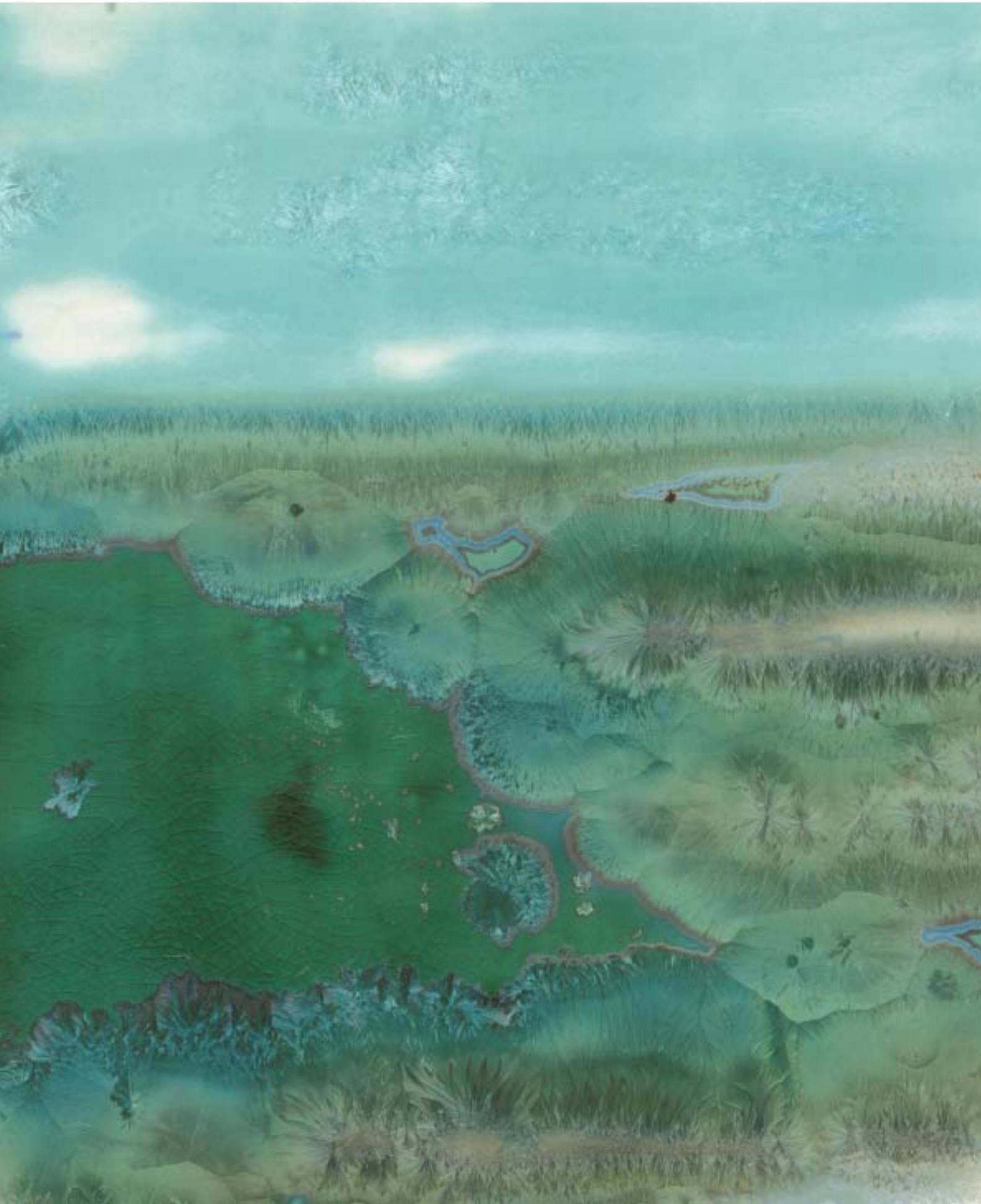
MELBOURNE WATER

Water Resources and the Environment 2002/03



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Water Resources and the Environment 2002/03

WHO WE ARE

Melbourne Water is owned by the Victorian Government. Our operating area extends from Melbourne's water supply catchments high up in the Yarra Ranges, to the Mornington Peninsula and Western Port, north to Yan Yean and west to Werribee.

We are a significant business, managing $7.1 billion of natural and built assets. Our annual operating revenue of more than $510 million is earned from water supply, sewage treatment and drainage rates. This is to fund our operations and capital program, to pay off debt and return dividends and equivalent taxes to the Government.

We plan to invest more than $145 million a year over the next three years on our infrastructure including reservoirs, sewage treatment plants, pumping stations, sewers and drains to help ensure we meet our objectives. We are committed to decision-making based on economic, social and environmental considerations.

An independent Board of Directors is responsible for the governance of Melbourne Water. The responsible Minister is the Minister for Water.

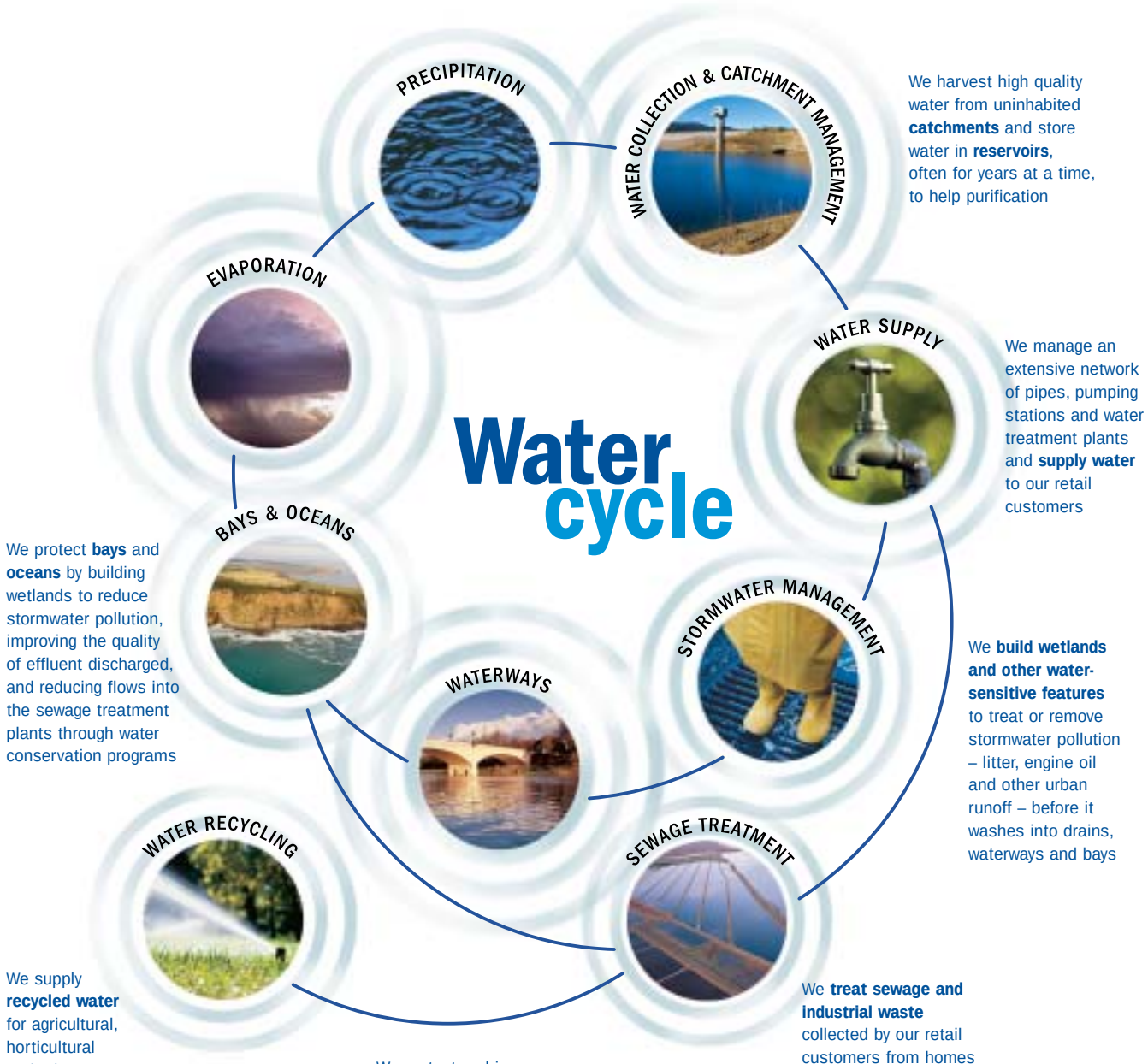
Our people have diverse skills and expertise, and range from environmental scientists to engineers and research and technology specialists, and we place a high priority on building strong partnerships and relationships in the government, industry and community sectors.

WHAT WE DO

We manage Melbourne's water resources in a way that aims to ensure that future generations enjoy one of the best urban environments in the world. This involves a major role in the total water cycle.

Our Vision

At Melbourne Water, we understand that engaging our stakeholders is the key to achieving our vision of *"Making Melbourne the world's most water-sensitive city".*



We harvest high quality water from uninhabited **catchments** and store water in **reservoirs**, often for years at a time, to help purification

We manage an extensive network of pipes, pumping stations and water treatment plants and **supply water** to our retail customers

We **build wetlands and other water-sensitive features** to treat or remove stormwater pollution – litter, engine oil and other urban runoff – before it washes into drains, waterways and bays

We **treat sewage and industrial waste** collected by our retail customers from homes and businesses

We protect and improve **waterways** by managing irrigators, stabilising beds and banks, preventing flooding, fencing off stream frontages, removing willows and other weeds, planting native species and releasing water from reservoirs to ensure environmental flows

We supply **recycled water** for agricultural, horticultural and other businesses and to irrigate open spaces such as golf courses

We protect **bays** and **oceans** by building wetlands to reduce stormwater pollution, improving the quality of effluent discharged, and reducing flows into the sewage treatment plants through water conservation programs

Who we work with

EPA Victoria, the Department of Human Services and the Essential Services Commission regulate the environmental, public health and economic aspects of our business. We work across several arms of the State Government, including the Department of Sustainability and Environment, and the Department of Treasury and Finance.

Our main customers are the retail water companies – City West Water, South East Water and Yarra Valley Water. We also provide services to other water authorities, local councils, land developers, businesses that divert river water, and recycled water users.

Industry partners include AGL Ltd, which generates electricity from biogas to help power the Western

Treatment Plant at Werribee, research organisations such as the CSIRO and Co-operative Research Centres, engineering consultants, and contractors who carry out tasks ranging from inspecting and maintaining assets to catchment surveillance and litter removal.

We work closely with a wide range of community stakeholders including "Friends of", Landcare, resident and environment groups, advisory bodies, rural landowners, and the education sector.

Our values

We have developed values that guide our decision-making and enable the organisation to operate in a professional manner, and in the best interests of our customers, employees, shareholder, suppliers and stakeholders.

We are people who:

- recognise we achieve more by working with others
- feel privileged to be custodians of our water resources
- behave with integrity
- attain excellence through creativity and innovation
- celebrate our achievements and learn from our experiences.

Why we produced this report

This Water Resources and Environment report describes and illustrates Melbourne Water's performance in meeting our environmental goals in 2002/03.

We are responsible for managing Melbourne's water resources now and for the future. We set ourselves high standards and our goals reflect our approach of working with government, retail water companies and the community to achieve results over and above those set for us through regulation.

We want the community and other stakeholders to understand our efforts to secure Melbourne's water future. This requires open and transparent reporting, especially regarding the operation of our two major sewage treatment plants. This publication, together with our *Annual Report 2002/03* and the *Social Report 2002/03* are important steps towards achieving this goal.

This report describes our continuing improvement in water and biosolids recycling, water conservation initiatives, how we are reducing greenhouse gas emissions from our operations, and enhancing the health and amenity of our waterways and marine environment.

Our *Annual Report 2002/03* is available on request by e-mailing inquiry@melbournewater.com.au or ringing 131 722 within Victoria or (03) 9235 7100 from elsewhere in Australia. *Water Resources and the Environment 2002/03* and the *Social Report 2002/03* are available on CD or on our website www.melbournewater.com.au.

We have provided a feedback form at the back of this report, and we welcome your comments.

Environmental Management System

We believe that all Melbourne Water people have a role to play in managing environmental issues. Our Environmental Management System encourages their involvement through a co-ordinated approach to gain continuous improvement.

Our Environmental Management System is certified to the international ISO 14001 standard and is formally certified and audited by Lloyd's Register Quality Assurance. We achieved recertification in February 2003.

PERFORMANCE SNAPSHOT

The effects of drought

During the continuation of the longest running drought since records began, Melbourne Water maintained environmental flows in the rivers we manage. Melburnians raised their awareness of the need to conserve water while their access to a high quality supply continued with little disruption to daily lives.

Water recycling

This year we made considerable progress in increasing the efficiency of water use by supplying recycled water for a variety of irrigation applications. We recycled 11 per cent from our sewage treatment plants, an increase of about 80 per cent over the previous year.

During the year, the Eastern Treatment Plant began supplying recycled water to the Sandhurst Club residential development in Carrum, and the Western Treatment Plant began supplying the Werribee Tourist Precinct.

Sustainable management of biosolids

Finding beneficial uses of biosolids from our sewage treatment plants is a key goal in improving the sustainability of the water cycle through waste minimisation. This year we found markets for the equivalent of 104 per cent of the annual biosolids production from the Eastern Treatment Plant (based on one year's production plus use of some stored biosolids).

Waterways improvements

Improving Melbourne's urban and rural waterways remains a large proportion of Melbourne Water's work. The pollutants and toxicants found in industrial, agricultural and urban environments make improving the condition of streams particularly challenging. Our work through the year included litter reduction, stormwater quality improvement, monitoring programs and substantial research into urban waterways.

We invested $6.3 million directly on waterway rehabilitation, mostly removing non-indigenous trees and pest plants, and stabilising and revegetating stream banks. In total we invested $23.3 million during the year to benefit Melbourne's waterways.

