used in above qualification) as well as a further 310 ML to maintain the viability of critical businesses relying on water from the Bacchus Marsh irrigation system Date: From 20 October 2007 to 30 June 2008
Differential access by priority entitlement holders	Access to groundwater in Deutgam WSPA banned through a qualification of rights from July 2007 to June 2008 (including domestic and stock). Exemptions apply

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 26-10. Irrigators and diverters in the Werribee system received an allocation of 8% of their entitlement.

The ban on access to groundwater within the Deutgam WSPA remained in place thoughout 2007/08. Access to the resource will resume when the risk of salt water intrusion has diminished.

Table 26-10 Seasonal allocations and restrictions on water use in Werribee basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Ballan	Stage 4 restrictions from July 2007 to June 2008
	Barry's Reef and Blackwood	Stage 3 restrictions from July 2007 to June 2008
	Toolern and Diggers Rest	Stage 3a restrictions from July 2007 to April 2008
	Myrniong, Bacchus Marsh and Melton	Stage 3a restrictions from July 2007 to June 2008
Licensed diversions from unregulated streams	Lerderderg River	Irrigation ban from July 2007 to June 2008
	Kororoit Creek	Irrigation ban from July 2007 to June 2008
Irrigation and regulated diversions	Werribee system (Werribee irrigation district, Bacchus Marsh irrigation district, Werribee River)	The seasonal allocation for Werribee and Bacchus Marsh irrigation districts remained at 8% in June 2008
Groundwater	Deutgam WSPA	Access to groundwater banned through a qualification of rights from July 2007 to June 2008 (including domestic and stock). Exemptions apply

26.10 Recycled water

Five wastewater treatment plants operate within the Werribee basin. Around 42% of wastewater was reused in 2007/08, over 5,000 ML more than the 55,281 ML recycled in 2006/07.

The majority of water recycling in the basin occurs at Melbourne Water's Western Treatment Plant, which reused 42% of wastewater, including 27,481 ML for on-site irrigation and environmental management and 15,930 ML for habitat management at Ramsar-listed wetlands. The main reason for the increase in recycled water usage was greater sales from Melbourne Water to City West Water for on-sell to urban customers, and to Southern Rural Water for use in the Werribee Irrigation District.

Table 26-11 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]
				To retailers	Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Altona	4,698	73	0%	0	0	0	0	73	0	4,625
Ballan	61	73	120%	0	0	73	0	0	0	-12[4]
Melton	3,033	3,033	92%	0	539	2,297	0	197	0	0
Parwan (Bacchus Marsh)	701	701	100%	0	0	701	0	0	0	0
Western Treatment Plant	136,136	56,778	42%	12,814	553	27,481	15,930	0	0	79,358
Total 2007/08	**144,628**	**60,657**	**42%**	**12,814**	**1,092**	**30,552**	**15,930**	**270**	**0**	**83,971**
Total 2006/07	150,080	55,281	37%	11,047	655	29,723	13,856	0	0	94,799

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) A negative entry in other for Ballan occurred because of recycled water stored on site at the beginning of 2007/08.

26.11 Water for the environment

26.11.1 Environmental Water Reserve (EWR)

Important environmental asets, such as the Australian Grayling, Tupong and Red Gums, are dependent on the Werribee basin EWR.

In 2007/08 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 26-12 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 26-12 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 2007/08
	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 6500 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 2007/08
	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 • 1500 ML/day for 24 hours in 3 out of 4 years if the instantaneous flow at this location exceeds 1500 ML/day Passing flow requirements were met during 2007/08
	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 2007/08

.

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

Total inflows to the Moorabool basin in 2007/08, although double the previous year, were still 40% of the long term average.

The extremely dry conditions in the basin over the last three years have severely impacted water availability. By the end of the year, the volume of water in store had dropped to 5% of capacity. Furthermore, 3% of total inflows had left the basin by the end of the year.

Ballarat was connected to the Goulburn system by the Goldfields Superpipe in May 2008. Although Central Highlands Water had access to the Goulburn system's water quality reserve via a qualification of rights and had purchased water shares to supplement Ballarat's long term supplies, there was not enough time for this augmentation to impact on water availability.

In the face of extreme shortages for Ballarat, Central Highlands Water introduced targeted restrictions in an effort to reduce consumption below Stage 4 levels, resulting in urban water use in the basin halving compared to 2006/07. Environmental flows in the Moorabool River downstream of Lal Lal Reservoir were again qualified to retain water for Ballarat, while Barwon Water also agreed to transfer part of its share of water in the reservoir to Central Highlands Water.

Barwon Water's use of water from the Moorabool basin was also greatly reduced in 2007/08. This was because its share of the resources in the basin was very low and there was a need to reserve water for Meredith, whose normal supply had dried up and was secured through a qualification.

Licensed diverters from the Moorabool River were restricted until November, and subsequently banned due to the extremely low river flows.

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, 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 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 Obligation 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 2007/08

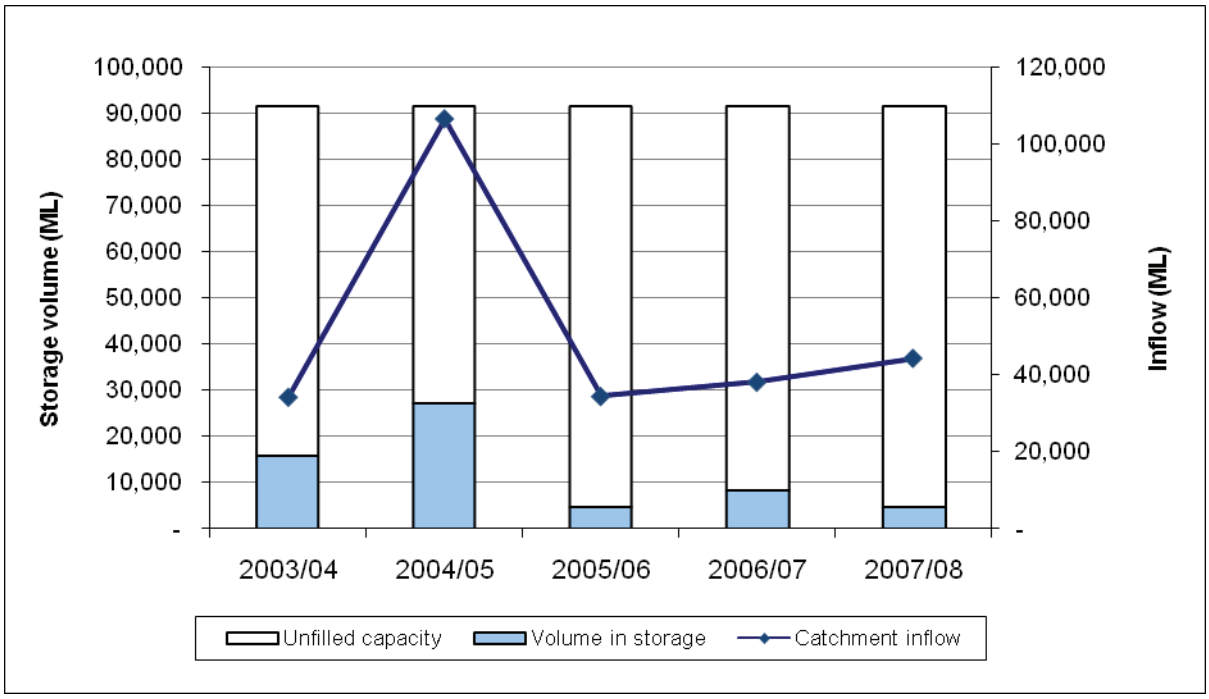
In 2007/08, rainfall in the Moorabool basin was generally between 60% and 100% of the long term average. This was higher than rainfall in 2006/07 which was recorded 40% to 80% of the long term average.

Catchment inflows in 2007/08 were 40% of the long term average of 97,000 ML, which was an improvement from 2006/07 when 26% of long term average inflows were recorded.

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 1,300 ML in 2007/08, or 3% of the catchment inflows into the basin. This is approximately 60% lower than the outflow of 3400 ML in 2006/07.

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. At the beginning of the 2007/08 season, total storage volumes began the year at 9% of capacity and dropped to 5% by the end of the year.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	39,200	29,600
Groundwater[2]	4,000	2,400
Recycled water	0	0

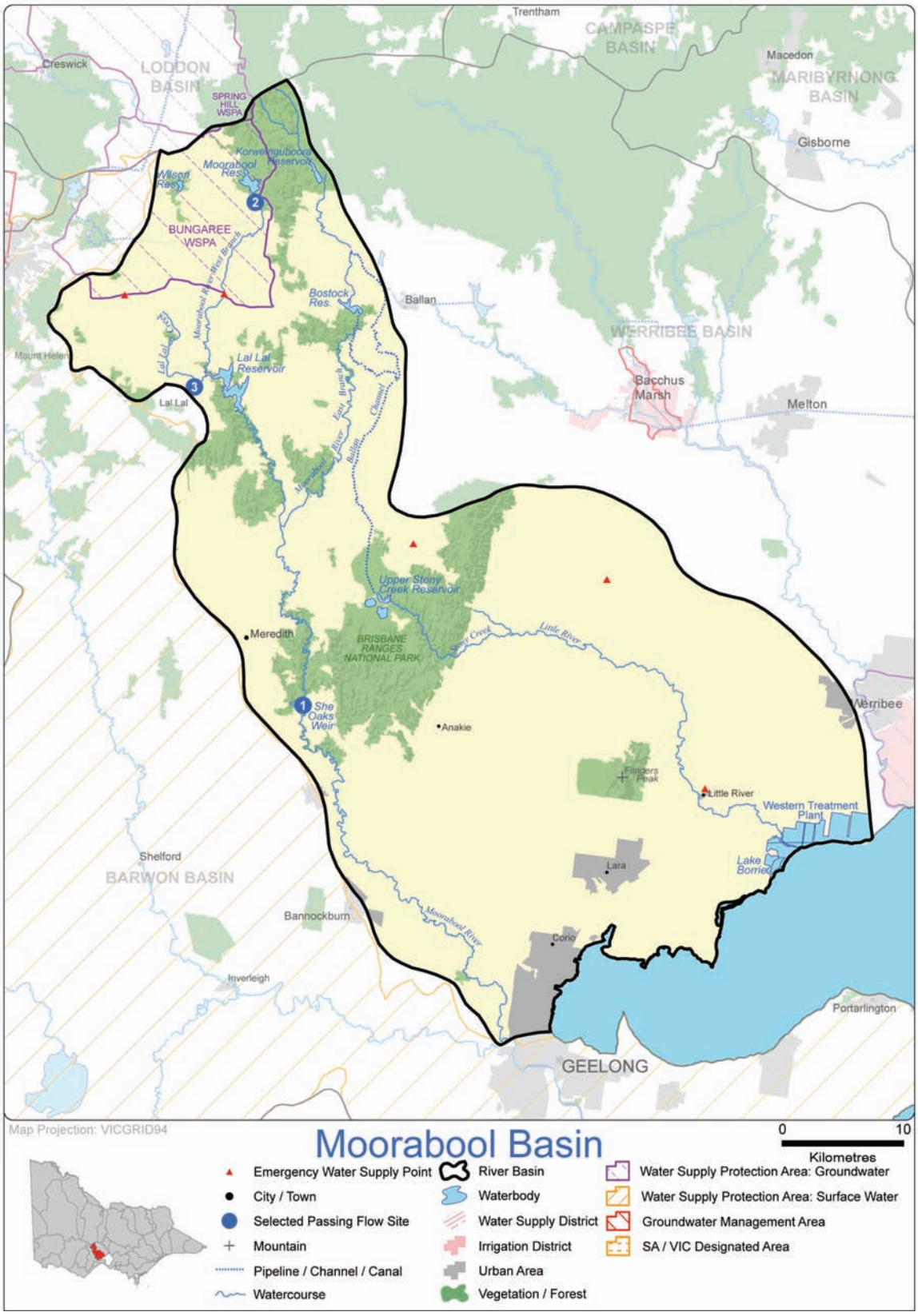
Notes:

(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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	3,800	17,100
Volume in storage at end of year	3,100	3,800
Change in storage	**-700**	**-13,300**
Inflows		
Catchment inflow(1)	39,200	25,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**39,200**	**25,100**
Usage		
Urban diversions(2)	4,120	9,780
Transfers to Barwon basin (White Swan Reservoir)(2)	2,140	210
Licensed diversions from unregulated streams	1,100	1,400
Small catchment dams(3)	22,200	15,300
Sub-total	**29,600**	**26,700**
Losses		
Net evaporation losses from major storages	1,100	1,700
Evaporation from small catchment dams(3)	7,300	5,700
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	600	900
Sub-total	**9,000**	**8,300**
Water passed at outlet of basin		
River outflows to Port Phillip Bay (Little River)	900	2,900
River outflows to the Barwon River (Moorabool River)	400	500

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) The urban diversions figure of 4,120 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 2,140 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 2007/08 is not readily available. The values in Table 27-4 below are based on the methodology outlined in Chapter 5.

Table 27-4 Estimated small catchment dam information, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	6,100	3,000	n/a
Registered commercial and irrigation	22,800	19,200	n/a
Total	**28,900**	**22,200**	**29,500**

n/a - Information not available.

27.6.3 Water entitlement transfers

A summary of entitlements transferred within the Moorabool basin is presented in Table 27-5. The single temporary transfer occurred when Barwon Water transferred 750 ML to Central Highlands Water from the Barwon Water share in Lal Lal Reservoir. There were no permanent transfers in 2007/08

Table 27-5 Transfer of entitlements in the Moorabool basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Barwon Water								
Lal Lal Barwon	0	0	0	0	0	750	1	750
Central Highlands Water								
Lal Lal - Central Highlands	0	0	0	0	750	0	1	750
Total 2007/08	**0**	**0**	**0**	**0**	**750**	**750**	**1**	**0**
Total 2006/07	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

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 2007/08.