CONSERVING OUR PRECIOUS WATER

Goal: We continue to conserve Melbourne's high quality, affordable drinking water for present and future generations without the need for further dams

ACHIEVEMENTS

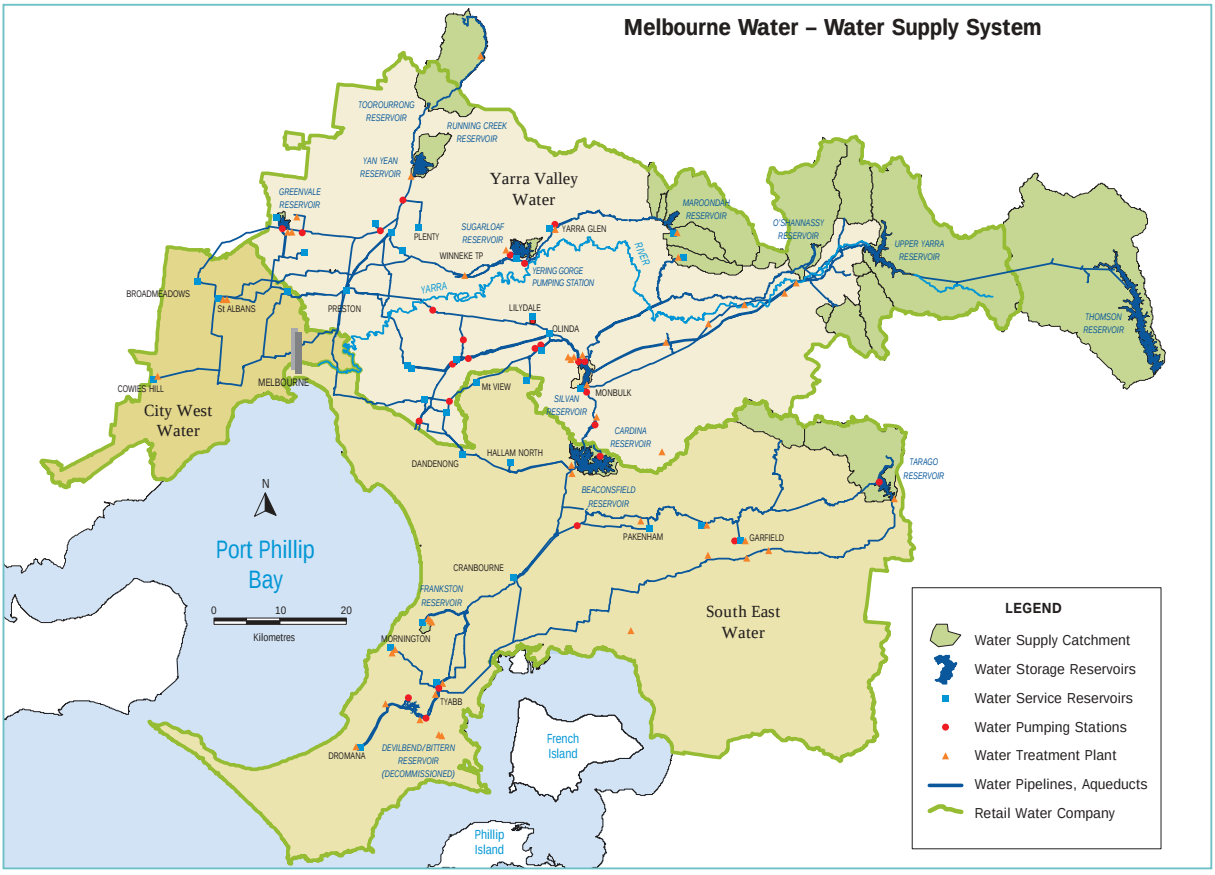
- ✓ Principally funded and project managed a Water Resources Strategy for the greater Melbourne area, which will allow Melbourne's population to grow by 32 per cent over the next 50 years without the need to build new dams.
- ✓ Piloted and funded a sustainable water management plan with the City of Melbourne and created a template to be used by other councils.
- ✓ Prepared drought contingency plans that will supply a further 170,000 million litres of water to Melbourne should extreme conditions persist.

KEY CHALLENGES

- > Maintaining the community's enthusiasm for water conservation even during periods of high rainfall.
- > Implementing recommendations of the Water Resources Strategy as agreed by the Victorian Government.
- > Developing contingency plans to counter the impact of climate change on our water resources.
- > Developing a more integrated approach to managing available water resources, including the use of groundwater, stormwater and treated effluent.

Melbourne is one of the few cities in the world that draws most of its water from protected forested catchments. Our uninhabited catchments in the Yarra Ranges, closed to the public for more than 100 years, are the source of most of our highly regarded drinking water.

Forests act like a vast natural sponge, holding and slowly releasing rainwater into our streams and reservoirs. Their water yield depends not only on rainfall but also on a complex relationship between factors such as the age of the forests, how recently they have been affected by fire, the slope and aspect of hillsides, and soil depth.



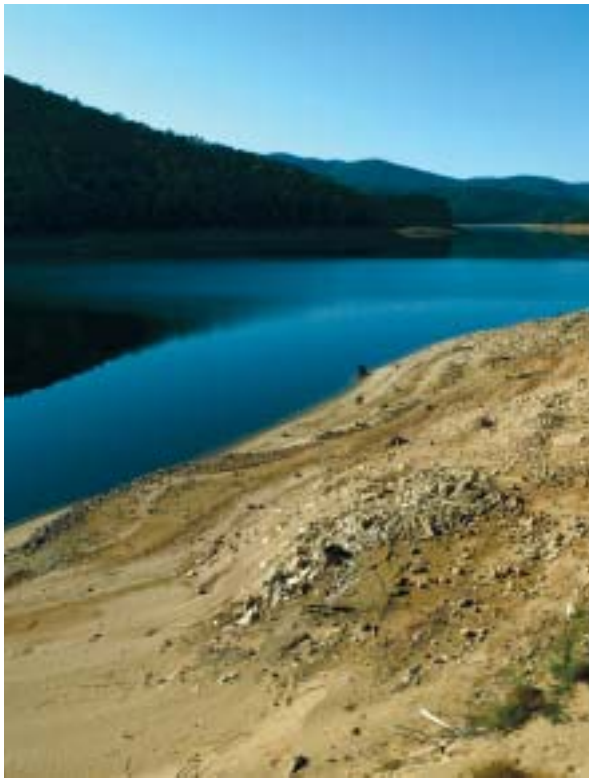
Protecting our catchments

Bushfires pose a constant threat to our water supply. Rain on a burned forest will wash ash and debris into reservoirs. However fire affects the quantity of water run-off as well as the quality. Forests of mountain ash, which cover about half of Melbourne's catchments, need large quantities of water for many years after a bushfire.

Melbourne's catchments were unaffected by the bushfires in many parts of Victoria's ranges during the 2002/03 summer. However, in light of the events throughout Victoria during the year's bushfire season, Melbourne Water is undertaking a strategic review of our approach to fire protection and suppression, ensuring all appropriate contingencies are in place. This involves providing major input into the Department of Sustainability and Environment's fire plans for national park and state forest catchments, and reviewing with the Country Fire Authority the plans for our freehold catchments.

North East Water, based in Wodonga, and ActewAGL, the ACT water authority, sought expert advice from Melbourne Water as part of their catchment rehabilitation planning following the devastating bushfires of early 2003.

In recent years, Melbourne Water has upgraded signage and security systems in the catchments. Security officers are employed to minimise public access and apprehended 40 people in the catchments this year.

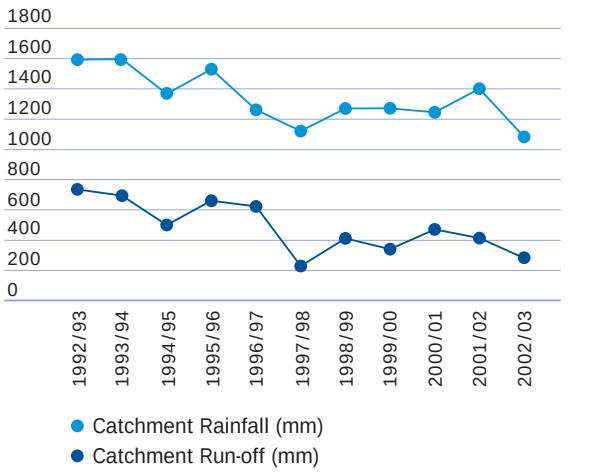


Our water storages, including the Maroondah Reservoir, dropped to a 17-year low during the year.

Impact of the drought

At 30 June 2003, Melbourne was in its seventh consecutive year of drought. The period from June 2002 to May 2003 was the driest since records began in 1855. In the year to May 2003, Melbourne recorded 344 millimetres of rain, some 50 millimetres below the next driest corresponding period, from June 1982 to May 1983. Rainfall across catchments was higher.

RAINFALL AND RUN-OFF FOR MELBOURNE CATCHMENTS



As forested catchments retain water, delays occur between rainfall, run-off, and increases in reservoir volumes. In turn, as reservoirs are constantly meeting the city's water demands, their water levels require close management in times of drought.

Water restrictions

In November 2002, our water storages dropped to 54.3 per cent of capacity, a 17-year low. The Victorian Government responded by introducing Stage One water restrictions for greater Melbourne. The restrictions included limits on the use of sprinklers, written approval to fill pools and spas, and the use of buckets for washing cars.

Melbourne Water estimates that about 29,000 million litres of water were saved between November 2002 and June 2003 through restrictions and increased community awareness – more than enough to fill either Maroondah Reservoir or Greenvale Reservoir.

At 30 June 2003, Melbourne's water storages were at 40.4 per cent of capacity. Our largest reservoir, the Thomson, experienced a record low of 30.4 per cent on 6 June.

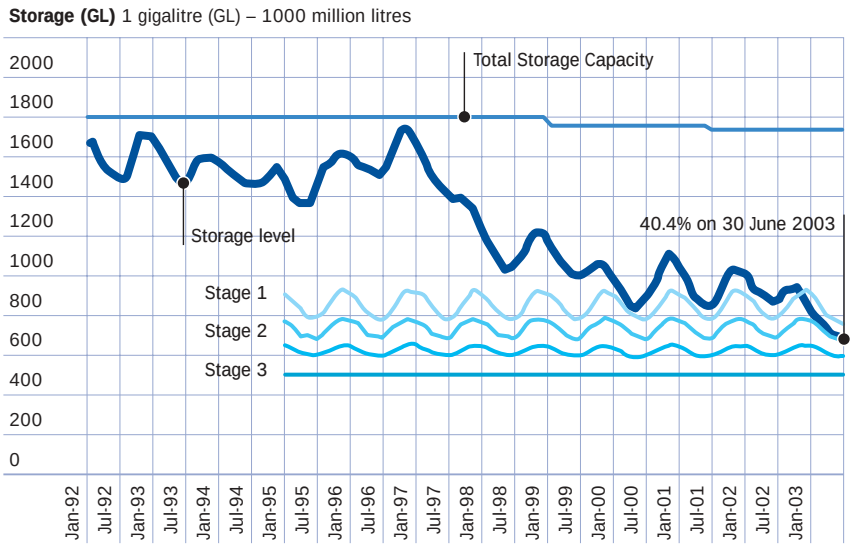
Water restrictions are applied according to the Drought Response Plan first agreed in 1995 between Melbourne Water and the city's three retail water companies. The plan was put in place to manage the water supply system, ensure water authorities meet their statutory requirements, and minimise the impact of drought on water users and the environment.

The city's thirst

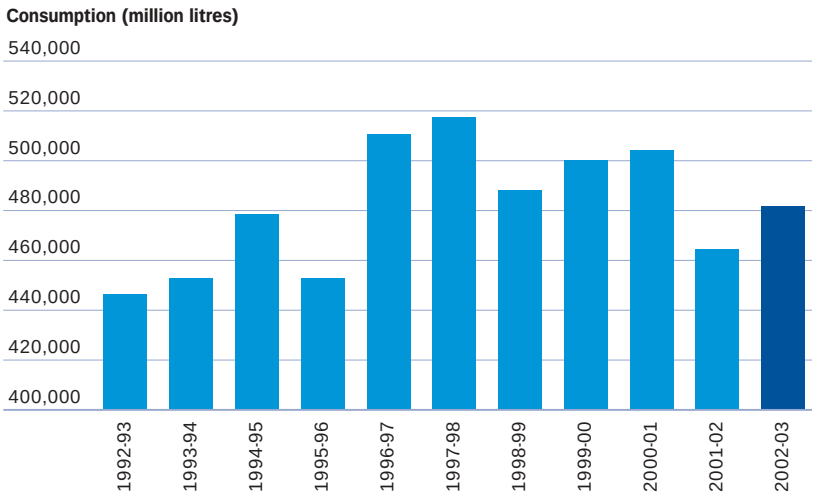
During 2002/03, Melbourne Water supplied 479,188 million litres of water to the retail water companies, City West Water, Yarra Valley Water and South East Water. These companies delivered it to Melbourne homes, businesses and other consumers through their reticulation networks. We also supplied 3812 million litres to Western Water.

High daily temperatures, especially during summer months, drives up the demand for water. Our peak consumption for the year occurred on 25 January when the temperature reached 44.1 degrees and we used 2212 million litres of water. Water restrictions and community awareness, however, kept this figure well below historic daily peaks of more than 3000 million litres.

DROUGHT IMPACT ON MELBOURNE'S WATER STORAGES



MELBOURNE WATER CONSUMPTION 1992-93 TO 2002-03



Our water challenge

A fundamental challenge for present and future generations of Melburnians is to continue to live within our water means. The city's population will continue to grow, increasing demands on water reserves. The current drought reminds us of the natural extremes of our climate and increases concerns about permanent climate change. Melbourne's current water supply and storages are limited, and we recognise that the environmental and social costs of building more dams are unacceptably high.

Melbourne's city planners left a legacy of pristine catchments and a well-engineered sewage treatment system. Our challenge is to maintain these excellent foundations and secure the city's water for the next 100 years by changing our attitudes and becoming the world's most water-sensitive city. We aim to make a significant contribution to achieving the Government's target of a 15 per cent reduction in water consumption by 2010.

Planning for the long term

A Water Resources Strategy for greater Melbourne, led and principally funded by Melbourne Water, was presented to the Victorian Government in October 2002.

The strategy proposed a blueprint for maintaining a safe, reliable, and financially and environmentally affordable water supply, which will cope with the predicted growth in Melbourne's population of 32 per cent over the next 50 years.

In its initial response, the Government adopted 10 of the initiatives proposed in the strategy, including leading the development of national water efficiency labelling standards, encouraging the use of water-efficient appliances, education campaigns, research, and the development of water management plans for large industrial users.

Further recommendations regarding environmental management, water pricing and regulation of water-efficient appliances are under consideration by the Government.

The planning committee comprised representatives from government and non-government organisations, the farming sector, and scientific and academic institutions.

Studying climate change

During October 2002, Melbourne Water sent two senior managers to Britain, Spain and the United States to study water resources planning for climate change. The trip allowed us to benchmark Melbourne Water's water resource management planning, and revealed it to be world class. Our high variability of streamflow means that we are relatively experienced in factoring climate uncertainty into our planning.

Following the overseas visit, we commissioned an investigation of the impact of climate change on Melbourne's water supply. The study, conducted by the CSIRO and due for completion in 2003/04, is examining climate change projections for Melbourne's catchment and service areas, including possible changes in rainfall, temperature, evaporation and humidity.

The study will assess the implications of climate change on catchment fire risks, sea level changes, flooding, water quality and water recycling. It will also identify likely future developments that could affect the demand for water and opportunities to enhance the reliability of our water supplies.

Investing in a sustainable future

During the year, in consultation with CSIRO Urban Water, we developed a Water Conservation Action Plan that proposes steps to achieve a 13,000 million litre annual water saving by 2010, with significant and continuing savings afterwards. The plan proposes a mix of management efficiency, recycling, education and partnerships to deliver the savings.

This mix of approaches is reflected in a variety of projects Melbourne Water progressed during the year.

Helping councils to develop water plans

Melbourne Water is working with councils to prepare a model planning process and support material to help them develop customised sustainable water plans.

In late 2002, we worked with the City of Melbourne on a pilot project that developed a sustainable water management strategy and created a template for other councils.

In June 2003, in a joint project with the Municipal Association of Victoria, we made $300,000 available to other metropolitan councils over two years for the development of sustainable water use plans. Each council is invited to apply for a grant of $10,000 to fund a tailored plan using the template provided by Melbourne Water.

The possibilities for our water future

Melbourne Water engaged the expertise of environmentalist Professor Peter Cullen and leading hydrologist Professor Russell Mein to study options to guide water resource management in greater Melbourne in the next 20 years. The study will consider the most appropriate ways of using an abundant supply of high quality effluent, becoming available as a result of major upgrades of Melbourne's two major sewage treatment plants.

Spreading the message

Awareness and education surrounding water issues are vital to achieving our long-term plans. During the year Melbourne Water invested $1.4 million on a variety of programs including training workshops to accredit plumbers and gardeners in sustainable water practice and community education.

Water conservation in public housing

Melbourne Water is investing $200,000 during 2003 to roll out a water conservation program in Melbourne's high-rise public housing estates. The program, a partnership with the Victorian Government, will reduce water usage in public housing estates by collecting rainwater from the roof to irrigate estate gardens.

The pilot program at Prahran's King Street housing estate saved 3000 litres of drinking water a week.

Best practice urban design

In May 2003, Melbourne Water made a submission to the Commonwealth Games Planning Advisory Committee as a contribution to the planning of the proposed Athletes Village.

Our submission provided advice and guidance on how the Games Village could showcase world's best practice in water-sensitive urban design and included suggestions on water conservation and water recycling. We will continue to provide technical advice and support to the Victorian Government as it designs and builds a model water-sensitive village.

We are also working with a number of urban housing developers, encouraging the adoption of industry best practice for water-sensitive design in their projects.

Smart Water Fund

Melbourne Water and the retail water companies launched the Smart Water Fund in November 2002 to promote water recycling, water conservation and biosolids use. Each water authority will contribute $1 million over the next two years for innovative water schemes. A selection of 27 projects won the first round of funding in May 2003. They range from onsite recycling in commercial buildings, racecourses and parklands, to enabling nurseries to recycle water using peat-based biofilters.

Partners in sustainability

Like water, energy is a natural resource that underpins our economic prosperity and quality of life. In April 2003, the Sustainable Energy Authority of Victoria (SEAV) and Melbourne Water formally agreed a partnership that will exploit synergies between energy and water and improve the sustainability of both. The partnership will identify and develop joint projects that demonstrate combined sustainable resource management.

Bolstering our reserves

Under contingency plans devised by Melbourne Water, Melbourne could access a further six months' supply of water should the extreme dry conditions continue.

About 170,000 million litres of water lies below current minimum operating levels of our reservoirs. The levels are dictated by the location of the outlet pipes or water quality standards. Under the plans, pumps would be installed to access the reserves and, if necessary, aerators fitted to ensure water quality.

We also prepared, in consultation with Melbourne's retail water companies, a plan that would see Melbourne's water storage reservoirs replenished under normal rainfall conditions by about May 2006.

Under the $1.5 million plan, increased volumes of water will be pumped into Sugarloaf Reservoir from the Yarra River at Yering Gorge while maintaining environmental flows. The increased use of Sugarloaf Reservoir and the attached Winneke water treatment plant will protect storage levels in other reservoirs.

Minimising water loss

Melbourne Water delivers drinking water via 1000 kilometres of distribution mains and more than 200 kilometres of aqueducts and tunnels.

During the year we engaged an expert from Melbourne University to review our approach to managing leaks across the supply system and to benchmark our methods against other similar water authorities.

The report, delivered in February 2003, found Melbourne Water's management to generally be of a very high standard. The report's key recommendation was that even though the amount of leakage from Melbourne Water's system was considered to be low, the method of quantifying the volume of leakage could be improved.

Melbourne Water invests about $100,000 a year rehabilitating and reducing leakage from more than 200 kilometres of aqueducts, most of which were built in the 1880s. The aqueducts transfer water from Melbourne's reservoirs to our seasonal storages.

Work during the year included the rehabilitation of an aqueduct in the Wallaby Creek catchment, and in May 2003 we began major work on the Maroondah Aqueduct. We estimate our aqueduct program saved 1070 million litres of water during the year.

The work will continue during 2003/04 when postgraduate engineering students from Melbourne University undertake a study to identify leakage points and develop remediation strategies.

The Maroondah Aqueduct, which dates from the 1880s, is undergoing major work to reduce water leakage.

RECYCLING WATER TOWARDS A GREENER FUTURE

Goal: We continue to conserve Melbourne's high quality, affordable drinking water for present and future generations without the need for further dams

ACHIEVEMENTS

- ✓ Increased water recycling from our sewage treatment plants by about 80 per cent, recycling more than 11 per cent of treated effluent.
- ✓ Launched the Smart Water Fund with the retail water companies to promote water recycling, other sustainable water conservation measures and biosolids reuse.
- ✓ Began supplying recycled water to the Werribee Tourist Precinct after completing a $2.5 million, six-kilometre pipeline from the Western Treatment Plant.
- ✓ Began supplying recycled water to the Sandhurst Club residential development in Carrum. The development will initially use 600 million litres a year to irrigate its two golf courses.

KEY CHALLENGES

- > Achieving our challenging water recycling targets.
- > Establish water recycling projects on a sustainable financial basis.

A valuable water resource

Substituting recycled water for drinking quality water will make a major contribution to a sustainable water future for Melbourne. People in and around our city use almost 500,000 million litres of water a year for a variety of industrial, commercial, farming and household purposes. Many of these uses do not require drinking quality water.

Water recycling reduces the discharge of treated effluent to bays and the ocean, creates economic growth, and conserves supplies of our precious drinking water, which in turn can defer the need to build further water storages.

Melbourne Water is progressing a range of water recycling schemes using effluent from the Eastern and Western Treatment Plants, for agriculture, horticulture, golf courses and other uses.

During 2002/03, we supplied 1979 million litres of recycled water to 34 customers and used another 31,186 million litres within our treatment plants.

Our sewage treatment plants, the Eastern Treatment Plant at Bangholme and the Western Treatment Plant at Werribee, currently discharge about 300,000 million litres of treated effluent a year.

Melbourne Water is working to achieve 20 per cent water recycling by 2010.

WATER RECYCLING PROJECTS

Project	Actual 2002/03		Target 2010		Target 2030	
	Million litres	%	Million litres	%	Million litres	%
Western Treatment Plant						
Onsite recycling	17,386	5.80	35,000	11.67	35,000	11.67
Werribee Tourist Precinct	84	0.03	1,000	0.33	1,000	0.33
Western region*	–	–	36,000	11.99	80,400	26.8
Eastern Treatment Plant						
Onsite recycling	13,800	4.60	13,800	4.60	13,800	4.60
Existing customers	1,675	0.56	8,000	2.67	16,000	5.33
Eastern region**	220	0.07	20,400	6.81	29,500	9.83
Other (eg onsite recycling in parks)	–	–	1,010	0.34	1,010	0.34
Total	**33,165**	**11.06**	**115,210**	**38.41**	**176,710**	**58.90**

* Includes Balliang recycled water pipeline
** Includes Eastern Irrigation Scheme, sandbelt and other golf courses, city councils

Developing opportunities west of Melbourne

Low rainfall, concentrated land ownership and large areas of land that could be improved by irrigation present major opportunities to expand water recycling schemes in Melbourne's west, using recycled water from the Western Treatment Plant.

The plant is phasing out land and grass filtration and diverting all raw sewage to treatment lagoons, making available increasing quantities of lagoon-treated water for use within and outside the plant. More than 17,000 million litres were used during 2002/03 to irrigate pasture within the treatment plant.

Salt, a common by-product of industrial processes and an ingredient in domestic detergents, re-emerges in recycled water. Lowering its salt levels will increase demand and potential uses. In June 2003, Melbourne Water and City West Water began an investigation into methods of reducing salt concentrations in sewage at the Western Treatment Plant. The study will assess a number of options including reducing industry salt output, treating salt before it enters the sewerage system, and treating it on-site at water recycling projects.

Werribee Tourist Precinct

Supply of recycled water to the Werribee Tourist Precinct began this year after the completion of a six-kilometre pipeline from the Western Treatment Plant. Some 84 million litres was used by 30 June 2003.

This project, our first off-site recycling scheme in the Western region, will supply about 160 million litres of recycled water a year to the Werribee Park Golf Course and the National Equestrian Centre. The pipeline is designed to accommodate the future requirements of other potential customers in the precinct, including Victoria's Open Range Zoo and Parks Victoria (which runs the Werribee Mansion).

Werribee South Irrigation District

Under the Victorian Government's Werribee Plains – A Vision for Sustainable Growth program launched in August 2002, the Werribee Plains will be transformed into a region internationally renowned for its sustainable development.

Currently the Werribee South Irrigation District extracts more than 10,000 million litres of water each year from the Werribee River and underground aquifers. There is potential to supply the region with recycled water.

Balliang district

The Balliang district, north-west of the Western Treatment Plant, contains 70,000 hectares of land in a low rainfall area, readily accessible to the transport and infrastructure of Melbourne and Geelong. A Melbourne Water-led engineering study, completed in December 2002, explored the potential of a trunk pipeline to supply recycled water from the Western Treatment Plant to the district.

The pipeline could irrigate up to 10,000 hectares of dry cropping land, significantly increasing agricultural and horticultural production.

Horticulture within the treatment plant

In January 2003, Melbourne Water called for expressions of interest to develop a showcase for recycled water in sustainable agribusiness at the Western Treatment Plant. The 400-hectare horticulture precinct will demonstrate new technology and intensive horticultural development with sound environmental outcomes, and promote water recycling. Major issues to be addressed are the salt content in the effluent and environmental issues associated with large scale dry land irrigation.

Developing opportunities east of Melbourne

The Eastern Treatment Plant has for some years sold Class C recycled water to irrigate agriculture and sporting facilities. The planned $170 million upgrade to the plant will improve the quality of recycled water to Class A through tertiary filtration, enhanced disinfection and reduced ammonia.

During the year, Melbourne Water commissioned a study to investigate water recycling opportunities for agricultural, industrial, recreational and urban uses in the Eastern region.

The first phase of the study, costing $100,000 and jointly funded by Mornington Shire Council and Frankston City Council, evaluated opportunities along the 56-kilometre pipeline from the Eastern Treatment Plant to Boags Rocks, where effluent is discharged to Bass Strait. The study looked at current and future market demand, land capability, water quality and the costs of using recycled water to irrigate council recreational reserves, golf courses, orchards, vineyards and vegetable crops.

The second phase, co-funded by South East Water, incorporated the results of phase one into a broader investigation of the opportunities for water recycling in Melbourne's east, including potential urban demand in greenfield developments and existing residential areas.

A draft report on the comprehensive study, including assessment of anticipated volumes and a ranking of potential schemes, was delivered in June 2003.

USES FOR RECYCLED WATER BY EXISTING EASTERN TREATMENT PLANT CUSTOMERS

Type of scheme	Product type	Volume used 2002/03 (million litres)	Percentage
Horticultural	Nursery/turf farm/flowers/ vineyard/orchard	500.0	29.8
Agricultural	Hydroponics/market garden	426.6	25.5
Silviculture	Foliage	20.0	1.2
Dust control	Biosolids dust control	58.6	3.5
Municipal	Golf courses/recreational reserves	666.2	39.8
Aquacultural/ornamental	Wetlands	3.8	0.2
Total		**1,675.2**	**100**

Eastern Irrigation Scheme

A 1999 Melbourne Water study identified a potential demand of 8000 million litres of recycled water in a corridor from Carrum to Cranbourne and Koo Wee Rup. That study initiated the development of the Eastern Irrigation Scheme to deliver recycled water from the Eastern Treatment Plant for horticultural, agricultural, urban and recreational irrigation.

The aim of the scheme is to deliver 5000 million litres of Class A recycled water a year from the plant to the Five Ways district.

In January 2003, a pipeline between the Eastern Treatment Plant and the Sandhurst Club development in Carrum was completed, enabling the irrigation of a new golf course with Class C recycled water for much of the summer period. When fully developed, Sandhurst will comprise 1850 homes and two golf courses, and use 600 million litres of recycled water a year.

The pipeline to Sandhurst has been designed as the first section of the Eastern Irrigation Scheme pipeline.

The Water Recycling Committee, which represents users of recycled water from the Eastern Treatment Plant, meets regularly with Melbourne Water.

Using recycled water at the Eastern Treatment Plant

The Eastern Treatment Plant uses recycled water for processes such as cleaning screens and toilet flushing. During the year, the plant used 13,800 million litres for these purposes and, for the first time, we have reported this amount in our recycling figures.

Supplying golf clubs in Melbourne's sandbelt

Melbourne's sandbelt region boasts more than 20 golf courses with substantial irrigation needs. During the year Melbourne Water, in association with three councils, continued to investigate opportunities to provide a secure, drought-proof supply of recycled water to golf clubs in the region.

Workshops and interviews held with the golf clubs and councils indicated a commitment to take more than 800 million litres of Class A recycled water annually.

With council reserves, horticultural businesses and future golf course developments, demand could increase to about 2000 million litres a year. Preliminary designs and cost estimates for the scheme have been completed, and Melbourne Water is engaging the Victorian Government and other stakeholders to progress the project.

Future opportunities

During the year, Melbourne Water continued to pilot and demonstrate recycling through sewer mining. In a project with Parks Victoria and South East Water, a portable water recycling plant used to irrigate King's Domain gardens during a trial last year was upgraded and installed at Albert Park.

During May and June 2003, the plant extracted and treated sewage from the Albert Road main sewer to supply recycled water for park irrigation and for use in Albert Park Lake. The trial demonstrated the potential for membrane technology to remove nitrogen and phosphorus from the effluent before discharge into the lake.

In a study concluded in November 2002, Melbourne Water assessed the feasibility of using depleted or degraded aquifers to store recycled water from the Eastern and Western Treatment Plants.

Excessive withdrawal from underground supplies has depleted aquifers in some areas of Victoria and, in some cases, allowed salt to degrade the reserves. Recharging the wells with recycled water may provide a suitable alternative to on-farm storage, reducing evaporation and improving water quality.

The study identified an aquifer near Werribee as a viable site for a storage and recovery trial.

HOW WE OPERATE TO PROTECT THE ENVIRONMENT

Goal: Operate in a manner that improves the environment

ACHIEVEMENTS

- ✓ Invested $14.4 million on new treatment facilities at the Western Treatment Plant's lagoons to reduce nitrogen flowing to Port Phillip Bay by 500 tonnes a year.
- ✓ Completed four wetlands that will reduce nutrients entering waterways and Port Phillip Bay by a further 14 tonnes a year.
- ✓ Sourced substantial markets for biosolids generated at the Eastern Treatment Plant as a major step towards achieving our target to recycle all of the biosolids we produce.
- ✓ Bought the first seven of a planned 25 hybrid electric and petrol-powered vehicles as part of our commitment to environmentally sound operations.
- ✓ Achieved no sewage spills to the environment.
- ✓ Complied with all discharge licence conditions for the Western Treatment Plant.
- ✓ Joined the Australian Greenhouse Challenge, a voluntary partnership between government and industry to reduce greenhouse emissions, and developed a greenhouse action plan.