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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?[2]
Barwon Water					
Lal Lal	3	7,000	750	0	Yes
Meredith	1	600	0	149	Yes
Upper East Moorabool System	1	9,000	0	1,658	Yes
She Oaks	3	2,000	0	0	Yes
Central Highlands Water					
Lal Lal	3	14,000	750	2,330	Yes
Upper West Moorabool System	1	10,500	0	2,142[3]	Yes
Total annual volume of bulk entitlements 2007/08		**43,100**	**0**	**6,280**	
Total annual volume of bulk entitlements 2006/07		**43,100**	**0**	**9,981**	
Licensed diversions from unregulated streams 2007/08		*2,047*		*1,121*	
Licensed diversions from unregulated streams 2006/07		*2,022*		*1,400*	

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) Variation between the number reported here and the Central Highlands Annual Report 2007/08 is due to different quality checking procedures.

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.

Usage within the Bungaree WSPA during 2007/08 was less than in 2006/07, explained by the aquifer being used as an emergency supply for Ballarat in 2006/07, resulting in unusually high extraction volumes in that year. The usage in 2007/08 is comparable to the volume used in 2005/06.

Table 27-7 Licensed groundwater volumes, Moorabool basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Bungaree WSPA (67%)	All depths	3,512	3,544	1,965	3	1,968	2,412
Total[6]		**3,512**	**3,544**	**1,965**	**3**	**1,968**	**2,412**

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. Licensed entitlement is greater than the PCV which is currently under review.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence. The licensed entitlement has increased in 2007/08 due to the inclusion of the Mineral Water Licence.
(5) Non-metered use includes dairy wash and low consumption commercial use only.
(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. There is a significant rise in the number domestic and stock bores in 2007/08 compared with 2006/07.

Table 27-8 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Bungaree WSPA (67%)	207	414
Total	**207**	**414**

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 those registered in the state database as being drilled since 1965 multiplied by the surface area percentage in 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 not used to supplement urban supplies in the Moorabool basin.

27.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Moorabool basin in 2007/08, including:

- restricting urban and rural water use (discussed in section 27.9)
- providing access to emergency water supply points
- construction infrastructure to supply Lethbridge township from the Moorabool water treatment plant
- water carting 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. Details of these qualifications are presented in Table 27-9.

Table 27-9 Qualifications of rights

Qualification type	Qualification description
Reduce passing flows	Waived passing flow obligations downstream of Upper West Moorabool reservoir, Lal Lal Reservoir and White Swan Reservoir in Barwon Water's Lal Lal Reservoir and Upper West Moorabool System bulk entitlements, as well as Central Highlands Water's Lal Lal Reservoir bulk entitlement, to reserve water for emergency supplies to Ballarat. Dates: 1 July 2007 to 30 June 2008
Additional diversion point	Changed Barwon Water's Lal Lal bulk entitlement to enable its share of Lal Lal Reservoir to be extracted at a different location to secure an emergency supply to Meredith. Dates: From 10 July 2007 to 30 June 2008

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.

Groundwater use was unrestricted in the Moorabool basin during 2007/08.

Table 27-10 Seasonal allocations and restrictions on water use in Moorabool basin, 2007/08

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 from July 2007 to June 2008, with general exemptions from October 2008
	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 2007 to June 2008
Licensed diversions from unregulated streams	Moorabool River	Winter fill roster from July to November 2007, and an irrigation ban from December 2007 to June 2008

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.

In 2007/08 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 2007/08, however minor instances of non-compliance with daily passing flows occurred at some sites due to streamflow variations.

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 2008). However, one pulsed release of 80 ML from the environmental release was made in accordance with the catchment management authority's requirements.

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 2007/08, 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 2007/08, 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 2007/08, 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

While inflows in the Barwon basin in 2007/08 were higher than in 2006/07, they were still 51% of the long term average. Storages recovered slightly and finished the year at 32% of capacity.

Low water availability in the Barwon and Moorabool basins meant that for the second consecutive year, Geelong relied heavily on groundwater to supplement surface water supplies.

Although the resource position eased slightly in October 2007, Geelong was subject to severe restrictions the entire year. Licensed diverters from the Barwon and Leigh rivers and Boundary Creek were also placed on severe restrictions in periods throughout the year.

In the face of continuing dry conditions, Barwon Water commenced work on upgrading the Anglesea borefield, located in the Otway basin, to augment Geelong's supplies.

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, 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		
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.

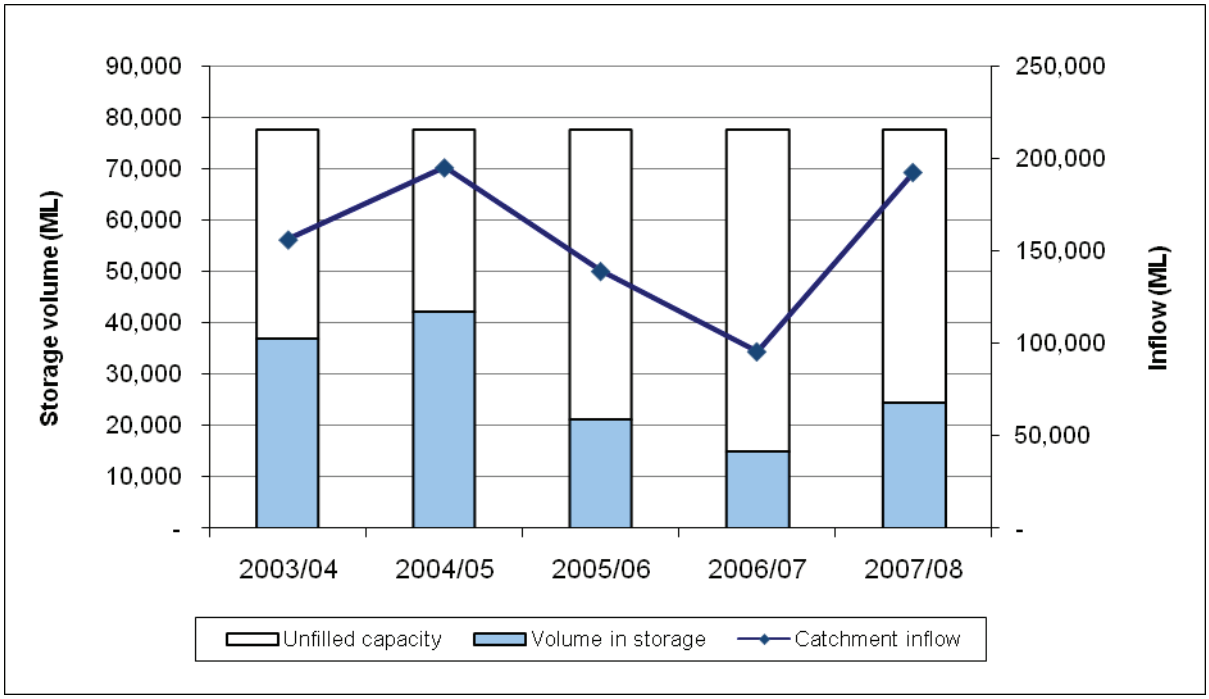
28.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Barwon basin ranged between 60% and 100% of the long term average, compared with 40% and 80% experienced in 2006/07. Inflows in 2007/08 were 51% of the long term average (of 360,000 ML), compared with 23% in 2006/07.

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 112,300 ML in 2007/08. This represents 51% of the catchment inflows into the basin, compared with 38% in 2006/07.

The volume of water in the major storages in the basin – West Barwon, Wurdiboluc, White Swan and Gong Gong reservoirs – increased from 19% at the start of 2007/08 to 32% by the end of the year.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	201,300	61,800
Groundwater[2]	22,400	13,700
Recycled water	25,030	2,750

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 28-6 and estimated domestic and stock use presented in Table 28-7. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

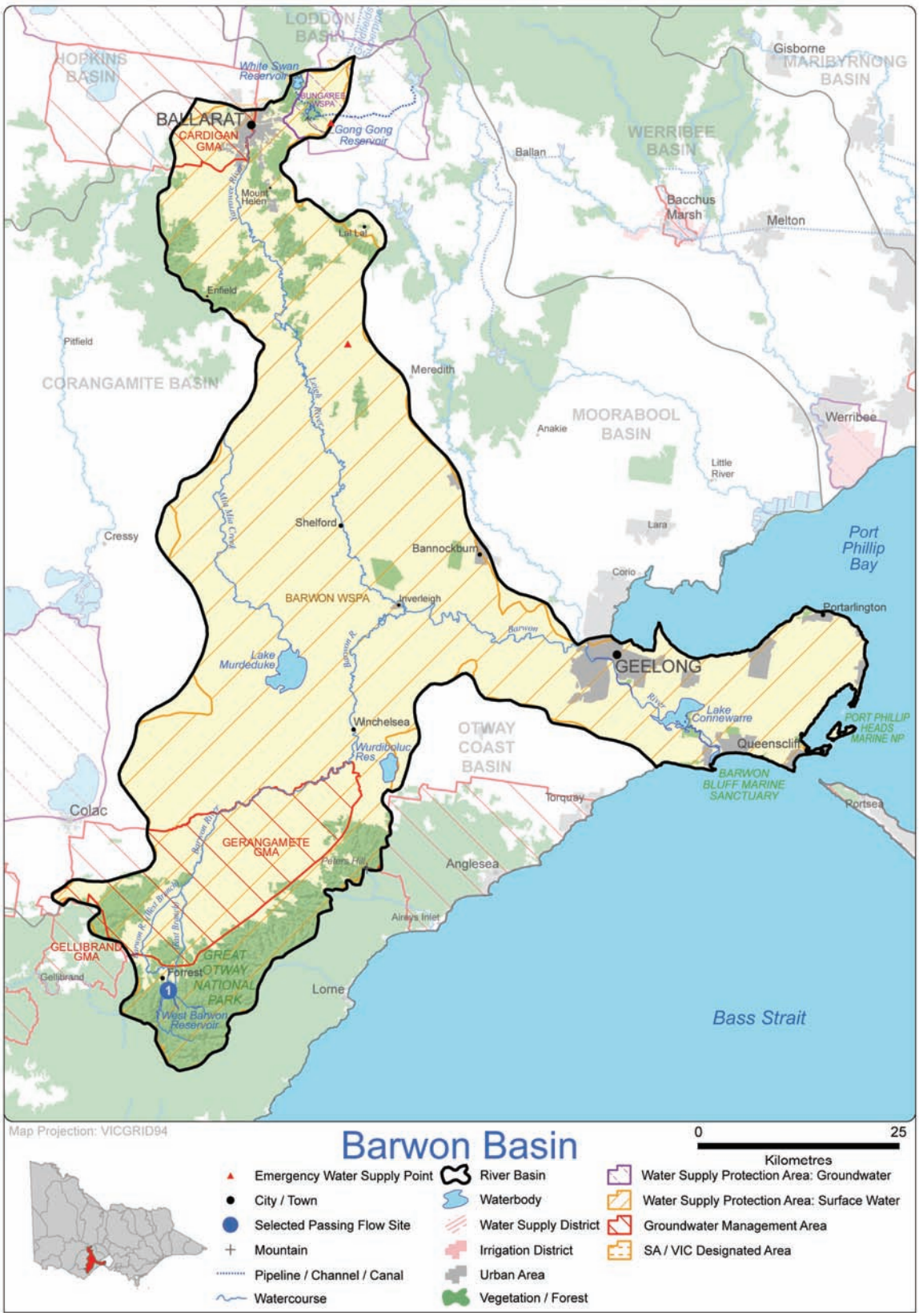
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. The Gerangamete GMA is one exception in the Barwon basin and this is discussed in note 7 beneath Table 28-6.

28.4.1 Infrastructure projects to improve water availability

The Ballarat link of the Goldfields Superpipe (from the Goulburn system) was completed towards the end of the 2007/08 season, allowing water to be pumped from the Waranga Main Channel at Colbinabbin to Lake Eppalock through the new pipeline to secure supplies for the Ballarat system.

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. 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 Gong reservors operated by Central Highlands Water. The combined capacity of small catchment dams in the Barwon basin however is about the same as the combined capacity of the major on-stream storages.

Transfers from the Moorabool basin to the Barwon basin significantly increased in 2007/08 compared to the previous year. The water was transferred to White Swan reservoir and used to supply the Ballarat system.

Table 28-3 Balance of surface water in the Barwon basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	5,200	8,500
Volume in storage at end of year	8,200	5,200
Change in storage	**3,000**	**-3,300**
Inflows		
Catchment inflow(1)	182,300	83,400
Inflows from the Moorabool River	400	500
Transfers from Moorabool basin to White Swan Reservoir	2,140	210
Return flow from irrigation	0	0
Treated wastewater discharged back to river	16,460	7,150
Sub-total	**201,300**	**91,300**
Usage		
Urban diversions	28,880	17,460
Licensed diversions from unregulated streams	2,000	1,700
Small catchment dams(2)	30,900	19,100
Sub-total	**61,800**	**38,300**
Losses		
Net evaporation losses from major storages	1,000	1,300
Evaporation from small catchment dams(2)	12,500	21,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	10,700	2,100
Sub-total	**24,200**	**24,600**
Water passed at outlet of basin		
River outflows to the ocean	112,300	31,700

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 the total water harvested.

(3) Losses estimated using loss functions from the Lower Barwon Simulation Model (REALM).

28.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2007/08 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, 2007/08

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

There were no transfers of water entitlements within the basin or across basin boundaries in 2007/08.

28.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 28-5.

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 2007/08. 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 28-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(2)
Barwon Water					
Upper Barwon system	3	43,467	0	24,371(4)	Yes
Central Highlands Water					
Yarrowee-White Swan system(3)	3	12,267	0	4,511	Yes
Total annual volume of bulk entitlements 2007/08		**55,733**	**0**	**28,882**	
Total annual volume of bulk entitlements 2006/07		**55,733**	**0**	**17,462**	
Licensed diversions from unregulated streams 2007/08		*4,412*		*1,971*	
Licensed diversions from unregulated streams 2006/07		*4,740*		*1,700*	

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.

(4) Variation between the number reported here and the Barwon Water Annual Report 2007/08 is due to different quality checking procedures.

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 28-6.