DISAPPOINTMENTS

- × The planned major upgrade of the Eastern Treatment Plant was delayed by a legal challenge to the EPA Victoria works approval.
- × Delays to the Eastern Green Energy Project, which was designed to provide about half the power needed to run the Eastern Treatment Plant, meant Melbourne Water produced 2000 tonnes of carbon dioxide equivalent above target for the plant.
- × Failed one odour limit from our odour control facility at the Eastern Treatment Plant.

KEY CHALLENGES

- > Achieving our greenhouse reduction and renewable energy targets by 2005/06.
- > Finding cost effective ways to remediate biosolids at the Western Treatment Plant to enable them to be recycled.
- > Achieving our goal of eliminating offensive odours from any Melbourne Water asset by 2007.

Melbourne Water faces a number of challenges as we work to minimise and continually reduce discharges and emissions into the environment from our operations, especially from our two sewage treatment plants.

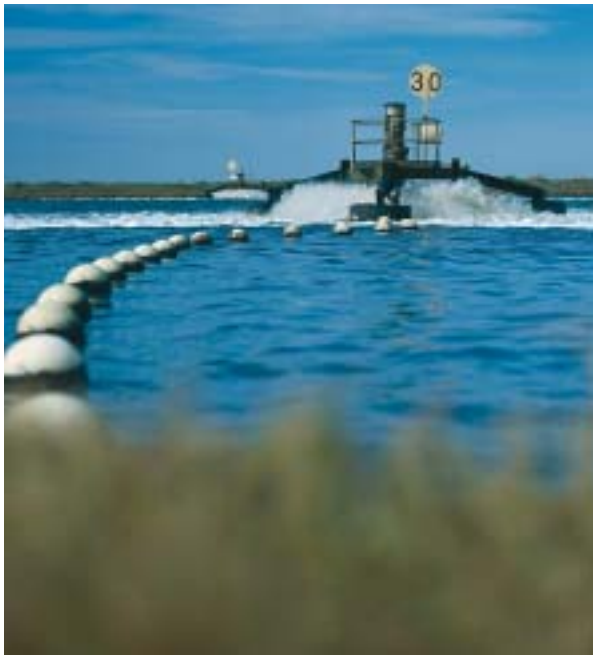
The Western Treatment Plant

The Western Treatment Plant is the largest sewage treatment facility in Australia and covers 10,850 hectares. It was designed and built more than 100 years ago to treat Melbourne's sewage using land filtration. The plant introduced grass filtration in the 1930s, and more recently constructed lagoons to treat sewage. Treated effluent from the three processes is discharged into Port Phillip Bay.

The plant treats more than 500 million litres of sewage a day from more than half of Melbourne's population and a large proportion of the city's industry. Homes and factories discharge into a sewerage network managed by retail water companies Yarra Valley Water and City West Water, who in turn discharge to the Western Treatment Plant. The retail water companies manage the concentration and quantities of pollutants in industrial sewage through Trade Waste Agreements with industries.

The Western Treatment Plant holds an accredited licence from EPA Victoria to discharge to the environment. The accredited licence reflects a trust in Melbourne Water to display high levels of responsibility in its operations of the plant. It was granted because the plant has an Environmental Management System, an audit program, an Environment Improvement Plan, and a history of clean operation.

Land and grass filtration, and the associated grazing of filtration land by cattle and sheep, will continue until the major upgrade of the Western Treatment Plant is completed.



Aerators maintain oxygen levels in lagoons as part of the treatment process at the Western Treatment Plant.

Upgrade of the Western Treatment Plant

The $124 million upgrade of the Western Treatment Plant, due for completion in 2005, continued throughout the year. Through this upgrade, we aim to reduce nitrogen entering Port Phillip Bay by 500 tonnes a year by 2006. Nitrogen reduction is being achieved through the installation of new treatment facilities at the lagoons, allowing the phasing out of land and grass filtration.

We completed the detailed design of the 25 West lagoon upgrade and began construction in January 2003. On its completion in December 2004, this lagoon will deliver the second half of the plant's 500-tonne nitrogen reduction objective.

Works include the installation of an activated sludge plant to enhance nitrogen removal, expansion of the biogas handling capacity, and extension of the cover over the anaerobic ponds to improve biogas capture.

The completed 25 West lagoon will make available land currently used in sewage treatment for irrigation with recycled water. It will increase by more than 50 per cent our ability to capture biogas and reduce odour emissions.

The first half of the nitrogen reduction project, the upgrade of the 55 East lagoon, was commissioned at the end of 2001.

During the year, the Department of Sustainability and Environment, in conjunction with EPA Victoria and Melbourne Water, began a three-year program to monitor the ability of Port Phillip Bay to process nitrogen. Monitoring devices have been placed offshore from the treatment plant, in the bay's centre, and at Hobsons Bay.

The Western Treatment Plant's Environment Improvement Plan, revised during the year, will guide further environmental improvements over the next three years. This plan covers the environmental upgrade, renewable energy generation, water recycling, biosolids use, agricultural practice, conservation management, and environmental objectives and actions.

Changing land use at Western Treatment Plant

The upgrading of treatment processes at the plant is making land available for other uses. Land used for sewage filtration is being released in three stages to allow its irrigation with recycled water. The completion of the 55 East lagoon upgrade during 2001 enabled the Stage 1 and Stage 2 areas to be irrigated with recycled water during the 2002/03 summer. The upgrade of the 25 West lagoon will allow Stage 3 to switch to irrigation in 2004, with complete changeover to recycled water by 2007.

Melbourne Water, in consultation with key stakeholders, is devising guiding principles for land use, to be finalised by the end of 2003, regarding future use of land within the plant. Zones include operational, agriculture, and conservation.

Protecting biodiversity

The Western Treatment Plant is an area of great ecological significance because of its function as a sewage treatment works, its large area, its location on Port Phillip Bay, and the presence of a number of threatened species. The plant has been listed as a wetland of international importance under the Ramsar Convention.

The upgrade of sewage treatment facilities at the plant is subject to monitoring and research to assess its impact on the conservation values of the plant. Melbourne Water's conservation management program involves wildlife monitoring, studies and investigations, and habitat maintenance activities.

Bird studies and monitoring

The Arthur Rylah Institute, on behalf of Melbourne Water, is monitoring migratory birds, waterfowl, wading birds, and cormorants at the plant. This extensive program, which builds on similar work undertaken from 2000 to 2002, began in February 2003 and will continue for three years.

We are also undertaking detailed water quality sampling at the Western Treatment Plant and relating it to waterbird numbers on the sewage treatment ponds to better understand the potential impacts of improved sewage treatment processes on bird populations. The collected data will be used to create a predictive model.

During summer, the Victorian Wader Study Group trapped and tagged migratory shorebirds at several sites within the plant as part of a worldwide effort to monitor migration, survival and reproduction rates of these species.

Significant flora and fauna

Flora and fauna studies completed this year at the Western Treatment Plant confirmed that the site supports a range of environmentally significant species requiring careful management. The following important species were subject to detailed studies:

- Fat-tailed Dunnart (Sminthopsis crassicaudata)
- Swamp Harrier (Circus approximans)
- Growling Grass Frog, also known as the Warty Bell Frog (Litoria raniformis)
- Spiny Rice-Flower (Pimelea spinescens)

Melbourne Water commissioned a conservation management plan for the rare Growling Grass Frog, due in August 2003, and we continue to monitor the population.

Habitat maintenance

Our extensive weed and vermin control programs included an ecological burn of 100 hectares of the Lake Borrie Spit grassland within the Western Treatment Plant during May 2003. It was the first time that Melbourne Water has used fire for weed control and regeneration of native grassland species. The burn was intended to especially benefit a population of the nationally significant Spiny Rice-Flower (Pimelea spinescens), one of the endangered species that once spread across the volcanic plains west of Melbourne. The burn was conducted with the assistance of firefighters from the Country Fire Authority.

EPA Victoria licence compliance

Melbourne Water complied fully with our obligations under EPA Victoria's discharge licence. Detailed tables appear on page 41 of this report.

The Eastern Treatment Plant

Every day the Eastern Treatment Plant at Bangholme processes 370 million litres of sewage from Melbourne's eastern and south-eastern suburbs. This is about 42 per cent of Melbourne's sewage.

The plant opened in 1975 and at the time was a world leader in sewage treatment. The 1,000-hectare plant uses an activated sludge process to treat sewage. A small amount of effluent is recycled and the majority is discharged under EPA Victoria licence via a 56-kilometre pipeline into Bass Strait at Boags Rocks. Three smaller treatment plants operated by South East Water also discharge effluent into the pipeline.

A two-year study completed in 1999 by the CSIRO showed that the effluent, which contains freshwater and ammonia, was affecting the marine environment. We aim to improve water quality and reduce freshwater discharge through implementing a major upgrade at the Eastern Treatment Plant.

Upgrade of the Eastern Treatment Plant

Melbourne Water's proposed $170 million upgrade to the Eastern Treatment Plant is designed to significantly reduce the impact of effluent at Boags Rocks by improving its quality. Flows into and out of the plant would be reduced through water conservation and recycling programs. Effluent quality would be improved by tertiary filtration to remove fine solids, enhanced disinfection without using chlorine, and ammonia reduction.

An independent panel appointed by EPA Victoria approved the works and recommended the shoreline outfall at Boags Rocks be extended by two kilometres into Bass Strait. EPA Victoria approved the works plan in July 2002 and the Clean Ocean Foundation appealed against the decision. The Victorian Civil and Administrative Tribunal dismissed this appeal in March 2003, but the Clean Ocean Foundation has sought leave to appeal the decision in the Supreme Court. Works are on hold pending a court ruling.

When EPA Victoria approved the proposed upgrade, it requested that Melbourne Water undertake a study of the potential to achieve a 12 per cent reduction in sewage inflows into the plant by 2012.

In April 2003, in close consultation with the retail water companies, we engaged consultants to examine recycling opportunities and potential measures to reduce water demand. The consultants' brief includes examining best practices in Australia and overseas that are applicable to Melbourne.

Improving the quality of treated effluent

The reduction of ammonia in treated effluent is a key objective for the Eastern Treatment Plant. A $47 million project to reduce ammonia levels in treated effluent by more than 75 per cent began in August 2002, after a successful $5 million six-month pilot in one of the plant's six aeration tanks.

Ammonia reduction is achieved by the incorporation of a treatment process, called nitrification-denitrification, into the existing system. The trial tank was fitted with barriers and upgraded aeration to create alternating aerobic and anoxic (low oxygen) zones. The additional aeration improves conditions for the aerobic bacteria, and ensures greater mixing of the waste, leading to more thorough treatment. In the aerobic zones, bacteria are encouraged to convert ammonia to nitrate, and in the anoxic zones the nitrate is reduced to nitrogen gas, which makes up about 80 per cent of air.

The quality of sewage received at the plant impacts the quality of effluent discharged. In April 2003, Melbourne Water began a study of the trade waste received to determine possible ways of reducing trade waste pollutants and flows. The study, due for completion in late 2003, will recommend ways of reducing volume and load of trade waste and ensuring water recycling and biosolids use is not compromised.

The colour of sewage received may lead to a visible plume at Boags Rocks because not all colour is removed by the treatment process at the Eastern Treatment Plant. Key industrial areas were sampled by South East Water to identify trade waste discharges with high colour levels. Results of this investigation will help determine ways of reducing colour levels in effluent from the plant.

The risks to safety and aesthetic quality associated with recycled water and biosolids provided from the plant are the subject of a draft quality plan for the Eastern Treatment Plant. Melbourne Water used the drinking water quality system principles of the Hazard Analysis and Critical Control Point system and the ISO 9001 standard as its basis.

The plan, a requirement of the works approval for the upgrade of the treatment plant, will be submitted to EPA Victoria upon its completion. We intend to pursue certification of the treatment process to an international quality standard.

Monitoring the marine environment

Melbourne Water closely monitors the effluent discharged from the Eastern Treatment Plant and its impacts on the marine environment.

In April 2003, the second phase of a wide-ranging two-and-a-half-year study of the marine environment, managed by the CSIRO, began looking at effluent toxicity, its dilution and dispersion into the environment at Boags Rocks, and its effects on marine flora and fauna.

Tests confirmed concentrations of ammonia higher than one part per million can inhibit spore germination and growth of macroalgae.

Ammonia concentration in undiluted effluent from the Eastern Treatment Plant is currently 20 parts per million. Within the mixing zone surrounding the outfall at Boags Rocks, concentration can sometimes be measured at greater then one part per million. However, outside the mixing zone concentrations fall to non-toxic levels.

The seabed and marine environment surrounding the proposed extended outfall was also the subject of surveys and monitoring. The geology of the seabed and its surrounding marine flora and fauna has been extensively studied and recorded using video cameras. The survey will provide a baseline against which future monitoring results may be compared. The interpretation and assessment of this study's results will be presented in August 2003.

EPA Victoria licence compliance

A condition of the EPA Victoria licence for the Eastern Treatment Plant is that it has an Environment Improvement Plan. The plan details the methods by which Melbourne Water will achieve the required environmental standards, and how we will, over time, improve on that performance.

During the year, we redrafted the plant's Environment Management Plan to incorporate all key environmental initiatives included in the proposed major upgrade: tertiary treatment, disinfection upgrade and ammonia reduction. The draft, developed with the Community Liaison Committee, will be presented to the community for comment by early 2004.

Melbourne Water complied with all but one obligation under EPA Victoria's discharge licence for the Eastern Treatment Plant. Non-compliance with an odour obligation was noted in three monitoring rounds. Detailed tables appear on page 39 of this report.

Our no-odour objective

The nature of sewage, the infrastructure and processes used to transfer and treat it, and the subjective nature of odour measurement makes management of odour a challenge for water authorities.

Community expectations of acceptable odour levels from sewage treatment have risen in recent years. Melbourne Water received 22 complaints from the public about odour emanating from our facilities throughout the year, and each odour complaint is investigated. We aim to improve odour management so that by 2007 no offensive odour is emitted from our assets.

Currently our EPA Victoria licence does not permit offensive odours beyond the boundary of the Eastern Treatment Plant. By 2005/06, the licence for the Western Treatment Plant will also disallow odour beyond the boundaries.

During the year, Melbourne Water completed a strategy to achieve our no odour objective. The odour management strategy details several odour mitigation projects, and also recommends that odour be considered when planning, developing work procedures, and optimising the operation of the system.

Where possible we undertook air quality sampling and developed dispersion models to establish priorities and plan the works program. Where this was not feasible, we drew upon our complaints database to locate risk areas.

Odour from Western Treatment Plant

The continuing major upgrade of the Western Treatment Plant will reduce odour by progressively phasing out grass and land sewage filtration, covering anaerobic zones and mechanically aerating lagoon systems.

In addition, Melbourne Water plans to build a $4.6 million odour treatment plant at the raw sewage inflow channel, a major source of odour beyond the plant's boundaries.

As new treatment processes are commissioned, detailed odour modelling will prioritise further work.

Odour from Eastern Treatment Plant

At the Eastern Treatment Plant, we are investing in works to identify significant sources and eliminate odour progressively as part of the major plant upgrade.

A major odour investigation was completed this year at the plant including odour sampling and modelling, and determining a staged program of improvement works.

Our monitoring included the performance of the odour control facility for an activated sludge channel within the plant. On three occasions during the year the plant showed odour in excess of the discharge licence level. However dilution in the atmosphere meant that no odour reached the plant boundary.

The most probable cause of the high odour levels is the age of the biofilter material used to treat it.

During the year, Melbourne Water engaged consultants to assess the suitability of the biofilter and its performance as part of an investigation into odour at the Eastern Treatment Plant. They recommended that the biofilter be replaced as greater odour removal efficiencies can be expected. However, the biofilter itself has an inherent odour of between 200 and 500 odour units. EPA Victoria agreed that Melbourne Water apply for a licence limit amendment for the biofilter so that the plant can operate with new media and not exceed the EPA Victoria licence limit, currently at 200 odour units.

Date	Outlet odour (average odour units)	Licence requirement for outlet (average odour units)
25 July 2002	6,400	200
6 November 2002	2,100	200
10 February 2003	4,418	200

Transfer system

Appropriate odour management within the sewage transfer system can be achieved through, for example, installing a treatment facility, chemically dosing sewage, or blocking offending vents.

Melbourne Water operates four odour control facilities throughout the transfer system. The odour management strategy proposes that capital works are prioritised according to complaint history and frequency.

Odour complaints received

Melbourne Water responds to all odour complaints it receives by implementing actions designed to reduce the source of odours.

Site	2000/01	2001/02	2002/03
Eastern Treatment Plant	14	16	5
Western Treatment Plant	4	1	4
Transfer system	27	15	13
Total	**45**	**32**	**22**

Sustainable management of biosolids

Biosolids are dried sludge created as a byproduct of the sewage treatment process. In the past, Melbourne Water has stored biosolids at our treatment plants.

The Western Treatment Plant has treated sewage for more than 100 years, and the biosolids stored there contain different types and levels of contaminants, including heavy metals and toxicants no longer allowed in the sewerage system. Stored biosolids from the newer Eastern Treatment Plant are of a higher quality. However, the practice of storing is unsustainable and we are seeking beneficial uses for biosolids.

Over the years the implementation of Trade Waste Agreements has improved the quality of industrial inflow to our treatment plants, allowing us to recycle some biosolids in beneficial uses such as soil improvement and quarry rehabilitation. However, older stores tend to contain contaminants, making their remediation a long-term project.

Our plan for biosolids

Under Melbourne Water's Biosolids Management Strategy, we will recycle the equivalent of 100 per cent of the Eastern Treatment Plant's annual production of biosolids by 2004/05. At the Western Treatment Plant, we will recycle the equivalent of 100 per cent of the annual production from enhanced treatment lagoons by 2010. EPA Victoria requires biosolids to be stored for three years before allowing recycling.

We also plan to reduce our biosolids stored at the Eastern Treatment Plant and, over the long term, we will remediate the contaminated stores held at the Western Treatment Plant.

Woodlands Industrial Estate, Braeside, will have a foundation of compacted biosolids from the Eastern Treatment Plant.

In February 2003 we completed a review of the environmental risks associated with groundwater, surface run-off and odour from existing sludge management practices at the Western Treatment Plant. We are preparing a detailed sustainable sludge management plan for the plant, due for completion in July 2003.

Markets for biosolids

During 2002/03, Melbourne Water supplied 28,342 tonnes of biosolids for use in the Woodlands wetlands project and to the blended soil market. Our target for 2003/04 is 16,000 tonnes.

Melbourne Water and Blue Circle Southern Cement investigated using biosolids from the Western Treatment Plant as fuel in the company's Waurn Ponds cement kiln. A 12-month feasibility study is underway and due for completion in April 2004.

In February 2003, we called for expressions of interest from companies with potential uses for biosolids from the Eastern Treatment Plant. Several companies undertook trials before tendering for substantial quantities. At 30 June 2003 Melbourne Water had agreements with three companies to use biosolids in the blended soil market. Initial agreements are for about two-thirds of the Eastern Treatment Plant's annual production, with the likelihood of volume increases.

A disused clay pit at the Woodlands Industrial Estate in Braeside is being filled with 110,000 tonnes of biosolids from the Eastern Treatment Plant as part of its conversion to wetlands.

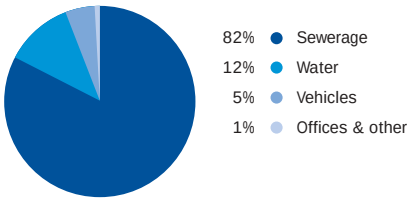
Earthworks began in February 2003, and landscaping and planting of the wetlands are due for completion in June 2004. The equivalent of five years' biosolids production from the plant are being compacted to form the base of one of three wetland lakes. A one-metre thick clay liner and cap will seal in the biosolids and mitigate seepage, in accordance with an EPA Victoria works approval and licence.

Reducing greenhouse emissions

Most of Melbourne Water's energy consumption is used to power our sewage treatment plants and to pump water and sewage. As community expectations and regulatory requirements demand more stringent treatment of water and sewage, our treatment processes are becoming more mechanised and sophisticated and our energy consumption is consequently rising.

The drought has led to increased energy use as more water than usual is pumped out of the Yarra River into Sugarloaf Reservoir. Our electricity consumption is the largest contributor to Melbourne Water's greenhouse gas emissions, with methane emissions from sewage treatment forming another significant portion.

AVERAGE ENERGY USE 1995/96 TO 2002/03



Our energy plans

By 2005/06, we aim to reduce our greenhouse gas emissions by 35 per cent compared with 2000/01 levels, and we will cut our use of electricity from the grid by 10 per cent. We will achieve this through a variety of renewable energy and conservation projects and by reducing direct emissions. This will also minimise our impact on the environment and reduce costs.

By 2008, we plan to fully compensate for the electricity we import from the grid by generating the equivalent amount from renewable energy.

Meeting these targets will deliver significant environmental and social benefits, as well as providing a net financial benefit to Melbourne Water of $6 million a year.

In April 2003, Melbourne Water and the Sustainable Energy Authority of Victoria signed an agreement to jointly exploit synergies between water and energy. Together we will identify and develop projects that will demonstrate combined sustainable resource management.

Biogas capture at Western Treatment Plant

The major upgrade of the Western Treatment Plant includes significant energy initiatives.

Treatment lagoons are being covered to capture biogas for use in power generation facilities. Sewage treatment using land and grass filtration is being phased out at the plant and, by 2005/06, all sewage will be treated in lagoons.

This will eliminate direct emissions of methane and nitrous oxide, and will increase the amount of gas captured.

The commissioning of the activated sludge plant in 2004/05 will temporarily increase our demands on the electricity grid. However, by the following year, the resulting increased production of biogas will enable the treatment plant to produce about two-thirds of its energy needs.

In October 2002, Melbourne Water completed an upgrade of the gas extraction system at the treatment plant. During 2002/03, the AGL power plant located at the treatment lagoons used captured biogas to generate some 18.1 gigawatt hours of electricity that would otherwise have been drawn from the grid, saving about 26,500 tonnes of carbon dioxide equivalent. These figures will increase to 24 gigawatt hours and 32,200 tonnes respectively when the plant runs at full capacity.

One gigawatt hour (GWh) is enough energy to run an average Melbourne household for 100 years.

Accepting the challenge

Melbourne Water joined the Australian Greenhouse Challenge in September 2002. This is a voluntary partnership between government and industry to reduce greenhouse gas emissions.

Membership allows us to achieve recognition of our emission reductions and to position Melbourne Water to capitalise on future emission trading programs.

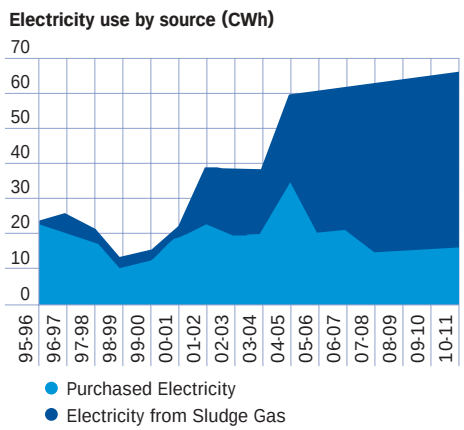
Our main greenhouse gas emissions are methane, directly from sewage treatment and livestock, and carbon dioxide, indirectly through electricity used to pump and treat water and sewage.

In 2002/03, Melbourne Water emitted about 462,000 tonnes of carbon dioxide equivalent. This is equal to the annual greenhouse gas emissions from about 100,000 cars based on average Australian car use.

As part of the Australian Greenhouse Challenge, we developed an action plan that includes targets and performance measures for reduced energy consumption, reduced greenhouse gas production and increased green energy production. More than 800 organisations are members of the Australian Greenhouse Challenge.

Above: Lagoon covers capture methane gas at the Western Treatment Plant.

WESTERN TREATMENT PLANT ENERGY USE



Eastern Green Energy Project

Melbourne Water's major upgrade of the power station and outfall pumping station at the Eastern Treatment Plant, originally planned for completion by September 2003, has been delayed by an industrial dispute.

The $30 million project involves replacing seven generators with new equipment that can run solely on biogas (a byproduct of the sewage treatment process, primarily methane), supplemented by natural gas as needed. The project will produce 30 gigawatt hours a year of green energy and has the potential to provide about half the power needed to run the Eastern Treatment Plant, cover all its heating and cooling requirements and to reduce electricity and maintenance costs.

The delayed works meant Melbourne Water produced 2000 tonnes of carbon dioxide equivalent above target for the year and will increase our 2003/04 emissions above target levels.

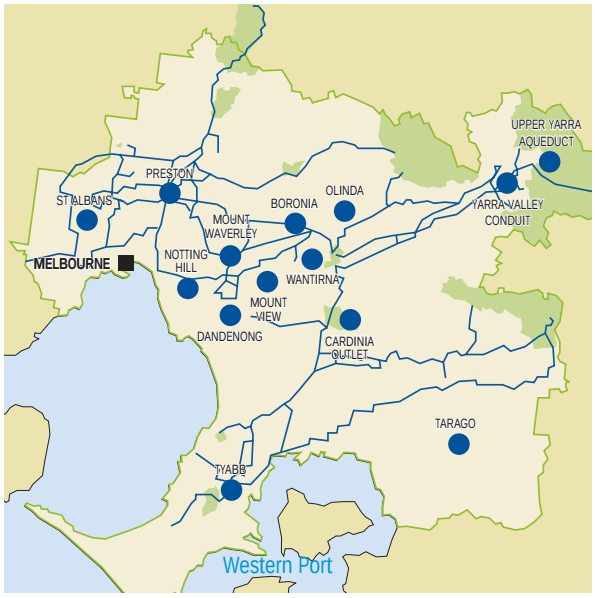
Melbourne Water is registered as a generator of renewable energy in the Australian Government's Renewable Energy Certificates program. During the year, we undertook substantial preparation for the registration of the Eastern Treatment Plant's upgraded power station, a component of the Eastern Green Energy Project, as part of this program.

Hydro-electricity generation

As part of our renewable energy program, Melbourne Water continued to plan for the construction of 14 mini-hydro-electric power plants. When completed, these will generate 66 gigawatt hours of renewable energy each year. During the year, we finalised our plans for building and operating these plants and sent out a request for submissions to our preferred tenderers. Next year we will establish contracts with the successful tenderers to build and operate these plants.

The project to expand our hydro-electric capacity is due for completion at the end of 2006. It complements existing hydro-electricity plants at the Thomson Reservoir and on the pipeline supplying Cardinia Reservoir. These generated 31.8 gigawatt hours of electricity during 2002/03.

Planned hydro-electricity generation plants



Other greenhouse and energy savings

In June 2003, Melbourne Water bought the first seven of a planned 25 hybrid electric and petrol-powered vehicles to replace existing fleet cars. The rest will be incorporated into the fleet by the end of 2004. The Toyota Prius hybrid vehicles use about 50 per cent less fuel compared with similar-sized vehicles and produce 46 per cent of the emissions. Each is expected to achieve a saving of 4.5 tonnes of carbon dioxide equivalent a year.

Melbourne Water has a fleet of 280 cars and will introduce other hybrid or fuel cell technology vehicles (such as hydrogen) into the fleet as opportunities arise.

During the year Melbourne Water completed a number of energy saving projects within our operations. We replaced filtration membranes in the microfiltration plants at Yarra Glen, Frogley and Creswell allowing reductions in energy and chemical consumption, and replaced motors at the Somerton Road pumping station. We also commissioned the recycle pump as part of the 55 East lagoon upgrade at the Western Treatment Plant, reducing the need for high-energy aeration in sewage treatment. Projected energy savings in each project were achieved.

The trees and shrubs planted under our Stream Frontage Management Program this year were responsible for mitigating about 700 tonnes of carbon dioxide equivalent over the year.

Greenhouse and energy data

During the year Melbourne Water changed the way we record actual and forecast energy and greenhouse data to improve its accuracy and to align with the Australian Greenhouse Office methodology. Forecast figures have been updated to reflect the current status of energy/greenhouse projects. Consequently, some figures differ from those previously reported.