The Barwon basin contains part of the Cardigan GMA, Gellibrand GMA, Gerangamete GMA and Bungaree WSPA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater extractions in the Barwon basin increased slightly in 2007/08, due mostly to an increase in extractions from the Gerangamete GMA. The Gerangamete GMA is a key supply for Geelong, however is experiencing a declining long term trend in water levels. 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) is currently set to zero, however it is a potential resource for augmenting urban water supplies in the future following further assessment.

Table 28-6 Licensed groundwater volumes, Barwon basin 2007/08

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)[10]	Total licensed groundwater use (ML) 2007/08	Total licensed groundwater use (ML) 2006/07
Cardigan GMA (20%)	All depths	785	770	44	1	46	45
Gellibrand GMA (10%)[5]	All depths	0	0	0	0	0	0
Gerangamete GMA (86%)[6][7]	>60	20,000	20,000	12,605	0	12,605	11,807
Bungaree WSPA (24%)	All depths	1,246	1,258	697	1	698	856
Total[9]		**22,032**	**22,027**	**13,346**	**2**	**13,349**	**12,708**

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.

(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 PCV and licensed entitlement for the Gellibrand GMA are set at zero.

(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 28-6 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 28-8). 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) Bungaree licensed entitlement is greater than the PCV which is currently under review.

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

(10) Non-metered use includes dairy wash and low consumption commercial use only.

An estimate of domestic and stock groundwater use is provided in Table 28-7.

Table 28-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cardigan GMA (20%)	84	168
Gellibrand GMA (10%)	0	0
Gerangamete GMA (86%)	5	10
Bungaree WSPA (24%)	74	148
Total	**163**	**326**

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 28-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965. 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 signifiant part of the urban water supply for Geelong in 2007/08. The licensed entitlements and metered use for this supply is provided in Table 28-8. Groundwater supplied 33% of greater Geelong's water supply in 2007/08.

Table 28-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Greater Geelong area	20,000	12,605	11,807

28.8 Drought contingency measures

A range of drought contingency measures was undertaken in the Barwon basin in 2007/08 including:

- restricting urban and rural water use (discussed in section 28.9)
- supplementing supplies from the completed Ballarat West Groundwater Project
- supplementing supplies from Bungaree groundwater resources (located on the boundary between Moorabool and Barwon basins)
- implementing a number of emergency water supply points
- carting water from Colac to rural customers on Boundary Creek
- supplementing supplies by connecting Newlyn Reservoir to the Ballarat system.

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

Restrictions applying to urban customers and licensed diversions in 2007/08 are shown in Table 28-9.

Groundwater use was unrestricted in the Barwon basin during 2007/08.

Table 28-9 Seasonal allocations and restrictions on water use in Barwon basin, 2007/08

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 from July 2007 to June 2008 with general exemptions from October 2007
	Towns within the greater Ballarat area serviced by Central Highlands Water	Stage 4 restrictions from July 2007 to June 2008
Licensed diversions from unregulated streams	Boundary Creek	Irrigation ban from July to August 2007, a total ban from December 2007 to January 2008, and an irrigation ban from February to June 2008
	Barwon River (Reach 1 & 2)	Stage 1 restrictions from October 2007 to January 2008 and an irrigation ban from February to May 2008
	Barwon River (Reach 3)	Stage 1 restrictions from October 2007 to January 2008 and an irrigation ban from February to March 2008, Stage 4 from April to May 2008
	Leigh River	Stage 1 restrictions from October 2007 to January 2008, and Stage 3 from February to May 2008

28.10 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin.

In 2007/08, some 5% or 2,754 ML of wastewater in the Barwon basin was recycled, mostly for agricultural purposes. This is a decrease from 10% in the previous year. The decrease was primarily due to a decrease in reuse at Black Rock.

Table 28-10 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]		
Ballarat North	1,537	182	0%	0	0	0	182	0	1,355
Ballarat South	5,688	7	0%	0	0	0	7	0	5,681
Bannockburn	39	39	100%	0	39	0	0	0	0
Black Rock	17,595	2,352	7%	0	1,136	0	1,216	16,459	-1,216
Portarlington	153	153	100%	0	153	0	0	0	0
Winchelsea	21	21	100%	0	21	0	0	0	0
Total 2007/08	**25,033**	**2,754**	**5%**	**0**	**1,349**	**0**	**1,405**	**16,459**	**5,820**
Total 2006/07	25,019	3,429	10%	3	2,590	0	836	7,153	14,438

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.

In 2007/08 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 reported some minor non-compliance of passing flow requirements in the upper Barwon streams diversion area, while passing flow requirements were met at the other points in the basin.

Central Highlands Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Barwon basin.

Table 28-11 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 28-11 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)

Technical studies are underway 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

Despite rainfall in the Corangamite basin ranging between 80% and 100% of the long term average in 2007/08, dry catchment conditions meant that inflows across the basin were 19% of the long term average. They were, however, still five times greater than those received in 2006/07.

For urban users these dry conditions had little relevance because towns within the Corangamite basin are supplied by other basins. 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.

The amount of water flowing from the Corangamite basin into the Ramsar listed Western District Lakes was 43,900 ML in 2007/08. This was a substantial increase of the 2,300 ML of flows experienced in 2006/07.

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, 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		
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

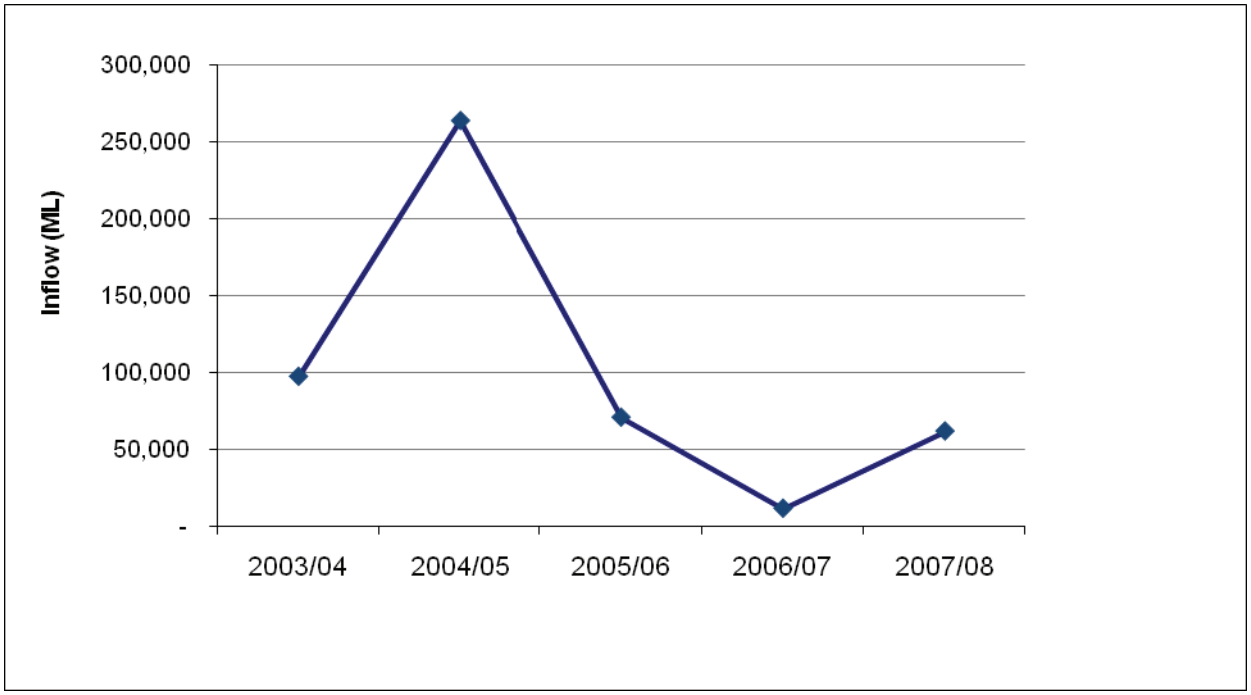
29.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Corangamite basin ranged between 80% and 100% of the long term average. However, dry catchment conditions meant that in 2007/08 inflows across the basin were 19% of the long term average. Inflows were, however, five times greater than those received in 2006/07, which were 4% of the long term average.

In 2007/08 some 43,900 ML of water flowed from the Corangamite basin into the Western District Lakes. This represents 71% of catchment inflows into the basin, compared to 17% in 2006/07. The increase in water passed at the outlet of the basin was as a result of increased catchment inflows, of which around 20% was used.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	62,900	12,400
Groundwater[2]	18,300	9,000
Recycled water	1,950	280

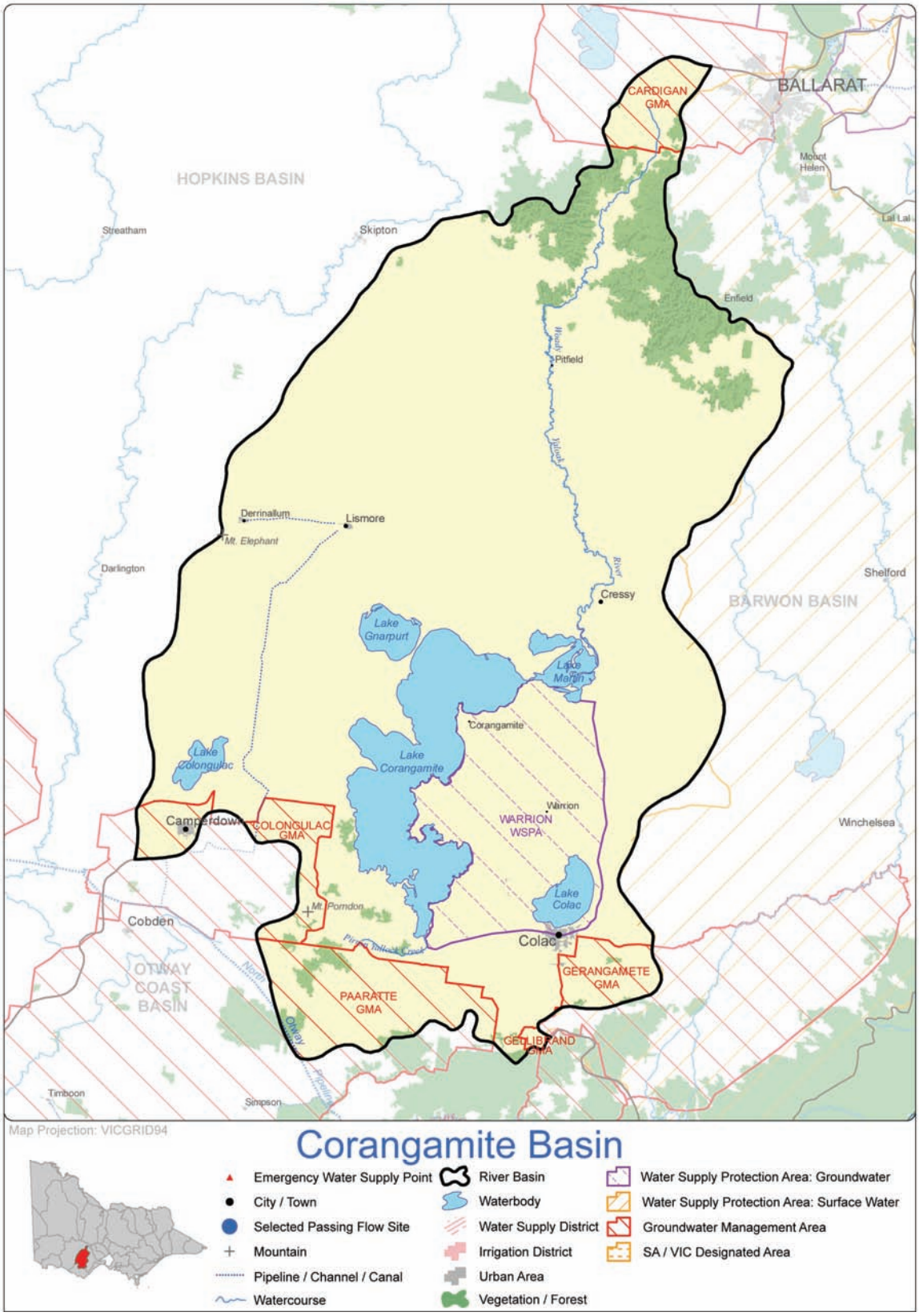
Notes:

(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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use .

(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	2007/08 (ML)	2006/07 (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)	61,400	11,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,500	1,510
Sub-total	**62,900**	**13,200**
Usage		
Urban diversions	0	0
Licensed diversions from unregulated streams	100	100
Small catchment dams(2)	12,300	6,800
Sub-total	**12,400**	**6,900**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	6,600	4,000
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**6,600**	**4,000**
Water passed at outlet of basin		
River outflows to the Corangamite Lakes	43,900	2,300

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 2007/08 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, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,100	4,000	n/a
Registered commercial and irrigation	9,900	8,300	n/a
Total	**18,000**	**12,300**	**18,900**

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 2007/08.

29.6.4 Volume diverted

The only surface water entitlements in the Corangamite basin are licences on unregulated streams. In 2007/08, the licensed volume totalled 922 ML. Use was estimated to be 67 ML.

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, more than doubled in 2007/08 compared to 2006/07. This resulted in an overall increase in groundwater use from the Corangamite basin in 2007/08. However, extractions from the Cardigan GMA remained the same as 2006/07, extractions from the Colongulac GMA were reduced slightly and extractions from the Paaratte GMA were reduced from 202 ML a year to no recorded extractions.

Table 29-5 Licensed groundwater volumes, Corangamite basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Cardigan GMA (19%)	All depths	773	758	44	1	45	45
Colongulac GMA (36%)	≤60	1,703	1,392	369	20	389	420
Gerangamete GMA (14%)[6]	>60	0	0	0	0	0	0
Paaratte GMA (15%)	>120	674	467	0	0	0	202
Warrion WSPA (100%)	All depths	13,836	13,835	6,630	85	6,715	2,994
Total [7]		**16,986**	**16,452**	**7,043**	**107**	**7,149**	**3,661**

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.

(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 only.

(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 28-6 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, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cardigan GMA (19%)	83	166
Colongulac GMA (36%)	91	182
Gerangamete GMA (14%)	1	2
Paaratte GMA (15%)	1	2
Warrion WSPA (100%)	730	1,460
Total	**906**	**1,812**

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 those registered in the state database as being drilled since 1965. 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. The Corangamite basin does not supply any towns with water, so urban water restrictions reflected the conditions of the respective supply systems outside the basin.