GREENHOUSE GAS AND ENERGY DATA

	Actual				Forecast		
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
Energy consumption by type (terrajoules)*							
Electricity imported from grid	669	694	648	681	715	600	597
Natural gas imported	67	29	78	79	95	270	271
Diesel imported	51	51	50	50	46	1	1
Biogas used	360	597	565	567	691	1,240	1,243
Vehicle fuels	32	31	36	30	29	29	29
Total energy used	1,178	1,401	1,377	1,408	1,577	2,140	2,141
Increase on 2000/01		119%	98%	102%	112%	136%	100%
Energy consumption by operation (terrajoules)*							
Eastern Treatment Plant	681	709	696	693	730	1,084	1,126
Western Treatment Plant	121	316	335	337	484	667	672
Winneke water treatment plant	153	170	139	176	140	140	81
Water – other	37	33	34	33	34	35	35
Sewage transfer	134	128	121	122	123	124	125
Minor sites	7	3	4	4	4	4	4
Other	44	43	49	43	64	87	98
Total	1,178	1,401	1,377	1,408	1,577	2,140	2,141
*3.6 terrajoules = 1 gigawatt hour							
Green electricity generation (gigawatt hours)							
Eastern Treatment Plant	0.6	0.8	1.1	1.1	3.7	32.0	32.0
Western Treatment Plant	3.4	16.1	18.1	18.1	24.6	41.1	41.1
Existing hydro-electricity plants	28.6	25.1	31.8	44.9	26.9	27.0	30.6
Proposed hydro-electricity plants	0.0	0.0	0.0	0.0	19.6	54.8	70.5
Total green electricity generation	32.6	42.0	51.0	64.1	74.8	154.9	174.1
Total Melbourne Water electricity consumption	185.7	192.9	180.1	189.2	198.6	166.7	165.9
Green electricity as a proportion of total electricity used	18%	22%	28%	34%	38%	93%	105%
Greenhouse emissions (carbon dioxide equivalent, tonnes)							
Electricity (purchased from grid)	272,416	278,415	260,023	273,166	286,665	240,588	239,556
Natural gas (for general)	82	90	90	90	90	90	90
Natural gas (for electricity, shaft power and heat)	3,856	1,764	4,94	4,985	6,039	17,259	17,307
Diesel transport	169	20	475	201	201	201	201
Diesel (for electricity, shaft power and heat)	3,790	3,920	3,849	3,878	3,587	60	97
Liquefied petroleum gas	73	106	97	106	106	106	106
Petrol	2,020	2,133	2,267	2,100	2,014	2,014	2,014
Methane (total direct emissions)	274,634	190,563	188,463	190,301	46,108	46,971	47,834
Nitrous oxide	6,504	3,166	6,272	6,402	5,206	5,391	5,575
Carbon dioxide sink (trees)	-3,560	-4,260	-4,960	-5,660	-6,360	-7,060	-7,760
Biogas methane (total captured)	0	0	0	0	0	0	0
Total	559,986	476,098	461,524	475,569	343,656	305,620	305,021
Greenhouse emissions per million litres of water supplied							
Carbon dioxide emissions in kilograms per million litres of water supplied	–	1,109	1,023	954	979	691	601

WATERWAYS AND STORMWATER MANAGEMENT

Goal:

- Ensure that Melbourne's natural waterways are healthy with increased numbers of native fish, platypus and plant life
- Improve the health and amenity of Port Phillip and Western Port bays for the prosperity and enjoyment of present and future populations

ACHIEVEMENTS

- ✓ Completed the CSIRO sediment study to increase our understanding of factors that affect the environmental health of Western Port as part of a $686,000 waterways environment research program.
- ✓ Submitted Victoria's first two Streamflow Management Plans for Hoddles Creek and Diamond Creek to the Minister for Water that will balance the needs of users while protecting the waterways' environmental flows.
- ✓ Planted about 850,000 trees, shrubs and grasses to improve the long-term health of waterways.
- ✓ Minimised the effects of the unprecedented drought conditions on the environmental health of the Yarra River.

DISAPPOINTMENTS

- × Failed to maintain environmental flows in the Yarra in April 2003 by allowing pumping from the river to continue for several hours after flow dropped below the required level.
- × Failed to engage the community early in waterway improvement projects.

KEY CHALLENGES

- > Meeting our target that all natural waterways in greater Melbourne will be in good condition by 2025.
- > Reducing nitrogen entering Port Phillip Bay from the stormwater system by 100 tonnes by 2010.
- > Creating an integrated masterplan for environmental management of the Yarra River.

The people of Melbourne value our rivers, creeks and streams, with about a third of the population choosing to live within a kilometre of a waterway. Waterways provide habitat for native species and recreational amenities for people, making a significant contribution to urban and rural environments.

Community expectations of our waterways have changed considerably, especially in recent decades. In the past, industrial waste was discharged into urban waterways that were regarded as little more than drains. Considerably more stringent environmental standards and regulations now reflect the value we place on these natural assets.

The health of many waterways has been damaged by land clearing, the loss of native vegetation, urbanisation, water harvesting, infestations by weeds and introduced species, and polluted run-off.

Melbourne Water is responsible for improving the health of our rivers and streams across rural and urban environments, releasing environmental flows from reservoirs, monitoring the health and water quality of waterways, and licensing and managing diverters who draw water from catchments.

We manage 3966 kilometres of waterways including 677 kilometres of modified waterways and channels, 54 natural and constructed wetlands, 153 monitoring stations of waterways and drains, 124 sediment and 23 litter traps and 25 recreational lakes.

We aim to have all of Melbourne's natural waterways in good condition by 2025. During 2002/03, we spent $23.3 million on waterway restoration and improvement, research, monitoring, and community programs.

Planning healthy catchments

The management of floodplains, waterways, flows, water quality and fish habitat for the 8000 kilometres of streams and rivers in the Port Phillip and Western Port region is to be co-ordinated through a regional approach.

Melbourne Water and the Port Phillip and Westernport Catchment Management Authority are working in partnership to develop a strategy that aligns with the State Government's integrated approach to managing Victoria's rivers and catchments over the next 20 years, released in August 2002.

The draft strategy for the Port Phillip and Western Port region will be released for community consultation in September 2003.

Improving waterway habitat

Melbourne Water spent $23.3 million during the year to improve the long-term health of our waterways. We oversaw the planting of around 850,000 trees, shrubs and grasses along stream banks. We also stabilised banks, removed willows and other non-indigenous trees, improved stream navigability for fish, and investigated and planned new works. Community and volunteer groups made an important contribution to bank revegetation.

We spent $6.3 million rehabilitating waterways during the year. Important projects completed included:

- Extensive remodelling of a 1.3 kilometre section of Mullum Mullum Creek in Ringwood. Revegetation will occur over the next two years
- Reshaping of banks and rebuilding bed structures of Brushy Creek at Mooroolbark to complete stabilisation works
- Removal of willows along the Yarra River at Ivanhoe
- Stabilising Steele Creek next to the Niddrie Quarry
- Construction of a fish ladder on Cardinia Creek to enable native fish to pass a structure built to stabilise the banks
- Replaced the levee and reshaped the banks of the Bunyip Main Drain to reduce sediment flows into Western Port and provide flood protection in the Koo Wee Rup area
- Installing a sediment trap at the mouth of the Yallock outfall in Western Port

We plan waterway rehabilitation in consultation with key stakeholders such as community groups, councils, landowners and government departments. This year we devised plans for the following rivers and creeks:

- Lower Yarra River from Dights Falls to Bolte Bridge at Docklands
- Watsons Creek from Frankston South into Western Port
- Boggy Creek near Frankston
- Blind Creek in the Knoxfield/Wantirna South area.

Some 70 to 80 per cent of the streams for which Melbourne Water is responsible flow through privately owned or leased land, largely in the rural and upper catchments in the Western Port/Port Phillip catchment.

Melbourne Water is helping landowners revitalise waterways on their properties damaged by livestock and loss of natural vegetation through the Stream Frontage Management Program. We fund weed removal, planting of indigenous species along banks, and fencing to exclude stock. Property owners, Landcare groups and volunteer groups undertake the work.

This year, some 348 properties benefited from the $900,000 program. A total of 122,680 trees, shrubs, grasses and sedges were planted, and more than 78 kilometres of fencing erected.

Study tracks endangered owls

Melbourne Water is studying a family of powerful owls found during a survey of willows and other pests along Olinda Creek in Mt Evelyn.

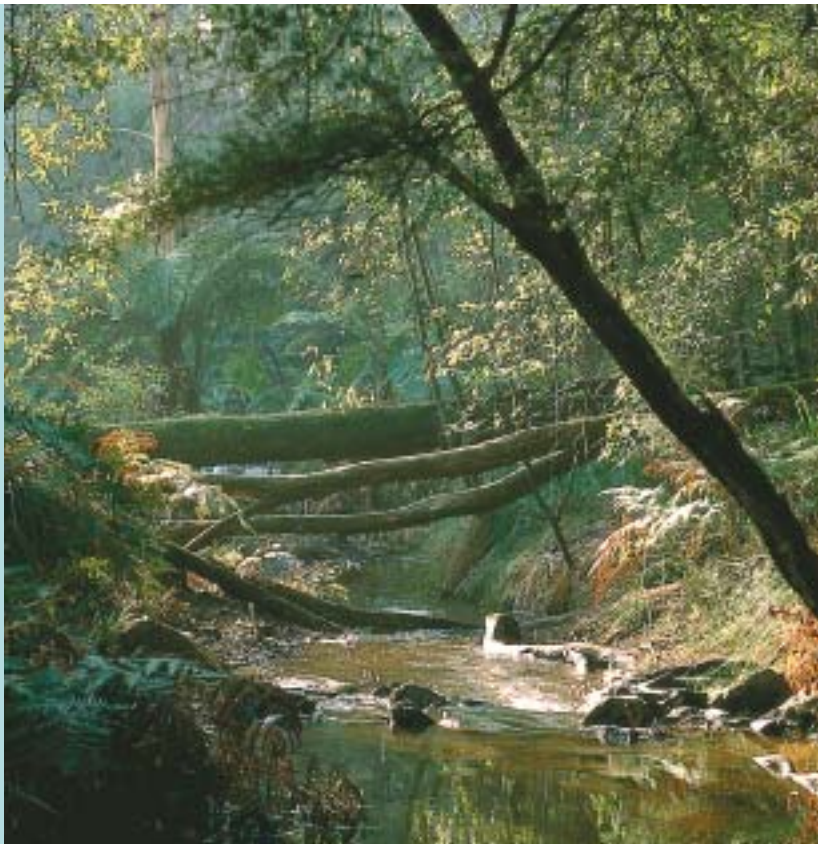
The study is examining how removal of willow, pittosporum and hawthorn trees would impact on the owls. These pest plants have contributed to localised flooding and reduced habitat in the creek, especially for platypus.

However, some of the willows have been identified as favoured roosting habitat during summer for the powerful owls.

Under a management plan for the area, indigenous species with dense foliage will be included in replanting scheduled for Spring 2003 to provide roosting alternatives for the owls.

The powerful owl is the largest owl species in Australia, with a wingspan of about 1.5 metres. Fewer than 500 pairs are known to exist in Victoria.

Right: Olinda Creek at Mt Evelyn Reserve.



Stream Frontage Management Program

Year	Plants	Fencing (kilometres)
1996-97	35,146	15.4
1997-98	64,595	29.2
1998-99	39,550	41.4
1999-00	60,500	59.2
2000-01	48,820	44.9
2001-02	112,125	100
2002-03	122,680	78.4
Total	**483,416**	**368.5**

Corridors of Green

Twelve councils received funding for 27 separate waterway sites in the fourth round of Melbourne Water's Corridors of Green funding. The program provided $193,500 for streamside vegetation rehabilitation works along 22 waterways, with almost 64,000 plants established. United Energy supported the project in its operating area in the south-eastern suburbs, funding another two projects to the value of $40,000 in which 10,000 plants were established.

Improving stormwater quality

The major pollutants carried by stormwater into Melbourne's waterways and Port Phillip Bay are nitrogen and litter.

Nitrogen is a widely distributed natural element in the atmosphere and water. In excessive amounts or in certain compounds, it causes vigorous growth of plants, including algae, leading to depletion of oxygen levels in water.

Sources of nitrogen pollutants include combustion of fossil fuels, animal droppings, fertilisers, industrial cleaning operations and plant debris. More than 90 per cent of the nitrogen carried in Melbourne's urban run-off settles from the air onto roads, urban surfaces, gardens and farms and is then washed into Port Phillip Bay.

Melbourne Water is taking action to control and treat stormwater before it reaches our waterways and bays. We aim to reduce nitrogen inputs to Port Phillip Bay from the stormwater system by 100 tonnes a year by 2010.

Using wetlands to treat stormwater

Melbourne Water aims to reduce nitrogen entering Port Phillip Bay by an additional average 10 tonnes each year by constructing wetlands that capture and treat stormwater. We plan to design and construct two to three wetlands each year over the next 10 years. Five years is needed to take each wetland from design through to functional maturity.

During 2002/03, we completed the construction of four wetlands ready for planting at the following sites:

- Police Road Retarding Basin at Rowville, which will remove five tonnes of nitrogen a year from the Corhanwarrabul Creek that runs through Scoresby.
- The Jacana wetlands at Glenroy, which will capture four and a half tonnes of nitrogen a year from the Widford Street Main Drain that ultimately enters the Moonee Ponds Creek system.
- The Golf Links Road wetland in Narre Warren, which incorporates an innovative solar-powered gate to control inflow from the Berwick Township Drain. It will remove four and a half tonnes of nitrogen a year.
- The Narre Warren Township Drain wetland, which will remove half a tonne of nitrogen a year.

The Dandenong Creek wetlands are now fully operational after planting during the year.

In October 2002, Melbourne Water, in conjunction with the Co-operative Research Centre for Catchment Hydrology, began one of the most comprehensive wetland monitoring programs undertaken in Australia. Two established wetlands will be studied during six significant storms to monitor their effectiveness in nitrogen and sediment removal. The results of the program will be used in the design of future wetlands.

Wetlands and rain gardens in urban developments

Melbourne Water is participating in the design of a wetland west of Royal Park to treat and store stormwater from the proposed Commonwealth Games Athletes Village. A greywater treatment facility is planned to link to the wetland, allowing the use of recycled water in the Games Village and to irrigate Royal Park Golf Course.

We are working with urban housing developers on several projects to encourage the adoption of industry best practice to manage and treat stormwater, protecting waterways and bays.

The developers of the Point Cook Gardens Estate are constructing a retarding basin and wetland on Cheetham Creek as part of Melbourne Water's Cheetham Creek drainage scheme. The works will mitigate the increase in run-off caused by the development of the catchment and remove pollutants and nutrients before the water reaches the downstream Sanctuary Lakes system. The innovative design protects the freshwater wetland from the saline groundwater through a series of clay-lined freshwater wetland zones laid over trenches of porous gravel.

Melbourne Water was represented on an expert panel advising the Victorian Urban Land Development Authority (VicUrban) on the Aurora development, 20 kilometres north of Melbourne. Aurora seeks to achieve the highest possible level of sustainability for urban development, especially water use.

The detailed planning process for the first stages of development began in May 2003. Melbourne Water is working with VicUrban and the City of Whittlesea to treat stormwater within neighbourhoods through rain gardens in new allotments and swales in the streets. Rain gardens work like very small-scale wetlands, retarding flows and removing sediment from stormwater before it flows into conventional stormwater pipes. Wetlands will provide water treatment and recycling at the Aurora development, which will eventually host 8000 homes.

The developers of the Arndell Park estate at Werribee have constructed swales as part of the design to improve the quality of stormwater entering nearby Skeleton Creek. Plans include rain gardens as part of court designs and a wetland along the edge of Skeleton Creek.

Wetlands mop up road run-off

Melbourne Water worked closely with VicRoads throughout the year to improve the long-term quality of run-off from major new road projects.

The Hallam Bypass, opened in July 2003, was the first major VicRoads construction project to incorporate new design principles that replace traditional roadside concrete channels with innovative water treatment.

Grass filtration in swales or biofiltration trenches provide initial water treatment for some heavy metals, oils and sediments carried in run-off. Water is then directed through sedimentation ponds into purpose-built wetlands before discharge into waterways.

The quality of water from the wetlands meets best practice environmental management guidelines, formulated in 1999 in partnership between Melbourne Water, EPA Victoria, the Municipal Association of Victoria and Government departments.

Automatic sampling in Gardiners Creek

Melbourne Water installed an automatic sampler in Gardiners Creek to test the nitrogen, phosphorus and heavy metal load in high stormwater flows as part of a storm event monitoring project. The Gardiners Creek catchment is extensively paved and includes a section of the Monash Freeway. Consequently, stormwater flows rise and fall very quickly and are most reliably sampled by machine.

The data collected will help us understand the stormwater toxicants and their sources during low and high flows in this highly urbanised catchment. It will contribute to a better understanding of the impact of storms on Port Phillip Bay nitrogen levels.

Measuring and investigating faecal contamination

EPA Victoria monitors the waters of Port Phillip Bay to determine health risks for bathers. New guidelines, released by the World Health Organization (WHO) and trialled by EPA Victoria, assess the risk associated with bathing waters using two attributes: the density of the indictor micro-organism enterococci in the water, and the potential for faecal contamination of the surrounding catchment.

In late 2002, Melbourne Water led a project for the Water Services Association of Australia (WSAA) to enhance the WHO guidelines, providing greater detail for catchment inspection. The suggested approach provides a rating category for a range of faecal sources and takes into account varying weather conditions to determine risk of contamination, a discrimination not made in the WHO guidelines.

The expanded guidelines, published by WSAA in May 2003, are likely to be adopted by the National Health and Medical Research Council for national use by Australian regulatory bodies.

Throughout the year we continued to work with EPA Victoria, seeking specific sources of human faecal contamination of beaches via drains and waterways. The research investigates priority stormwater drains by sampling at outlets then systematically working upstream into branch networks. The program detected and eliminated a significant source of human faeces in the Prahran Main Drain.

Sewage spills

Melbourne Water must manage the sewage in transfer pipes so that we experience no spills under normal rainfall conditions. Under very heavy rain, which would occur once in every five years, some sewage may escape through managed and controlled conditions. During the year no sewage spills to the environment occurred. This result was contributed to by low sewage flows as a result of the drought.

Year	Number of spills
1996/97	36
1997/98	31
1998/99	3
1999/00	6
2000/01	8
2001/02	0
2002/03	0

Council plan for stormwater quality

During 2002/03, Melbourne Water completed a program to help councils prepare stormwater management plans. All but one of the 32 metropolitan councils that participated now have plans completed or at draft stage. The final plan is being prepared independently by the council.

The plans identify key strategic actions to reduce the amount of gross pollutants entering Port Phillip Bay.

Melbourne Water is prioritising all the councils' plans to determine the projects to be undertaken in a $1.8 million program over the next three years.

Litter reduction

Litter traps form an essential part of Melbourne Water's infrastructure plans in stormwater management. Stormwater carries a large quantity of litter from Melbourne's streets and, without intervention, much of it would be deposited in Port Phillip Bay. There it poses choking or entangling hazards for marine life and is generally non-biodegradable.

A litter trap installed in Moonee Ponds Creek at Kensington in June 2003, will catch an estimated 60 tonnes of litter a year. The innovative design has a low weir to divert storm flows into the litter trap for easy collection. A series of nets allow water to pass through while retaining the litter and debris. The $320,000 project was part of the wider Moonee Ponds Creek – Keep it Clean project, co-funded by Environment Australia.

Melbourne Water is also installing traps in the Preston Main Drain and Karkarook Park in Moorabbin, both due for completion in 2003.

How healthy are our waterways?

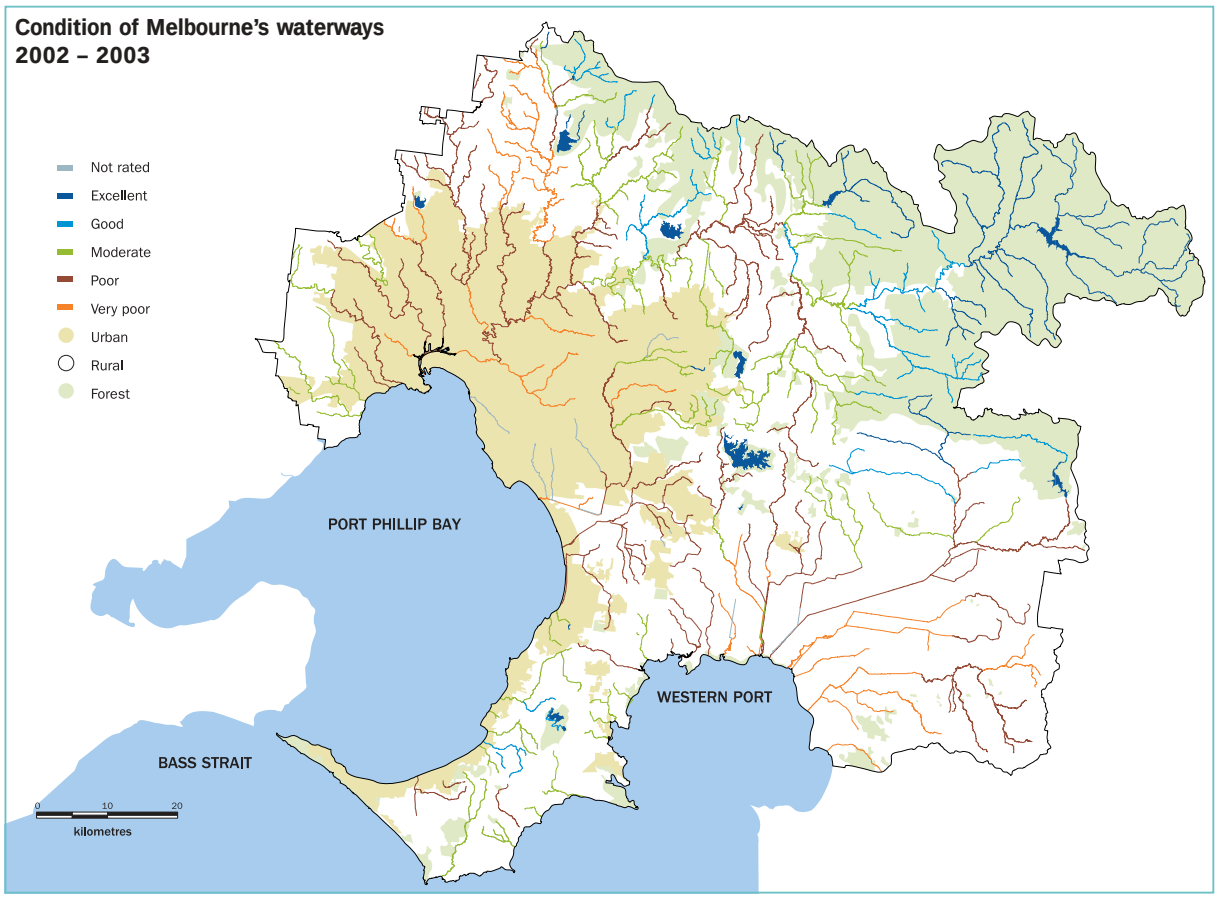
Each year Melbourne Water undertakes extensive monitoring of our stream water. The various programs measure pollutant and nutrient levels, water quality and aquatic life. The data measures our progress in improving waterway health and highlights problem areas.

Index of Stream Condition

The Index of Stream Condition provides an integrated measure of the environmental condition of streams. It amalgamates information on the naturalness of the flow regime, water quality, condition of the channel and its banks and the invertebrate communities living in the stream.

The index contains five sub-indices and summarises the extent of change from natural or ideal conditions for each of these:

- physical form (stream bank and bed condition, presence of and access to physical habitat, artificial barriers to fish migration)
- streamside zone (quality and quantity of streamside vegetation and condition of billabongs)
- hydrology (flow volume and seasonality of flow)
- water quality (key water quality indicators)
- aquatic life (diversity of macro invertebrates).



Each sub-index is scored out of 10, so that the overall score for the index will vary between zero and 50. Stream condition is then allocated to one of five classifications: excellent, good, moderate, poor or very poor.

The Department of Sustainability and Environment developed the index to provide a high-level reporting process on the state of Victorian streams. Melbourne Water modified the index to incorporate relevant data and methods for the urbanised context of some of our catchments. This year, new data has been incorporated into the aquatic life sub-index, the water quality sub-index and 230 sites have been re-assessed in the Western Port and Yarra catchments for streamside zone and physical form sub-indices.

Index assessments along waterways we manage show 16 per cent of streams are in excellent condition, 12 per cent in good condition, 25 per cent in moderate condition, 35 per cent in poor condition and 12 per cent in very poor condition.

The majority of waterways in excellent or good condition are pristine waterways in closed water supply catchments or forested areas. Densely populated urban catchments show mostly poor and very poor condition.

Alerting EPA Victoria to problem spots

Alert levels are generally well above water quality objectives specified in relevant State environment policies, representing instances of particularly undesirable water quality. Melbourne Water is required to report all alert-level exceedances that occur within our operating area to EPA Victoria. The notifications identify sites that often experience poor water quality and also provide a mechanism for locating and mitigating chronic pollution problems.

During the 2002/03 year, there were a total of 343 alert level exceedances reported to EPA Victoria, or approximately two per cent of the 18,000 analyses performed. Alerts were more prevalent over spring and summer than during autumn and winter.

The key problem sites for the year included:

- Watsons Creek at Dandenong-Hastings Road, Somerville, probably caused by fertiliser run-off from market gardens upstream.
- Merri Creek at Summerhill Road, mostly during summer when creek flows were minimal and pools became stagnant.
- Brushy Creek at Lower Homestead Road bridge, Wonga Park, showed elevated nutrient levels from the wastewater treatment plant upstream.
- Olinda Creek at Macintyre Lane, Coldstream, also has a wastewater treatment plant upstream.
- Mile Creek downstream of Cheltenham Road showed elevated levels of zinc, probably from local industry.

Year	Alert level exceedances
1998/99	462
1999/00	492
2000/01	511
2001/02	246
2002/03	343

Biological Monitoring Program

Aquatic macro invertebrates provide an indication of overall stream health and measurement of ecosystem condition.

The results of Melbourne Water's 2001/02 Biological Monitoring Program, released in July 2002, showed Upper Yarra tributaries in generally good stream health. However, the waterways around Gardiners Creek were poor, reflecting the heavily urbanised catchment. Mornington Peninsula sites generally showed moderate stream health, with reduced stream flows, lack of riffles to oxygenate the water, and inputs of polluted road run-off identified as contributing to lower counts of aquatic macro invertebrates. Monitoring sites in the Dandenong catchment showed varying stream health, with stream degradation attributed to increased stormwater volumes.

Waterway catchments surveyed during 2002/03 include the Maribyrnong River and Ararat Creek, Yallock Creek and the northern lowlands in the Western Port region. Aquatic macro invertebrates indicated that stream health was generally fair to poor throughout the Maribyrnong River catchment. Urban and agricultural pressures are the main factors degrading stream health.

Stream health within the Yallock Creek catchment was generally fair to poor, with slightly better ratings in the more natural reaches of Musk and King Parrot Creeks. Similarly, the artificial agricultural drains within the northern lowlands of Western Port showed poor ratings. Sites in the Ararat Creek catchment were generally in good condition upstream of Princes Freeway and fair to poor where the stream channel is highly modified through the former Koo Wee Rup swamp.

Waterways studied to help plan their future

Melbourne Water carried out water quality studies for Eumemmerring Creek, lower Yarra River, Maribyrnong River and upper Dandenong Creek during the year. Information from these studies will be used in Melbourne Water's waterway rehabilitation, stormwater management and streamflow management plans.

Results from the lower Yarra River survey suggest that water quality in the estuary is generally in fair condition, and that the tidal influence helps improve water quality during low flows. During storms, discharges from stormwater drains were found to be mostly of poor quality, although they seemed to have little impact after dilution in the Yarra River. At least two drains require further investigation to determine the source of elevated nutrient levels.

Water quality within the Eumemmerring Creek catchment was found to be variable, probably partly due to groundwater discharges to streams and persisting low flows during the drought. Elevated nutrients were of greatest concern, particularly within the Eastern Contour Drain and Troups Creek West.

The analysis of water quality trends over the past 30 years within the Dandenong Valley indicated the general improvement of water quality, especially *E. coli* and nutrient levels. Reasons for improvements include sewering of some suburbs, ceasing industrial discharges to waterways, and closing local sewage treatment plants.

Melbourne Water compiled an integrated stream health report for Merri Creek to help plan its rehabilitation. The report included information on water quality, aquatic macro invertebrates, fish, platypus, physical stream condition, riparian vegetation and sediment quality.

Algal management

Low waterway flows and hot days combined over summer to provide ideal conditions for algal blooms in waterways.

The most significant was in the Maribyrnong River between North Keilor and Avondale Heights during March 2003, and was the first recorded blue-green algal bloom in that river. Melbourne Water placed warning signs, and notified diverters, the Department of Sustainability and Environment, the Department of Human Services, EPA Victoria, and local councils. No public health issues arose from the bloom and it caused no damage to the ecosystem.

Smaller blue-green algal blooms appeared in the Quiet Lakes at Patterson Lakes, the Dingley Retarding Basin, Mill Park Lake, Berwick Springs and Taylors Lake. All cleared relatively quickly except for the Quiet Lakes which remain a problem. However we have had some success in cleaning the algae using management techniques.

Water quality monitoring is carried out at Dandenong Creek.

Waterway water quality monitoring

Detailed tables of water quality in Melbourne's waterways appear on pages 44–47 of this report.

Research into waterway health and aquatic life

Melbourne Water undertakes a wide variety of research projects to help improve waterway quality and management.

Many of Melbourne's streams and wetlands are contaminated with heavy metals, petroleum hydrocarbons, pesticides and other toxicants. The pollutants are found in sediments and waters, and vary with degrees of urbanisation and local geology.

Nutrients and suspended solids flushed into our waterways have reduced in recent decades, but stormwater is now the most significant source of pollution, particularly heavy metals and hydrocarbons. Sediments in many streams and wetlands are now toxic to indigenous macro invertebrates.

The health of urban aquatic ecosystems is also affected by other factors such as water quality and riparian vegetation, making it difficult to identify the effects of toxicants alone. Melbourne Water's research highlights the need for strategies to reduce toxicants entering our waterways and for treatment methods within the waterways.

Research conducted during 2002/03 included the following projects:

Health of Moonee Ponds Creek

The first comprehensive study of the large, aquatic invertebrates in the Moonee Ponds and Yuroke Creeks concluded that the system would benefit from improvements to the quality of stormwater run-off. The associated catchment is universally degraded with high concentrations of heavy metals in sediments, likely to originate from industrial areas including Melbourne Airport.

Urbanisation and stream ecology

In June 2003, the Water Studies Centre at Monash University completed a three-year research program for Melbourne Water into the effects of urbanisation on stream ecology.

The efficiency of urban drainage systems appears to be the most important factor in the degradation of aquatic life in urban streams. Slowing the flow of stormwater, for example using grasses or reeds, improves water quality.

The research findings are influencing Melbourne Water's water design requirements for urban developers.

The subject will be explored further at a symposium on urbanisation and stream ecology to be held in December 2003. Scientists from Melbourne Water, the Co-operative Research Centre for Freshwater Ecology and the Co-operative Research Centre for Catchment Hydrology are organising the event to examine the value and rehabilitation potential of streams flowing through urbanised landscapes.

Weed control

The Keith Turnbull Research Institute, a partner in the Co-operative Research Centre for Australian Weed Management, continued research for Melbourne Water throughout the year. The institute is assessing risks of new and emerging weeds in our waterways, recommending herbicides suitable for riparian environments, and developing methods to selectively kill weeds.