Groundwater use was unrestricted in the Corangamite basin during 2007/08.

Table 29-7 Seasonal allocations and restrictions on water use in Corangamite basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Linton, Rokewood, Smythesdale	Stage 4 restrictions from June 2007 to June 2008
	Beeac, Colac, Cressy, Alvie, Coragulac, Cororooke, Elliminyt, Irrewarra, Ondit, Warrion	Stage 2 restrictions from April to June 2008
Licensed diversions from unregulated streams	Lake Tooliorook	Irrigation ban July 2007 to June 2008

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 2006/07 the volume and percentage of recycled water reused increased in 2007/08, with around 13% 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	30	11	36%	0	11	0	0	0	19
Camperdown Municipal	389	244	63%	18	226	0	0	0	145
Colac	1,527	29	0%	0	0	0	29	1,499	0
Total 2007/08	**1,946**	**284**	**13%**	**18**	**236**	**0**	**29**	**1,499**	**164**
Total 2006/07	1,836	228	11%	0	199		29	1,479	129

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.

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.

In 2007/08 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 2007/08 were 70% of the long term average, which was more than double inflows experienced in 2006/07.

Consumptive use is only a small proportion of total available resources (94% of inflows are discharged to Bass Strait), however many urban and rural supplies need reliable flows throughout the entire year. A relatively dry summer meant that Apollo Bay residents were placed on stage 2 restrictions and licensed diverters on a number of unregulated rivers west of Cape Otway were placed on restrictions over this period.

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.

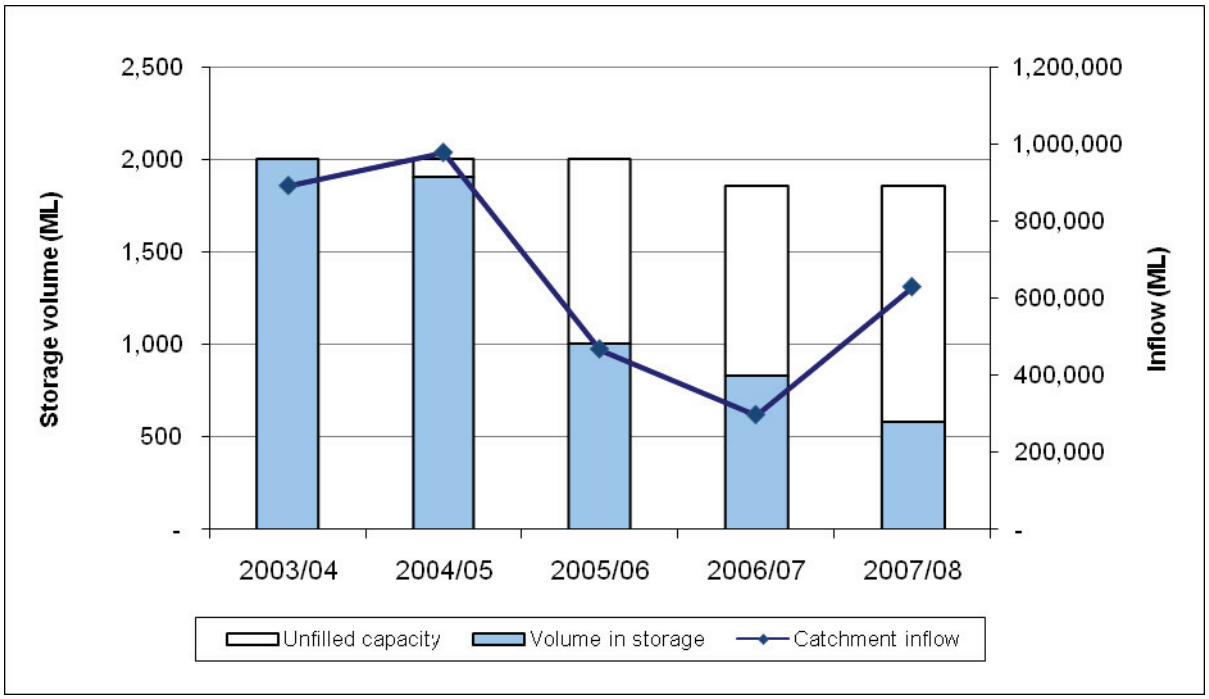
30.3 Rainfall, flows and storages in 2007/08

In 2007/08 rainfall in the Otway Coast basin in 2006/07 was just below average (80-100%), but was an increase on the rainfall recorded in 2006/07 (60-80% of average). Inflows in 2007/08 were 70% of the long term average, more than double that of 2006/07.

The amount of water flowing from the Otway basin into Bass Strait was 591,000 ML in 2007/08. This represents 94% of the catchment inflows into the basin, compared with 89% in 2006/07.

The only major storage in the basin is the West Gellibrand Reservoir, which started the year at 45% of capacity, and finished at 31% or 582 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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	623,500	29,100
Groundwater[2]	13,900	6,200
Recycled water	1,280	380

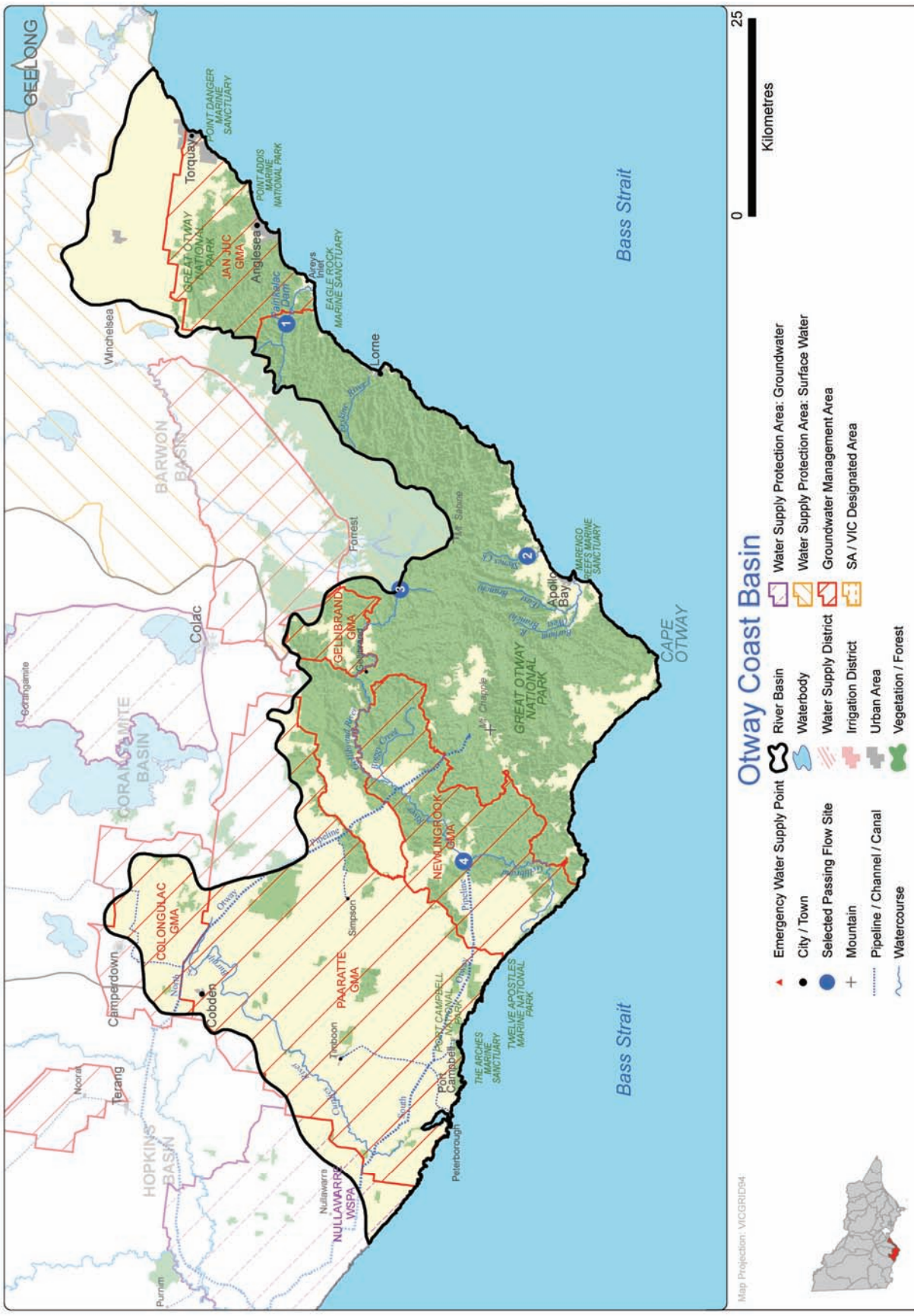
Note:

(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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

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	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	800	1,000
Volume in storage at end of year	600	800
Change in storage	**-200**	**-200**
Inflows		
Catchment inflow(1)	622,600	297,000
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	920	740
Sub-total	**623,500**	**297,700**
Usage		
Urban diversions	14,130	14,470
Licensed diversions from unregulated streams	2,200	1,700
Small catchment dams(2)	12,800	10,200
Sub-total	**29,100**	**26,400**
Losses		
Net evaporation losses from major storages	200	200
Evaporation from small catchment dams(2)	3,400	6,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**3,600**	**6,800**
Water passed at outlet of basin		
River outflows to the ocean	591,000	264,700

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 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 2007/08 is not readily available. The values in Table 30-4 below are based on the methodology outlined in Chapter 5.

Table 30-4 Estimated small catchment dam information, 2007/08

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 2007/08.

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 2007/08.

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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
Barwon Water					
Aireys Inlet	1	317	0	186	Yes
Apollo Bay and Skenes Creek	1	365	0	282	Yes
Colac	1	5,400	0	4,079	Yes
Gellibrand	1	60	0	19	Yes
Lorne	1	510	0	371	Yes
Wannon Water					
Otway system	1	12,580	0	9,193	Yes
Total annual volume of bulk entitlements 2007/08		**19,232**	**0**	**14,131**	
Total annual volume of bulk entitlements 2006/07		**19,232**	**0**	**14,472**	
Licensed diversions from unregulated streams 2007/08		*11,599*		*2,246*	
Licensed diversions from unregulated streams 2006/07		*7,716*		*1,700*	

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 2006/07. However the volume extracted from Paaratte GMA was reduced to almost zero and extractions from the Nullawarre WSPA were considerably reduced. However the increased volume extracted from the Jan Juc GMA balanced these reductions.

Table 30-6 Licensed groundwater volumes, Otway Coast basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Colongulac GMA (55%)	≤60	2,577	2,107	558	30	588	635
Gellibrand GMA (90%)[6]	All depths	0	0	0	0	0	0
Jan Juc GMA (100%)	All depths	4,250	4,250	3,641	0	3,641	1,275
Newlingrook GMA (100%)	All depths	1,977	1,947	30	2	32	70
Paaratte GMA (85%)	>120	3,932	2,726	0	1	1	1,180
Nullawarre WSPA (11%)	≤250	2,651	2,248	1,237	29	1,266	2,344
Total[7]		**15,387**	**13,278**	**5,466**	**62**	**5,528**	**5,504**

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 only.

(6) The PCV and licensed entitlement for the Gellibrand GMA are set at zero because the aquifer is reserved for potential urban supply in the future.

(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 30-7.

Table 30-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Colongulac GMA (55%)	137	274
Gellibrand GMA (90%)	2	4
Jan Juc GMA (100%)	11	22
Newlingrook GMA (100%)	14	28
Paaratte GMA (85%)	8	16
Nullawarre WSPA (11%)	151	302
Total	**323**	**646**

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 those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in 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 2007/08 (ML)	Metered use 2006/07 (ML)
Otway system (Carlisle)	1,800	70	249
Otway system (Curdie Vale)	2,150	0	0
Port Campbell, Timboon and Peterborough	1,009	336	370
Total	**4,959**	**406**	**619**

30.8 Drought contingency measures

The main drought contingency measure implemented in the Otway Coast basin in 2007/08 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 water sourced outside the Otway Coast basin. Towns in the west of the basin are supplied by groundwater, which was unrestricted in the basin during 2007/08.

Table 30-9 Seasonal allocations and restrictions on water use in Otway Coast basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Skenes Creek, Apollo Bay, Marengo	Stage 2 restrictions from December 2007 to June 2008
	Torquay, Mt Duneed, Jan Juc, Anglesea	Stage 4 restrictions from December 2007 to June 2008
Licensed diversions from unregulated streams	Curdies River	Stage 1 restrictions from October 2007 to January 2008, and Irrigation ban from February to May 2008
	Gellibrand River	Stage 3 restrictions in April and May 2008
	Lake Purumbete	Irrigation ban August 2007 to June 2008

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 2007/08, some 25% of the volume of treated wastewater was used within the Otway Coast basin (Table 30-10), which represents a decrease in both the volume and percentage of recycled water from 2006/07. The largest contributing factor to this reduction is reduced inflow to the Aireys Inlet plant, which reduced from 113 ML in 2006/07 to 61 ML 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	61	61	100%	0	61	0	0	0	0
Anglesea	222	92	29%	0	64	0	28	158	(28)
Apollo Bay	390	15	0%	0	0	0	15	390	(15)
Cobden	178	128	72%	0	128	0	0	54	(4)
Lorne	296	15	0%	0	0	0	15	296	(15)
Port Campbell	55	20	37%	0	20	0	0	0	35
Simpson	24	6	25%	0	6	0	0	17	1
Timboon	55	47	85%	0	47	0	0	0	8
Total 2007/08	**1,281**	**383**	**25%**	**0**	**325**	**0**	**58**	**916**	**(18)**
Total 2006/07	1,256	435	30%	0	380	0	55	740	81

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.

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.

In 2007/08 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 2007/08.

Barwon Water met all of its passing flow requirements with the exception of one occasion at the West Gellibrand and Olangolah Reservoirs due to pipeline repair works.

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)

Technical studies are underway in preparation for an SFMP for the Gellibrand 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

While inflows in the Hopkins basin in 2007/08 were more than double those recorded in 2006/07, they were still 33% of the long term average.

Improved surface water availability resulted in groundwater use decreasing by more than 40% compared to 2006/07. The extraction volumes in 2007/08 are more typical of the volumes observed in previous years as 2006/07 was one of the driest years on record.

Most towns within the basin were subject to Stage 2 or 3 restrictions throughout the year. However, most of these, including Ararat and Skipton, are supplied from outside sources. Supplies to Warrnambool, the largest town, were not restricted.

Licensed diverters 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, 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			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

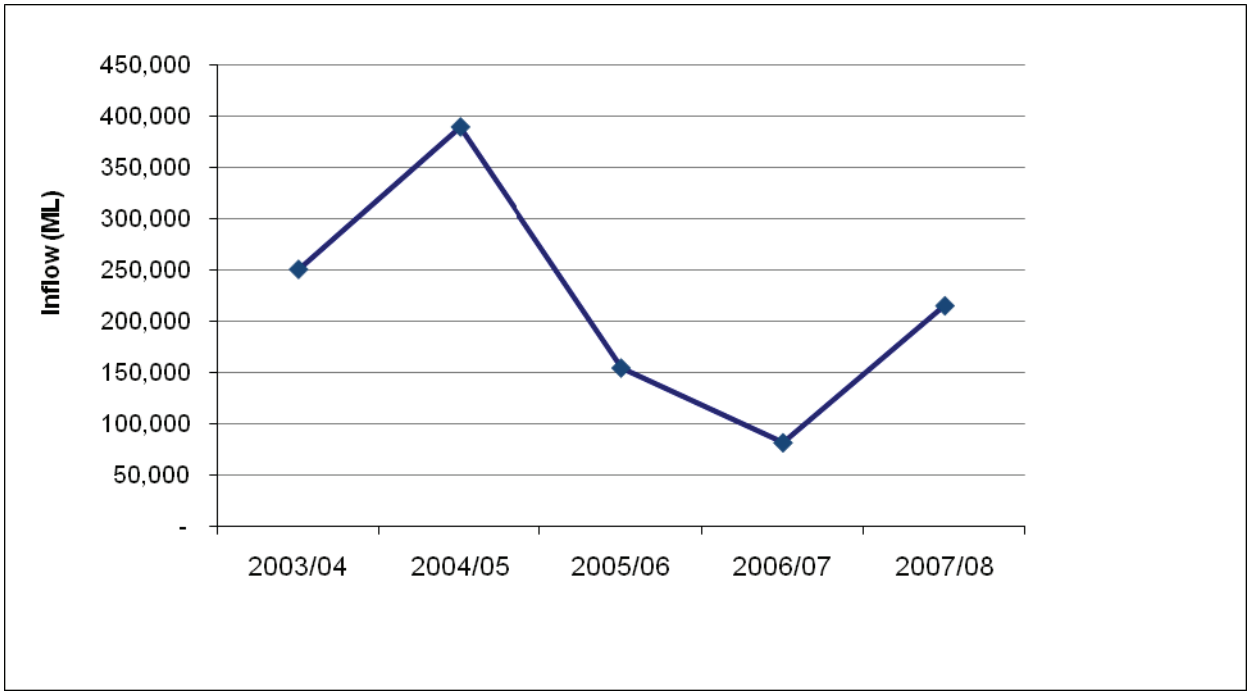
31.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Hopkins basin ranged between 80% and 100% of the long term average, which is an increase on 2006/07 (which was 60-80% of average). While inflows in 2007/08 were more than double those recorded in 2006/07, they were still 33% of the long term average (of 635,000 ML).

The volume of water flowing from the Hopkins basin into Bass Strait was 117,900 ML in 2007/08. This represents 55% of the catchment inflows into the basin, compared with 38% in 2006/07.

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. Wannon Water transferred water from the Otway Coast basin into the Hopkins basin to supply towns, Central Highlands Water transferred water from the Barwon basin into the Hopkins basin to supply Skipton, and GWMWater transferred water from the Wimmera basin to supply Ararat, Moyston, Willaura, Lake Bolac and Wickliffe.

Table 31-2 Summary of total water resources and water use in the Hopkins basin, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	214,700	66,700
Groundwater[2]	41,300	20,800
Recycled water	5,140	650

Note:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 31-6, and the estimated domestic and stock use presented in Table 31-7. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

31.5 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	2007/08 (ML)	2006/07 (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)	210,400	82,100
Transfers from other basins(2)	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	4,300	10
Sub-total	**214,700**	**82,100**
Usage		
Urban diversions	170	370
Licensed diversions from unregulated streams	1,900	4,400
Small catchment dams(3)	64,600	31,000
Sub-total	**66,700**	**35,800**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	30,100	15,300
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**30,100**	**15,300**
Water passed at outlet of basin		
River outflows to the ocean	117,900	31,000

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 2007/08 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, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	30,900	15,500	n/a
Registered commercial and irrigation	58,400	49,100	n/a
Total	**89,300**	**64,600**	**94,700**

n/a: Information not available.

31.6.3 Water entitlement transfers

There were no transfers of water entitlements within the basin or across basin boundaries in 2007/08.

31.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 31-5. 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 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 31-5 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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?
Central Highlands Water					
Beaufort	1	419	0	171	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 2007/08		**629**	**0**	**171**	
Total annual volume of bulk entitlements 2006/07		**629**	**0**	**373**	
Licensed diversions from unregulated streams 2007/08		*9,068*		*1,876*	
Licensed diversions from unregulated streams 2006/07		*9,007*		*4,400*	

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.

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 31-6.

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.

Reported groundwater use in the Hopkins basin was reduced by more than 40% in 2007/08 compared with 2006/07. This is largely due to the lower recorded extractions in the Nullawarre WSPA and the Yangery WSPA, however it is believed that extractions recorded for 2007/08 more accurately reflect the volume of groundwater extracted than what was reported in 2006/07.

Table 31-6 Licensed groundwater volumes, Hopkins basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Cardigan GMA (61%)	All depths	2,408	2,360	136	4	140	139
Colongulac GMA (9%)	≤60	416	340	90	5	95	102
Glenormiston GMA (100%)	≤60	2,565	2,464	785	46	831	1,044
Nullawarre WSPA (89%)	≤250	22,449	19,032	10,478	244	10,722	19,845
Upper Loddon WSPA (24%)	All depths	3,282	3,162	1,149	0	1,149	1,489
Yangery WSPA (60%)	≤100	8,520	8,509	2,408	52	2,460	4,359
Total[6]		**39,640**	**35,867**	**15,046**	**351**	**15,397**	**26,979**

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) Non-metered use includes dairy wash and low consumption commercial use only.
(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 31-7. The reported number of domestic and stock bores has increased from 2006/07.

Table 31-7 Number of domestic and stock bores and estimated use, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Cardigan GMA (61%)	257	514
Colongulac GMA (9%)	22	44
Glenormiston GMA (100%)	161	322
Nullawarre WSPA (89%)	1,282	2,564
Upper Loddon WSPA (24%)	29	58
Yangery WSPA (60%)	962	1,924
Total	**2,713**	**5,426**

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 31-6.
(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, except where the groundwater management unit is included in the Victorian Water Register (e.g. Upper Loddon WSPA) where the numbers are based on the register. 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 31-8.

Table 31-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2007/08 (ML)	Metered use 2006/07 (ML)
Caramut	50	36	35
Darlington	10	5	2
Koroit	524	0	0
Mortlake	335	36	41
Warrnambool, Allansford and Koroit	750	438	411
Glenthompson(1)	0	25	46
Willaura(2)	140	25	n/a
Total	**1,809**	**565**	**535**

Notes:

(1) Glenthompson has no licensed volume as it is supplied by an outside agreement by GWMWater and Wannon Water.

(2) The licensed volume for Willaura has incorrectly been reported as the license for Glenthompson in the previous Victorian water Acounts, and the Willaura supply and metered use not ncluded.

31.8 Drought contingency measures

A range of drought contingency measures was implemented in the Hopkins basin in 2007/08, including restricting urban and rural water use (discussed in section 31.9), and providing emergency water supply points.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 31-9.

Groundwater use was unrestricted in the Hopkins basin during 2007/08.

Table 31-9 Seasonal allocations and restrictions on water use in Hopkins basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Beaufort, Raglan	Stage 3 restrictions from July 2007 to June 2008
	Skipton	Stage 4 restrictions from July 2007 to June 2008
	Ararat	Stage 4 restrictions from July 2007 to June 2008
	Buangor	Stage 2 restrictions from July 2007 to June 2008
	Lake Bolac, Wickliffe and Willaura	Stage 4 restrictions from July to September 2007 and Stage 2 from October 2007 to June 2008
	Streatham and Westmere	Stage 1 restrictions from July 2007 to April 2008, and Stage 4 from May to June 2008
Licensed diversions from unregulated streams	Merri River	Stage 1 restrictions from October 2007 to January 2008 and June 2008, general restrictions in February, March and May, and irrigation ban in April
	Mt Emu Creek	Stage 1 restrictions from October 2007 to January 2008, Stage 3 from February to May 2008, and Stage 2 in June 2008
	Hopkins River	Stage 1 restrictions from October 2007 to January 2008, Stage 3 from February to May 2008, and Stage 1 in June 2008
	Lake Cartcarrong	Irrigation ban from July 2007 to June 2008

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. The total percent recycled in 2007/08 remained at 12% of the total wastewater volume produced. However, there was a siginificant increase at Terang, with an increase of more than 30% on the previous year.

Table 31-10 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]		
Ararat	439	439	98%	135	296	0	8	0	0
Beaufort	69	0	0%	0	0	0	0	0	69
Cardigan Village	4	0	0%	0	0	0	0	0	4
Mortlake	109	12	11%	0	12	0	0	0	97
Terang	214	197	92%	0	197	0	0	0	17
Warrnambool	4,287	0	0%	0	0	0	0	4,287	0
Willaura	14	0	0%	0	0	0	0	14	0
Total 2007/08	**5,137**	**648**	**12%**	**135**	**505**	**0**	**8**	**4,301**	**188**
Total 2006/07	5,640	701	12%	205	488	0	8	10	4,929

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.

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 2007/08 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 31-11 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 31-11 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 were insufficient supply to meet demand at Raglan

.

31.11.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway 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

Estimated inflows to the Portland Coast basin in 2007/08 were 87% of the long term average, significantly higher than those recorded in 2006/07.

The major towns in the basin are supplied by groundwater, in particular from the Dilwyn aquifer. The yields from these sources were adequate to provide unrestricted supplies to the towns.

A relatively dry summer however, meant that bans on licensed diversions were placed throughout the entire basin over the autumn period.

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, 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 diversion		
Wannon Water			Supplies Koroit, Port Fairy, Heywood and Portland	
Glenelg Hopkins Catchment Management Authority				Manages waterways in the whole Portland Coast basin

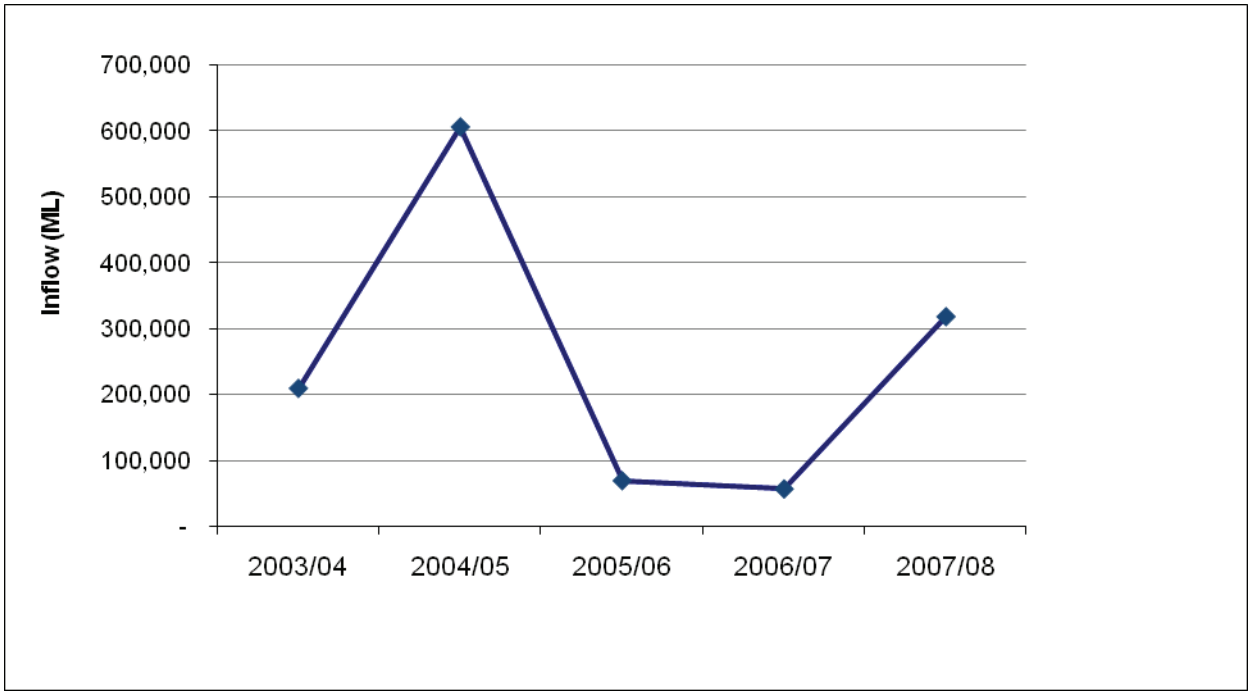
32.3 Rainfall, flows and storages in 2007/08

In 2007/08, rainfall in the Portland Coast basin ranged between 80% and 100% of the long term average, which was similar to 2006/07. However, estimated inflows of 315,400 in 2007/08 were significantly higher than the 57,100 ML recorded in the previous year. Overall, inflows were 87% of the long term average (of 361,000 ML) in 2007/08, up from 16% in 2006/07. The increased inflows were mainly a result of above average rainfall in July and November 2007, resulting in monthly flows of more than double the long term average for these months.

The amount of water flowing from the Portland Coast basin into Bass Strait was 297,400 ML in 2007/08. This represents 93% of the catchment inflows into the basin, a considerable increase on the 68% in 2006/07.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	318,100	16,300
Groundwater[2]	45,500	26,900
Recycled water	2,900	130

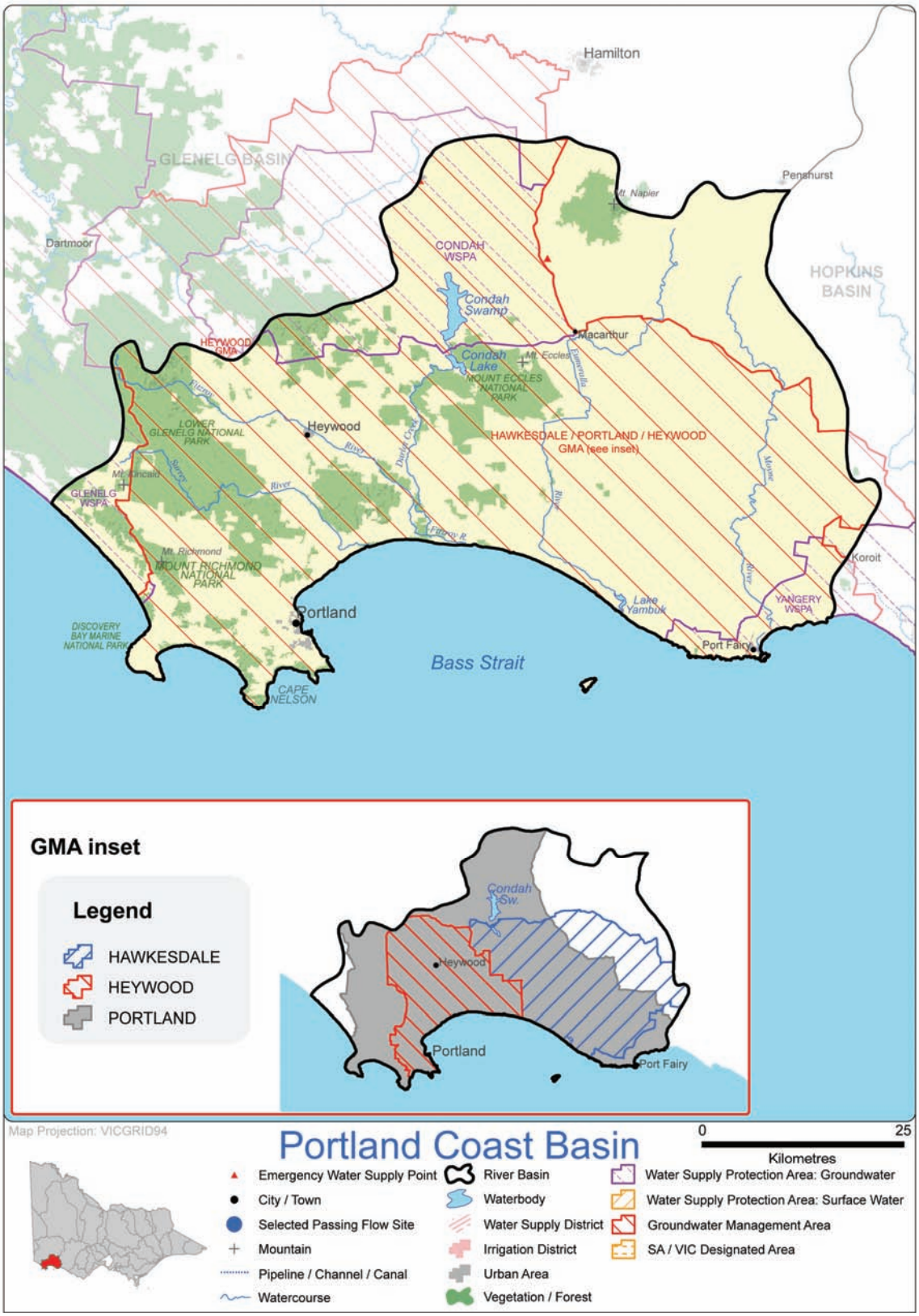
Note:

(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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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 footnote (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 5% 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	2007/08 (ML)	2006/07 (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)	315,400	57,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	2,690	0
Sub-total	**318,100**	**57,100**
Usage		
Urban diversions	0	0
Licensed diversions from unregulated streams	100	800
Small catchment dams(2)	16,200	7,000
Sub-total	**16,300**	**7,800**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	4,400	10,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**4,400**	**10,200**
Water passed at outlet of basin		
River outflows to the ocean	297,400	39,100

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 2007/08 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, 2007/08

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 2007/08.

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 2007/08, some 82 ML out of a total licence volume of 2,069 ML was diverted for use in the basin.

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 140% in groundwater use compared to 2006/07, while Yangery WSPA recorded a decrease of 43%. 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 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Hawkesdale GMA (100%)	Zone 1 All depths Zone 2 <200	16,161	11,752	3,303	119	3,423	1,423
Heywood GMA (100%)	≤70	8,500	6,692	1,809	108	1,916	1,629
Portland GMA (73%)	>200	4,358	7,736	3,232	5,506	8,738	3,458
Condah WSPA (52%)	70-200	3,902	3,901	1,470	28	1,498	2,053
Yangery WSPA (40%)	≤100	5,583	5,575	1,578	34	1,612	2,856
Total[6]		**38,503**	**35,656**	**11,392**	**5,795**	**17,186**	**11,418**

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. 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 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. In Portland GMA the entitlement is greater than the PCV which is currently under review.

(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 only.

(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, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Hawkesdale GMA (100%)	2,310	4,620
Heywood GMA (100%)	1,836	3,672
Portland GMA (73%)	60	120
Condah WSPA (52%)	41	82
Yangery WSPA (40%)	630	1,260
Total	**4,877**	**9,754**

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 those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in 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 2007/08 (ML)	Metered use 2006/07 (ML)
Heywood	333	202	195
Port Fairy	1,026	855	840
Portland	6,222	2,175	2,209
Total	**7,581**	**3,232**	**3,244**

32.8 Drought contingency measures

A range of drought contingency measures was implemented in the Portland Coast basin in 2007/08, including restricting diversions on unregulated streams (discussed in section 32.9), and providing emergency water supply points.

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

Restrictions applying to licensed diversions are shown in Table 32-8. Urban residents did not experience water restrictions above the permanent water savings measures adopted around the state. Most towns within the basin are supplied by groundwater, which was unrestricted during 2007/08.

Table 32-8 Seasonal allocations and restrictions on water use in Portland Coast basin, 2007/08

Type of restriction	Area	Nature of restriction
Licensed diversions from unregulated streams	Surrey River	Irrigation ban from March to May 2008
	Fitzroy River, Eumarella River and Moyne River	Irrigation ban from March to June 2008

32.10 Recycled water

Wannon Water operates all treatment plants within the Portland Coast basin. In 2007/08, some 4% of the total wastewater produced in the basin was reused, including 37% from the Heywood treatment plant for wood lot irrigation (down from 56% in 2006/07). The 4% recycled water use in 2007/08 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	349	129	37%	0	129	0	0	141	80
Port Fairy	742	0	0%	0	0	0	0	742	0
Portland	161	0	0%	0	0	0	0	161	0
Total 2007/08	**2,897**	**129**	**4%**	**0**	**129**	**0**	**0**	**2,689**	**80**
Total 2006/07	1,996	128	6%	0	128	0	0	0	1,868

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 2007/08 the Portland Coast basin EWR comprised:

- water in the basin not otherwise allocated for consumptive use, i.e. water above cap
- water set aside for the environment through the operations of licensed diversions in passing flow conditions.

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 were more than double those experienced in 2006/07 and 2005/06, but were still 32% of the long term average in 2007/08.

The increased inflows allowed GWMWater to transfer 14,100 ML of water to supplement supplies in the Wimmera Mallee system. However, despite being substantially higher than the volume transferred in 2006/07, this volume was still well below the 60,000 ML long term average.

Levels in Rocklands reservoir, which accounts for 97% of the total storage volume in the basin, did not recover and by the end of the year had been drawn to less than 1% capacity.

All Wimmera and Glenelg rivers bulk entitlements were qualified in 2007/08 to enable GWMWater to withhold and carry over water allocated for the environment from one season to the next in reserve, until supply conditions improve.

Most of the towns in the northern part of the basin were subject to severe restrictions until October, however improved flow conditions allowed restrictions to be eased somewhat in the latter part of the year. Towns supplied solely by groundwater were not subject to restrictions.

Licensed diverters across the basin were also subject to severe restrictions, particularly over the summer period.

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, 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 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

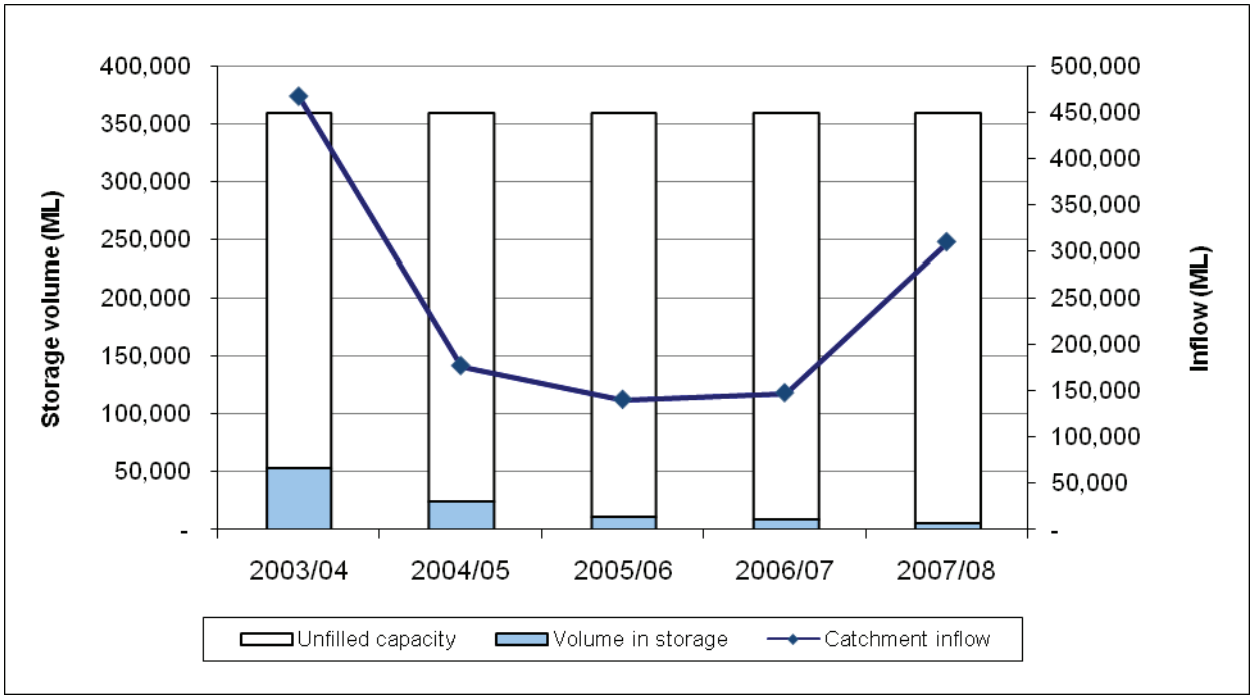
33.3 Rainfall, flows and storages in 2007/08

During 2007/08, rainfall in the Glenelg basin was between 60-100% of the long term average. Inflows across the basin were 308,100 ML. While this is more than double the inflows experienced in 2006/07, it was still low at 32% of the long term average (of 964,000 ML).

The volume of water flowing from the Glenelg basin into Bass Strait was 189,900 ML in 2007/08. This represents 61% of the catchment inflows into the basin, compared with 30% in 2006/07. Although streamflows improved in 2007/08, volumes in Rocklands Reservoir did not recover because the higher flows occurred in the catchments downstream.

Four major storages are located within the basin. Rocklands Reservoir, which accounts for 97% of the total capacity of Glenelg basin storages, was holding less than 1% of capacity at the end of 2007/08.

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, 2007/08

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	308,300	71,900
Groundwater[2]	27,900	9,900
Recycled water	1,100	820

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. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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.

33.5 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 increased from 2,500 ML in 2006/07 to 14,100 ML in 2007/08.

Table 33-3 Balance of surface water in the Glenelg basin

Water account component	2007/08 (ML)	2006/07 (ML)
Major on-stream storage		
Volume in storage at start of year	8,500	11,300
Volume in storage at end of year	5,700	8,500
Change in storage	**-2,800**	**-2,800**
Inflows		
Catchment inflow(1)	308,100	140,200
Transfers from other basins		0
Return flow from irrigation		0
Treated wastewater discharged back to river	240	0
Sub-total	**308,300**	**140,200**
Usage		
Urban diversions	1,990	1,150
Diversions to the Wimmera Mallee Water System	14,100	2,500
Licensed diversions from unregulated streams	300	1,000
Small catchment dams(2)	55,500	28,300
Sub-total	**71,900**	**33,000**
Losses		
Net evaporation losses from major storages	8,900	6,800
Evaporation from small catchment dams(2)	24,600	52,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	15,800	8,400
Sub-total	**49,300**	**67,800**
Water passed at outlet of basin		
River outflows to the ocean	189,900	42,200

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) 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 2007/08 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, 2007/08

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	27,100	13,600	n/a
Registered commercial and irrigation	49,900	41,900	n/a
Total	**77,000**	**55,500**	**80,100**

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 2007/08.

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 2007/08.

During 2007/08 1 ML was diverted under the Glenthomson bulk entilteliment. In addition, Wannon Water purchased 25 ML from GWMWater's Willaura groundwater supply to service Glenthomson.

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 2007/08 (ML)	Volume diverted 2007/08 (ML)	Bulk entitlement volume compliance?(2)
Coliban Water					
Wimmera and Glenelg Rivers(3)	1	450	0	380	Yes
Wannon Water					
Coleraine, Casterton, Sandford	1	855	0	241	Yes
Dunkeld	1	170	0	15	Yes
Glenthompson	1	94	0	1	Yes
Hamilton	1	3,435	0	1,672	Yes
Wimmera and Glenelg Rivers(3(4)	1	80	0	58	Yes
GWMWater					
Wimmera and Glenelg Rivers – Grampians Water(3)	1	16,109	0	3,357	Yes
Wimmera and Glenelg Rivers – Wimmera Mallee Water(3)	1	149,211	0	5,596	Yes
Environment Minister					
Wimmera and Glenelg Rivers(3)	5	40,563	0	8	Yes
Total annual volume of bulk entitlements 2007/08		**210,967**	**0**	**11,328**	
Total annual volume of bulk entitlements 2006/07		**211,352**	**0**	**26,146**	
Licensed diversions from unregulated streams 2007/08		*1,025*		*279*	
Licensed diversions from unregulated streams 2006/07		*1,175*		*1,000*	

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) 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) The bulk entitlement volume of 456 ML reported in 2006/07 has been corrected to 80 ML.

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 entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use almost halved in 2007/08 compared with 2006/07, with extractions in the Glenelg WSPA decreasing by more than 5,000 ML. This shift returned groundwater extractions to the levels experienced in 2005/06.

Table 33-6 Licensed groundwater volumes, Glenelg basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Portland GMA (27%)	>200	2,133	58	0	2,075	2,075	80
Condah WSPA (48%)	70-200	3,535	3,535	1,332	25	1,357	1,860
Glenelg WSPA (70%)	All depths	23,017	23,017	5,310	2	5,312	10,409
Total[6]		**28,686**	**26,611**	**6,642**	**2,102**	**8,744**	**12,349**

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. 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 Portland GMA has 27% of its surface area. 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 only.

(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, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Portland GMA (27%)	23	46
Condah WSPA (48%)	37	74
Glenelg WSPA (70%)	501	1,002
Total	**561**	**1,122**

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 those in the Victorian Water Register, multiplied by 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 2007/08 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 2007/08 (ML)	Metered use 2006/07 (ML)
Casterton	1,000	387	486
Dartmoor	170	26	28
Hamilton (emergency bores)[1]	668	314	624
Harrow[2]	29	37	45
Macarthur[3]	130	34	38
Merino	100	0	0
Penshurst	250	149	148
Total	**2,347**	**947**	**1,369**

Note:

(1) The Hamilton licence volume includes 120 ML of permanent licence, and 548 ML of temporary licence which expired on 30 June 2008.

(2) Harrow's groundwater licence was insufficient to supply the town's needs in 2007/08. GWMWater is considering an application for an increase in the licence volume.

(3) Macarthur's groundwater licensed volume was increased from 80 ML in 2006/07 to include and additional 50 ML from Braxholme bore 51409.

33.8 Drought contingency measures

A range of drought contingency measures was implemented in the Glenelg basin in 2007/08. These include:

- restricting urban and rural water use (discussed in section 33.9)
- providing emergency water supply points
- reducing demand by industry
- using evaporation retardant on Wannon Water's storages.

As reported in Chapter 15, all Wimmera and Glenelg Rivers bulk entitlements were qualified in 2007/08, which enabled GWMWater to withhold water allocated for the environment, as well as carry-over water, in reserve until supply conditions improve.

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.

Groundwater use was unrestricted in the Glenelg basin during 2007/08.

Table 33-9 Seasonal allocations and restrictions on water use in Glenelg basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Harrow	Stage 1 restrictions from July 2007 to June 2008
	Glenthompson	Stage 4 restrictions from July to October 2007, Stage 2 from November 2007 to June 2008
	Balmoral	Stage 4 restrictions from July 2007 to June 2008
	Cavendish, Dunkeld, Hamilton and Tarrington	Stage 4 restrictions from July to October 2007, Stage 3 from November 2007 to June 2008
Licensed diversions from unregulated streams	Wannon River, Crawford River and Grange Burn Creek	Irrigation ban from March to June 2008
	Glenelg River	Irrigation ban from February to June 2008
	Glenelg River Upper, Jimmy Creek, McLeod Creek and Rocklands Reservoir	Irrigation ban from July 2007 to June 2008

33.10 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. Around 75% of wastewater was recycled in 2007/08 compared with 27% in 2006/07. The increase was largely due to increased recycling at Hamilton compared to 2006/07.

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	242	82	34%	0	82	0	0	67	93
Coleraine	65	0	0%	0	0	0	0	0	65
Dunkeld	39	11	28%	11	0	0	0	0	28
Hamilton	756	730	97%	97	633	0	0	175	(149)
Total 2007/08	**1,102**	**823**	**75%**	**108**	**715**	**0**	**0**	**242**	**37**
Total 2006/07	1,102	296	27%	49	247	0	0	0	806

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 2007/08 the Glenelg basin EWR comprised the following components:

- the Wimmera and Glenelg Rivers – Flora and Fauna bulk entitlement
- 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

A Flora and Fauna bulk environmental entitlement order for the Glenelg and Wimmera Rivers was in operation in the Glenelg basin in 2007/08.

The Inter Catchment Advisory Group (ICAG) determines the share of environmental allocations between the two catchments. The full entitlement for the Wimmera Glenelg system is 40,563 ML.

No water was released to the Glenelg River under this entitlement in 2007/08. However water was released to the Wimmera River.

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 2007/08 ranged between 60% and 80% of the long term average.

Groundwater is the main source of water supply in the Millicent Coast basin. Groundwater use within the basin declined in 2007/08 compared to the previous year. Despite a decrease in use, water levels in the Neuarpur WSPA continue to decline.

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 a number of the lakes in the basin.

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, 2007/08

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 2007/08

In 2007/08, rainfall across the Millicent Coast basin ranged between 60% and 80% of the long term average, similar to 2006/07. 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 2007/08.

Table 34-2 Summary of total water resources and water use in the Millicent Coast basin, 2007/08

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	100	100
Groundwater(2)	48,600	23,300
Recycled water	30	30

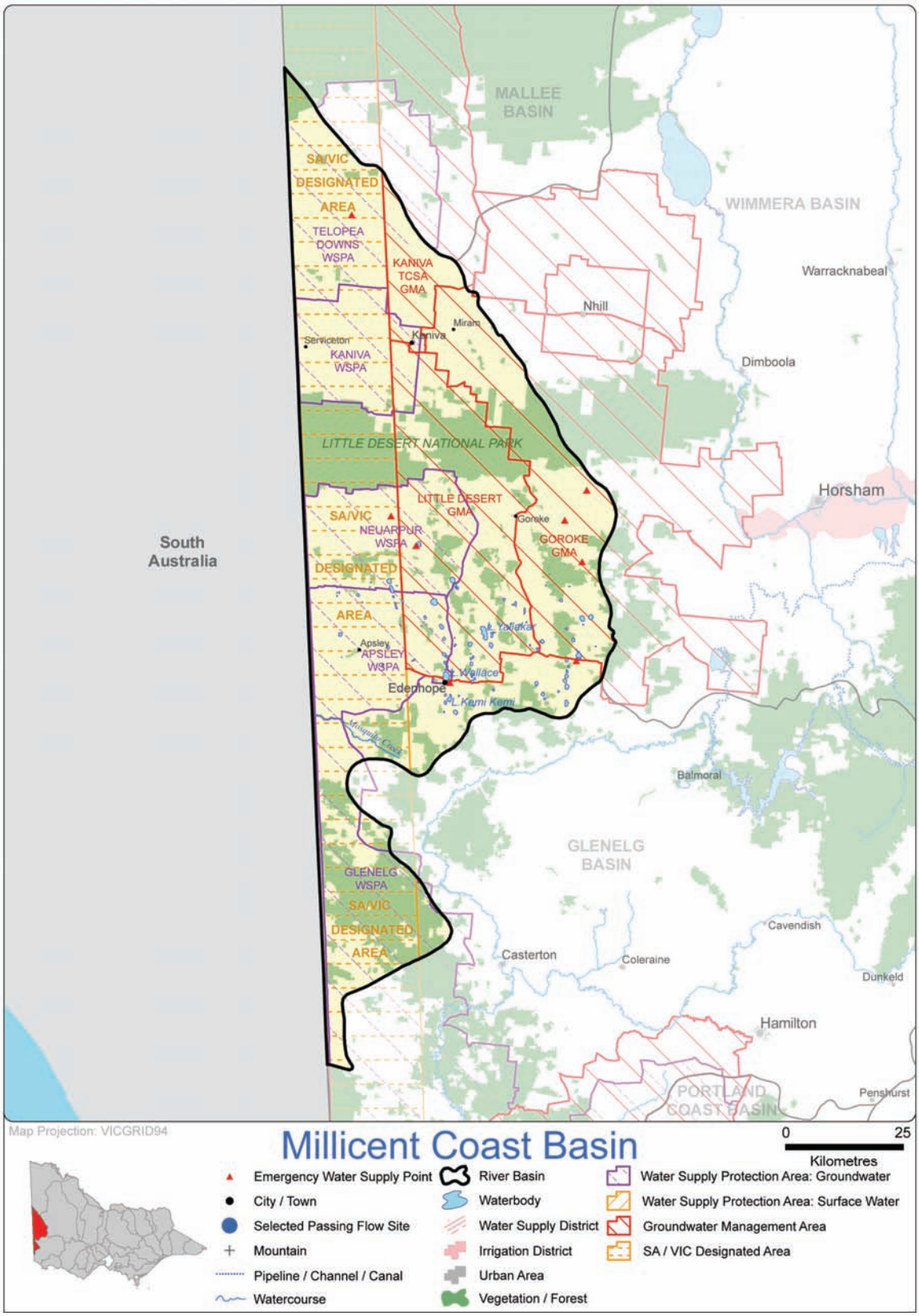
Note:

(1) For surface water and groundwater, the total water resource is the licensed entitlement volume as presented in Table 34-3 and estimate domestic and stock use as presented in Table 34-4. This represents a changed methodology from the *Victorian Water Accounts 2006-2007* which used the allocation limit volume and the estimated domestic and stock use.

(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 2007/08 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 2007/08.

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 2007/08, all of the total licence volume of 100 ML was diverted for use in the basin.

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 entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in the Millicent Coast basin reduced in 2007/08 compared with 2006/07. The most significant reduction in groundwater use occurred in the Neuarpur WSPA where extractions decreased from 22,000 ML in 2006/07 to 15,000 ML in 2007/08. More rain, and higher availability of surface water during 2007/08 is believed to be responsible for the reduction in groundwater usage. The volume extracted in 2007/08 is comparable to the volume extracted in 2005/06.

Table 34-3 Licensed groundwater volumes, Millicent Coast basin 2007/08

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) 2007/08	Total licensed groundwater use (ML) 2006/07
Goroke GMA (37%)	Tertiary confined sand aquifer	807	0	0	0	0	0
Kaniva TCSA GMA (17%)	Tertiary confined sand aquifer	187	0	0	0	0	0
Little Desert GMA (100%)	Tertiary confined sand aquifer	1,100	0	0	0	0	0
Apsley WSPA (100%)	All depths	4,285	4,285	1,451	0	1,451	1,772
Glenelg WSPA (30%)	All depths	9,643	9,643	2,225	1	2,225	4,361
Kaniva WSPA (100%)	25-140	3,673	3,673	2,087	0	2,087	2,142
Neuarpur WSPA (100%)	50-175	24,696	24,696	14,793	0	14,793	22,182
Telopea Downs WSPA (61%)	All depths	4,557	4,557	992	0	992	1,402
Total[6]		**48,948**	**46,854**	**21,547**	**1**	**21,548**	**31,859**

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 only.

(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, 2007/08

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2 ML/bore) (ML)[3]
Goroke GMA (37%)	0	0
Kaniva TCSA GMA (17%)	0	0
Little Desert GMA (100%)	0	0
Apsley WSPA (100%)	140	280
Glenelg WSPA (30%)	210	420
Kaniva WSPA (100%)	116	232
Neuarpur WSPA (100%)	333	666
Telopea Downs WSPA (61%)	63	126
Total	**862**	**1,724**

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 those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in 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 2007/08 (ML)	Metered use 2006/07 (ML)
Boikerbert (Apsley)	40	48	47
Edenhope (emergency bores)(1)	n/a	144	142
Goroke	86	61	76
Kaniva	600	244	279
Leeor (Serviceton)	25	9	14
Lillimur	32	12	11
Mirampiram (Miram)	7	2	2
Total	**790**	**520**	**572**

Note:

(1) 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

A range of drought contingency measures was implemented in the Millicent Coast basin in 2007/08 including restricting urban and rural water use (discussed in section 34.9), and providing emergency supply points.

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.

Groundwater use was unrestricted in the basin during 2007/08.

Table 34-6 Seasonal allocations and restrictions on water use in Millicent Coast basin, 2007/08

Type of restriction	Area	Nature of restriction
Urban	Edenhope	Stage 1 restrictions from July 2007 to June 2008
Diversions from unregulated streams	Lake Charlegrark, Lake Wallace and Lake Yampitcha	Irrigation ban from July 2007 to June 2008

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	35	35	100%	35	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 2007/08	**35**	**35**	**100%**	**35**	**0**	**0**	**0**	**0**	**0**
Total 2006/07	42	42	100%	42	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 2007/08 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]	Allocation limit as of 30/06/08 (ML)	Licensed volumes (as at 30/06/08)							Domestic and stock		Total use (Licensed + domestic and stock)
		Licensed entitlements (ML)	No. of licenses	No. of metered bores	Estimated no. bores yet to be metered	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Goulburn-Murray Water											
WSPA (approved plan)											
Campaspe Deep Lead WSPA	47,252	46,098	110	108	0	28,442	0		84	168	28,610
Shepparton WSPA	221,194	221,194	1,417	910	0	85,801	0		520	1,040	86,841
Spring Hill WSPA	5,062	4,909	57	72	0	2,156	0		52	104	2,260
Katunga WSPA	59,780	59,579	183	123	0	29,851	0		230	460	30,311
Upper Ovens WSPA	4,010	3,308	85	120	16	0	1,985	60% of entitlement	24	48	2,033
WSPA (plan in progress)											
Mid Loddon WSPA	37,200	34,014	94	99	0	21,382	0		93	242	21,624
Upper Loddon WSPA	13,648	13,149	111	133	0	4,778	0		122	244	5,022
GMA											
Alexandra GMA	1,937	1,714	10	7	2	0	1,028	60% of entitlement	7	14	1,042
Barnawartha GMA	2,100	485	4	4	0	0	291	60% of entitlement	10	20	311
Kinglake GMA	2,015	1,860	47	27	1	0	1,116	60% of entitlement	60	120	1,236
Mullindolingong GMA	6,980	1,512	34	13	1	0	907	60% of entitlement	28	56	963
Lower Ovens GMA	25,200	15,700	138	0	0	0	9,420	60% of entitlement	219	438	9,858
Mid Goulburn GMA	14,900	12,330	57	41	0	4,202	0		47	94	4,296
Southern Campaspe Plains GMA	8,850	7,895	17	19	2	2,932	0		13	26	2,958
Unincorporated areas											
Goulburn-Murray Water[2]	45,208	45,208	813	2,183	44		15,823	35% of entitlement	1,574	3,148	18,971
GWMWater											
WSPA (approved plan)											
Murrayville WSPA	10,883	9,634	37	41	0	6,212	0		286	572	6,784
Neuarpur WSPA	24,696	24,696	48	133	0	14,793	0		333	666	15,459
WSPA (plan in progress)											
Apsley WSPA	4,285	4,285	25	21	0	1,451	0		140	280	1,731
Kaniva WSPA	3,673	3,673	23	20	0	2,087	0		116	232	2,319
Telopea Downs WSPA	7,482	7,482	14	12	0	1,628	0		104	208	1,836
GMA											
Balrootan (Nhill) GMA	1,522	1,522	13	13	0	475	215		51	102	792
Goroke GMA	2,200	0	0	0	0	0	0		0	0	0
Kaniva TCSA GMA	1,100	0	0	0	0	0	0		0	0	0
Little Desert GMA	1,100	0	0	0	0	0	0		0	0	0

Groundwater management unit[1]	Allocation limit as of 30/06/08 (ML)	Licensed volumes (as at 30/06/08)							Domestic and stock		Total use (Licensed + domestic and stock)
		Licensed entitlements (ML)	No. of licenses	No. of metered bores	Estimated no. bores yet to be metered	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Nhill GMA	1,200	0	0	0	0	0	0		0	0	0
Unincorporated areas											
GWMWater[2]	15,754	15,754	59	0	0		5,514	35% of entitlement	64	128	5,642
Southern Rural Water											
WSPA (approved plan)											
Nullawarre WSPA	25,100	21,280	211	159	25	11,715	273	Only includes dairy licences or commercial (under 2.2mL) within GMA/ WSPA	1,433	2,866	14,854
Yangery WSPA	14,103	14,084	162	160	25	3,985	86		1,592	3,184	7,255
WSPA (plan in progress)											
Bungaree WSPA	5,273	5,321	105	128	15	2,950	4	Only includes dairy licences or commercial (under 2.2mL) within GMA/ WSPA	311	622	3,576
Condah WSPA	7,437	7,436	39	42	10	2,803	53		78	156	3,011
Denison WSPA	17,743	17,743	117	102	15	6,025	122		457	914	7,062
Deutgam WSPA	5,100	5,090	152	207	25	53	18		338	0	72
Glenelg WSPA	32,660	32,660	80	81	20	7,535	2		711	1,422	8,959
Koo-Wee-Rup WSPA	12,915	12,824	403	336	50	4,349	187		2,750	5,500	10,036
Sale WSPA	21,212	21,092	110	112	25	9,474	30		1,160	2,320	11,823
Wandin Yallock WSPA	2,924	2,924	186	208	35	563	2		236	472	1,036
Warrion WSPA	13,836	13,835	127	124	25	6,630	85		730	1,460	8,175
Wy Yung WSPA	7,426	7,462	61	69	15	624	7		155	310	941
Yarram WSPA	25,317	25,317	84	78	20	11,978	70		1,067	2,134	14,182
GMA											
Cardigan GMA	3,967	3,887	25	14	2	225	7	Only includes dairy licences or commercial (under 2.2mL) within GMA/ WSPA	424	848	1,079
Colongulac GMA	4,695	3,840	44	20	5	1,017	55		250	500	1,572
Corinella GMA	2,550	296	13	5	2	70	8		169	338	417
Cut Paw Paw GMA	3,650	710	8	3	0	239	2		2	4	245
Frankston GMA	3,200	1,077	31	18	0	239	2		209	418	659
Gellibrand GMA	0	0	0	0	0	0	0	Only includes dairy licences or commercial (under 2.2mL) within GMA/ WSPA	2	4	4
Gerangamete GMA	20,000	20,000	1	6	2	12,605	0		6	12	12,617
Giffard GMA	5,665	5,670	15	18	5	3,199	6		191	382	3,588
Glenormiston GMA	2,565	2,464	33	9	3	785	46		161	322	1,153
Hawkesdale GMA	16,161	11,752	47	49	10	3,303	119		2,310	4,620	8,043
Heywood GMA	8,500	6,692	94	47	10	1,809	108		1,836	3,672	5,588
Jan Juc GMA	4,250	4,250	3	6	2	3,641	0		11	22	3,663
Lancefield GMA	1,485	1,390	15	16	2	360	2		84	168	531
Leongatha GMA	6,500	1,361	32	11	2	559	41		139	278	877
Merrimu GMA	450	451	15	12	2	12	1		31	62	75
Moe GMA	8,200	3,779	87	20	5	1,296	118		242	484	1,898
Moorabbin GMA	2,700	2,647	54	50	10	1,169	20		255	510	1,699
Nepean GMA	6,013	6,012	70	70	10	3,285	13		1,966	983	4,281

Groundwater management unit[1]	Allocation limit as of 30/06/08 (ML)	Licensed volumes (as at 30/06/08)							Domestic and stock		Total use (Licensed + domestic and stock)
		Licensed entitlements (ML)	No. of licenses	No. of metered bores	Estimated no. bores yet to be metered	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Newlingrook GMA	1,977	1,947	5	3	1	30	2		14	28	60
Orbost GMA	1,200	1,201	5	3	1	488	2		4	8	498
Paaratte GMA	4,606	3,193	8	0	0	0	1		9	18	19
Portland GMA	6,000	7,794	7	1	0	3,232	0		83	166	3398
Rosedale GMA	22,313	22,257	52	44	5	10,651	27		451	902	11,580
Stratford GMA	27,643	27,645	9	6	0	24,097	2		451	902	25,001
Tarwin GMA	1,300	37	2	1	0	0	2		858	1,716	1,718
Wa De Lock GMA	30,084	28,456	241	131	15	6,972	222		795	1,590	8,785
Unincorporated areas											
Southern Rural Water[2]	58,742	58,742	1,445	0	0		23,497	40% of entitlement	0	0	23,497
Total	**1,014,693**	**950,618**	**7,594**	**6,468**	**465**	**354,154**	**61,542**		**26,148**	**48,727**	**464,423**

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 SRW and 35% of entitlement for GMWater and GWMWater, as with previous State Water Reports.

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

(4) Domestic and stock use is estimated as 2 ML/bore except in the Mid-Loddon, which has a use of 2.6 ML/bore based on survey of domestic and stock users, and Nepean GMAs (0.3 ML/bore), which is a more accurate estimate for these two GMAs.

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

(6) A review of the PCVs is underway where the entitlement exceeds the allocation limit.

Appendix B

Storage levels

Basin	Reservoir	On stream or off-stream?	Full storage capacity (ML)	% full at 1 July 2007	% full at 30 June 2008
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	100%	55%
	Thomson Reservoir	On-stream	1,068,000	19%	18%
Latrobe	Blue Rock	On-stream	208,188	56%	70%
	Lake Narracan	On-stream	8,000	93%	61%
	Moondarra Reservoir	On-stream	30,300	97%	62%
South Gippsland	Lance Creek Reservoir	On-stream	4,200	18%	42%
	Hyland Reservoir	On-stream	671	27%	38%
	Western Reservoir	On-stream	1,137	3%	32%
	Candowie Reservoir	On-stream	2,207	10%	38%
Bunyip	Tarago Reservoir	On-stream	25,000	74%	89%
Yarra	Upper Yarra Reservoir	On-stream	200,000	50%	48%
	O'Shannassy Reservoir	On-stream	3,000	79%	82%
	Maroondah Reservoir	On-stream	22,000	37%	25%
	Yan Yean Reservoir	On-stream	30,000	18%	15%
	Cardinia Reservoir	Off-stream	287,000	50%	51%
	Greenvale Reservoir	Off-stream	27,000	65%	83%
	Silvan Reservoir	Off-stream	40,000	90%	90%
	Sugarloaf Reservoir	Off-stream	96,000	24%	16%
Maribyrnong	Rosslynne Reservoir	On-stream	25,368	4%	3%
Werribee	Melton Reservoir	On-stream	14,364	4%	4%
	Merrimu Reservoir	On-stream	32,516	13%	13%
	Pykes Creek Reservoir	On-stream	22,119	3%	4%
	Djerriwarrh Reservoir	On-stream	983	44%	34%
Moorabool	Korweinguboora Reservoir	On-stream	2,100	13%	5%
	Bostock Reservoir	On-stream	7,480	2%	1%
	Lal Lal Reservoir	On-stream	64,495	5%	5%
	Wilsons Reservoir	On-stream	1,010	2%	0%
	Moorabool Reservoir	On-stream	6,738	1%	0%
	Upper Stoney Creek Reservoir	Off-stream	9,494	46%	17%
Barwon	West Barwon Dam	On-stream	21,000	12%	30%
	White Swan Reservoir	On-stream	14,107	19%	13%
	Gong Gong Reservoir	On-stream	1,902	0%	2%
	Wurdee Boluc Reservoir	Off-stream	40,431	24%	40%
Corangamite	None	n/a	n/a	n/a	n/a
Otway Coast	West Gellibrand Reservoir	On-stream	1,856	45%	31%
Hopkins	None	n/a	n/a	n/a	n/a
Portland Coast	None	n/a	n/a	n/a	n/a
Glenelg	Rocklands Reservoir	On-stream	348,310	2%	1%
	Moora Moora Reservoir	On-stream	6,300	29%	20%
	Konongwootong Reservoir	On-stream	1,920	29%	27%
	Hayes Reservoir	On-stream	2,700	28%	34%
Millicent Coast	None	n/a	n/a	n/a	n/a
Murray	Lake Victoria (Victoria's share only)	On-stream	338,500	48%	63%
	Menindee Lakes (Victoria's share only)[1]	On-stream	865,500	0%	52%

Basin	Reservoir	On stream or off-stream?	Full storage capacity (ML)	% full at 1 July 2007	% full at 30 June 2008
	Lake Hume (Victoria's share only)	On-stream	1,518,250	12%	14%
	Lake Dartmouth (Victoria's share only)	On-stream	1,953,795	19%	23%
	Lake Cullulerraine	On-stream	5,270	81%	84%
Kiewa	Rocky Valley	On-stream	28,294	37%	46%
	Lake Guy	On-stream	1,416	23%	41%
	Clover Pondage	Off-stream	255	44%	78%
	Pretty Valley Basin	Off-stream	500	100%	100%
Ovens	Lake William Hovell	On-stream	13,710	100%	84%
	Lake Buffalo	On-stream	23,900	73%	49%
Broken	Lake Mokoan	On-stream	362,450	10%	4%
	Lake Nillacootie	On-stream	39,950	28%	23%
	Loombah-McCall Say	On-stream	1,813	66%	77%
Goulburn	Lake Eildon	On-stream	3,334,158	11%	14%
	Goulburn Weir	On-stream	25,500	94%	99%
	Sunday Creek Reservoir	On-stream	1,700	7%	9%
	Greens' Lake	Off-stream	32,440	45%	72%
	Waranga Basin	Off-stream	432,632	15%	12%
Campaspe	Upper Coliban Reservoir	On-stream	37,480	1%	1%
	Lauriston Reservoir	On-stream	19,790	17%	39%
	Malmsbury Reservoir	On-stream	17,780	4%	2%
	Lake Eppalock	On-stream	304,651	1%	6%
	Campaspe Weir	Off-stream	2,624	79%	87%
Loddon	Newlyn Reservoir	On-stream	3,215	4%	5%
	Tullaroop Reservoir	On-stream	72,950	9%	5%
	Cairn Curran Reservoir	On-stream	147,130	2%	5%
	Laanecoorie Reservoir	On-stream	7,940	18%	13%
	Hepburn Lagoon	On-stream	3,001	0%	0%
	Evansford Reservoir	Off-stream	1,351	11%	6%
	Sandhurst Reservoir	Off-stream	2,590	68%	94%
	Spring Gully Reservoir	Off-stream	1,680	4%	35%
Avoca	None	n/a	n/a	n/a	n/a
Mallee	None	n/a	n/a	n/a	n/a
Wimmera	Taylors Lake	On-stream	33,700	27%	15%
	Lake Lonsdale	On-stream	65,480	0%	0%
	Wartook Reservoir	On-stream	29,300	37%	27%
	Lake Bellfield	On-stream	78,560	14%	10%
	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.

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 differs from the flow conditions if no water was extracted from the stream.

Flush: See 'fresh'.

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

Gigalitre: One thousand megalitres.

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

Groundwater 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 of the level of compliance with these requirements.

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

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

Potable water: Water that is suitable for drinking.

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

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. All rights qualified in 2006/07 were of a temporary nature.

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

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

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

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

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

Riparian: Situated alongside a river or stream.

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

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

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

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

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

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

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

Sewage: The waterborne wastes of a community.

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

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

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

Stormwater: Untreated rainfall run-off from urban areas.

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

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

Sustainable diversion limit: The maximum volume which can be diverted from a catchment while protecting the environmental values of the catchment's waterways.

Statewide sustainable diversion limits: Precautionary estimates of the sustainable diversion limit for 1,600 small Victorian catchments using a statewide methodology.

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

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

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

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

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

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

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

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

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

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

Water shares: A water entitlement held by a water authority or person. The government 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 which aims for equitable management and long term sustainability.

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

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

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