Cleaning up stormwater

The Co-operative Research Centre for Catchment Hydrology, co-funded by Melbourne Water, is researching the effectiveness of trenches in extracting sediments and nutrients, especially nitrogen, from stormwater. The research began in early 2003 and will continue for two to three years.

Modelling pollutants in stormwater

A recently released planning tool for stormwater management, the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), uses generic pollutant load estimates to plan stormwater management systems (for example where to place treatment measures in drains). Melbourne Water is creating pollutant concentration estimates based on Victoria's land use and climate for inclusion in the MUSIC software to provide better modelling of drainage systems.

Mosquito fish in urban streams and artificial wetlands

Mosquito fish are introduced pests that feed on native tadpoles, dominating and ultimately eliminating small native fish. In early 2003, Melbourne Water and the Centre for Environmental Stress and Adaptation Research investigated the movement of the pests in urban streams and artificial wetlands.

The research, using DNA markers to track populations, provided an understanding of the origins of the mosquito fish colonising newly constructed wetlands. It revealed that the fish arrived through (probably accidental) human intervention and will help Melbourne Water prevent the pests' introduction into new wetlands.

Effectiveness of wetlands on aquatic life

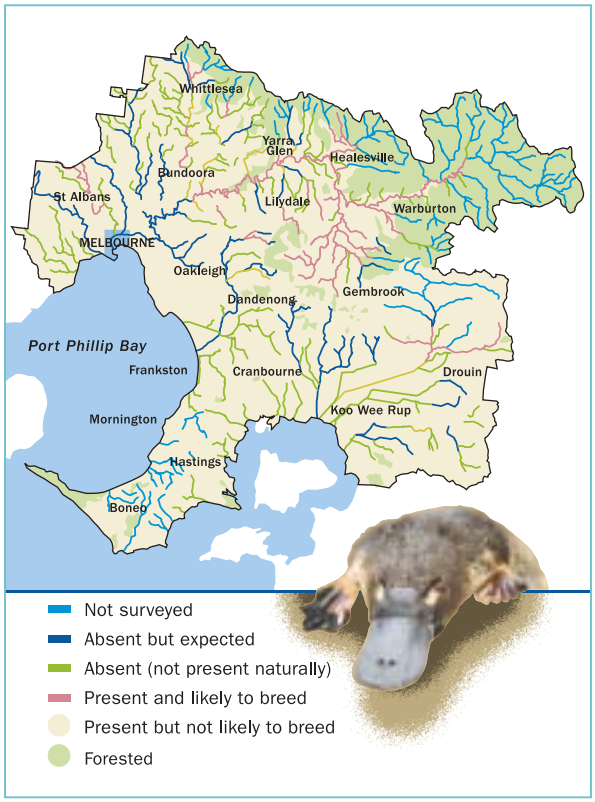
In early 2003, Monash University began a study for Melbourne Water to determine the benefits of wetlands to downstream aquatic life, particularly macro invertebrates. Due for completion at the end of 2004, the study is being conducted in four wetlands of contrasting size and location.

Platypus populations

During the year Melbourne Water continued to fund platypus research in Melbourne's waterways.

Surveys of populations throughout greater Melbourne indicated that fewer juvenile platypus were present during summer than in previous years.

A study of Running Creek in the Arthurs Creek catchment highlighted the benefits of removing willows and replacing them with indigenous trees and shrubs. The rehabilitation of the creek restored the habitat for macro invertebrates, a food source for platypus. Despite the drought-induced lack of flow, platypus remain in the creek's pools.



Frog census

Volunteers for the Amphibian Research Centre undertook the Melbourne Water Frog Census across Melbourne's waterways, providing us with a good indicator of stream health.

The spring census found the rare Growling Grass Frog in five locations, including two new sites in Nar Nar Goon. The Peron's Tree Frog was found for the first time in Belgrave and Pearcedale. Volunteers also reported two occurrences of the Eastern Dwarf Tree Frog, a native of coastal New South Wales and Queensland believed to have been transported south in fruit boxes.

Tackling the toxicants

Industrial estates housing small to medium-size businesses are the major source of heavy metal pollution in Melbourne's northern suburban creeks. Research undertaken by Melbourne Water indicates that poor practice by businesses is the probable cause of pollution washing from these industrial areas into Melbourne's waterways.

Researchers surveyed 15 drains every month for 10 months, measuring heavy metals and other water quality parameters and comparing weekday levels with Sundays. Many drains frequently contained oil slicks and paint scum, and some were polluted by heavy metals in concentrations rarely seen in other drains.

Melbourne Water is working with EPA Victoria to develop ways of better managing the pollution and reducing its impacts on waterways. The research enabled some sources to be pinpointed then followed up by EPA Victoria.

Melbourne Water is also developing methods of treating polluted stormwater before it reaches waterways. In June 2003, we began construction of a pollution trap in a Campbellfield drain. In collaboration with the CSIRO we will compare the effectiveness of different media in the trap, such as moss, sand and mulch, to capture heavy metals.

Managing environmental flows

Environmental flow refers to the amount of water required to ensure waterway health. It can be managed by releasing water into the waterway from reservoirs and by controlling the extraction of water for irrigators or urban dwellers.

Melbourne Water is responsible for managing extraction of water from the Yarra, Stony, Kororoit, Laverton, Skeleton and lower Maribyrnong catchments. We issue licences to customers, known as diverters, which enable them to take water for their farms, businesses and homes.

The total water in a catchment and how it is to be shared by water users while protecting environmental flows is the subject of a series of Streamflow Management Plans being devised by Melbourne Water.

During the year, we submitted Victoria's first two Streamflow Management Plans created under the revised Water Act – for Hoddles Creek and Diamond Creek – to the Minister for Water for sign-off.

We also progressed plans for the Plenty River, Olinda Creek, Stringybark Creek, and the Pauls, Steels and Dixon Creeks catchment.

The Yarra River's year

While the continuing drought placed pressure on the Yarra River, its environmental health was preserved during the year.

The minimum flow in the Yarra River is set under State Environment Protection Policy to ensure its environmental health is balanced with the water requirements of licensed diverters. Melbourne Water is required to ensure, to the extent that it is practicable, that the Yarra River flows at a rate of 245 million litres a day, measured at Warrandyte. When flows at Warrandyte fall below this level Melbourne Water applies progressively tighter restrictions on diverters.

In November 2002, Melbourne Water introduced Level One restrictions for diverters licensed to extract water from the Yarra River and its catchment. These restrictions rose to Level Two in early December and to Level Three in January. In late May 2003, the restriction eased to Level Two.

During the unprecedented drought conditions of January to March 2003, EPA Victoria agreed that Melbourne Water could temporarily allow a minimum flow of 120 million litres a day under a risk-based management approach.

We were required to closely monitor for risks such as algal blooms and low oxygen levels, and release short flushes of water from the Upper Yarra and O'Shannassy Reservoirs when flows fell below 150 million litres a day. The lowest river flow of 138 million litres a day was reached on 16 February 2003.

We contributed to the flow by releasing 240 million litres during February and March 2003. Flows recovered, however they are yet to experience sustained improvement.

Flow in the Yarra River again dropped below the required 245 million litres a day on 19 April 2003, however Melbourne Water failed to cease pumping water to Sugarloaf Reservoir. This breach of our obligations under the State Environment Protection Policy resulted from low-flow alarms remaining out of operation since a system upgrade. The river was dropping rapidly at the time and recorded an average flow of 270 million litres a day on 18 April, falling to 216 million litres a day on 19 April.

The low-flow alarm has since been reinstated and we installed a new gauge immediately downstream from the Yering pumping station.

Managing the Maribyrnong and Thomson Rivers

The harvesting of bulk water from the Maribyrnong and Thomson Rivers for domestic, irrigation or environmental purposes is managed by the Department of Sustainability and Environment through the issue of bulk entitlements to Melbourne Water.

Through its bulk entitlement agreement, Melbourne Water must maintain a flow in the Maribyrnong River at Keilor, of either five million litres a day or the natural flow, whichever is the lesser. We have rights to 9.5 per cent of the total capacity of Rosslynne Reservoir. We administer its release into the river and manage extractions from the river by 47 licensed diverters. We also issued one additional winter-fill licence of four million litres in accordance with the 2002/03 bulk entitlement.

Due to drought conditions, we restricted diverters to 15 per cent of their allocation in November 2002, and then in December released the last of our water earmarked for diverters. Consequently, diverters were to cease pumping three weeks later. There were no natural inflows at the time and the river stopped flowing at Keilor.

Diverters who draw from privately built weirs on the river requested that pumping continue. As the wording of the bulk entitlement was not considered sufficiently robust to reject this request, Melbourne Water allowed limited pumping from isolated pools for one week pending an investigation of impacts. The Arthur Rylah Institute, commissioned by Melbourne Water, reported that continued pumping endangered aquatic fauna and posed an unacceptable risk to water quality. We applied a pumping ban on 24 January 2003, enforced until 1 May 2003 when conditions improved.

Opinion was divided about Melbourne Water's actions at that time. We have since clarified the wording of the bulk entitlement in the Water Resource Management Plan for the Maribyrnong River. It is now stated clearly that pumping is not permitted from isolated or remnant pools for purposes other than essential domestic and stock during periods when water is not being released from the Rosslynne Reservoir.

The Maribyrnong bulk entitlement contains several conditions, including the requirement to develop a water resource management plan and supporting operating procedures. Melbourne Water and Southern Rural Water jointly developed the Maribyrnong Water Resource Management Plan and in June 2003, we submitted it to the Minister for Water for approval.

Entitlement to water in Rosslynne Reservoir as at 30 June 2003

	Volume (million litres)
Releases made from the reservoir to supply our licence customers	166
Share of storage capacity	-1%*
Inflows attributed to Melbourne Water for the year	55
Transfers and operating losses within the system	69
Melbourne Water releases to meet environmental flow requirements	80
Water taken by licence holders from the Maribyrnong River to satisfy entitlements	284
Transfer of licences	68

Excludes domestic and stock licences, which are currently unmetered.
* With the agreement from other bulk entitlement holders, Melbourne Water overdrew its share of reservoir water.

Melbourne Water releases water from the Thomson Reservoir to supply the people of Melbourne and meet the environmental needs of the Thomson River.

According to the criteria listed in the State Government's Victorian River Health Strategy the Thomson River is stressed. A Ministerial taskforce, including a Melbourne Water representative, is overseeing studies to determine environmentally sustainable flows and the implications of any increases in environmental flows on the security of supply. The taskforce will provide a final report to the Minister by September 2003.

The following table details how Melbourne Water managed our bulk entitlement from the Thomson Reservoir this year.

Entitlement to water in Thomson Reservoir as at 30 June 2003

	Volume (million litres)
Releases made from the reservoir to supply our licence customers	166
Water taken by Melbourne Water to supply Melbourne	267,765
Water released for flood control	0
Water released for hydro-electricity generation*	0
Melbourne Water releases to meet environmental flow requirements	49,990
Melbourne Water's share of storage	373,427
Inflows attributed to Melbourne Water for the year	120,903

* Environmental flow and irrigation releases were made via the Thomson hydro-electricity station. However, no releases were made specifically for hydro-electricity generation.

Improving the health of our bays

Port Phillip Bay

The environmental values of Port Phillip Bay have been significantly altered since European settlement. Urbanisation, farming, and a growing population place pressure on the bay, which is an essential environmental, economic and recreational asset for Victorians.

A four-year CSIRO study sponsored by Melbourne Water and completed in 1996, recommended a reduction in nitrogen entering the bay of 1000 tonnes a year. The Port Phillip Bay Environmental Management Plan, completed in early 2002 by the Department of Sustainability and Environment with contributions from Melbourne Water and EPA Victoria, aims to achieve the recommended 1000-tonne per year reduction.

Under the plan, Melbourne Water will achieve a 500-tonne per year reduction from the Western Treatment Plant by 2006 and another 100-tonne reduction from the stormwater system by 2010. Our efforts to achieve this reduction are detailed in this report under "The Western Treatment Plant" and "Improving stormwater quality".

Western Port

The continued environmental health of Western Port depends to a large extent on the flows into it from surrounding waterways managed by Melbourne Water. The bay is environmentally significant and hosts a range of recreational activities.

Melbourne Water aims to improve our understanding of sediments and other inflows into Western Port so we can minimise the environmental impact of the flows, particularly on the sensitive seagrass beds.

Three-year sediment study completed

A three-year study by the CSIRO for Melbourne Water into the major historical and contemporary sources of sediment and sediment-bound nutrients in Western Port was completed during the year.

The project consisted of three phases:

- Sediment transport and accumulation rates
- Modelling erosion and sediment dynamics within the catchment
- Tracing primary sources of sediment.

Large scale clearing and draining of the Koo Wee Rup swamp since European settlement caused the catchment to erode into the bay. Presently, the major sources of fine sediment are erosion of the Bunyip and Lang Lang River systems, and erosion of clay banks near the Lang Lang jetty.

Tides, winds and waves transport sediment around the bay, and maintain the suspension of fine particles in the waters. Sediment flushed into the northern region of the bay is transported to the east and south where it may affect water quality and seagrass habitat. The report recommends addressing the problems through stabilising and rehabilitating waterways.

Environmental study continues

During the year, Melbourne Water continued its commitment to a $100,000 environmental study of Western Port. The study will be co-ordinated by a team of representatives from the Department of Sustainability and Environment, EPA Victoria and Melbourne Water.

It aims to improve understanding of the biological, chemical and physical processes in Western Port and to develop sustainable management practices in the surrounding catchments and Western Port itself.

Melbourne Water is committed to improving the health and amenity of Port Phillip Bay.

OUR ENVIRONMENTAL PERFORMANCE

Eastern Treatment Plant inputs and discharges

Melbourne Water complied with all but one obligation under EPA Victoria's discharge licence for the Eastern Treatment Plant. Non-compliance with an odour obligation was noted in three monitoring rounds.

Raw sewage monitoring

The quality of raw sewage entering the Eastern Treatment Plant is described in the following table.

Parameter (units)	Median	90th percentile	Maximum
BOD_5 (mg/L)	310	487	530
Suspended solids (mg/L)	390	548	740
pH (pH units)	6.9	7.2	7.4
Ammonia as nitrogen (mg/L)	35	39	42
Total combined nitrogen (mg/L)	66	86.8	95
Total phosphorus (mg/L)	17	21	24
Anionic surfactants MBAS (mg/L)	4.4	7.2	12
Cadmium (mg/L)	0.0008	0.00164	0.0028
Chromium (mg/L)	0.046	0.122	0.18
Copper (mg/L)	0.14	0.19	0.2
Lead (mg/L)	0.021	0.0444	0.063
Mercury (mg/L)	0.00009	0.00024	0.0004
Phenol (µg/L)	4	38.4	75
Toluene (µg/L)	2	4.8	6
Benzene (µg/L)	0.5[1]	0.5[1]	3[1]
PAHs total (µg/L)	4[1,2]	4[1,2]	4[1,2]

[1] These results were less than the detection limit and were taken as half the given value i.e. <2 = 1.

[2] Total PAHs are calculated using the sum of the following PAHs: (acenapthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo (k) fluoranthene, 1,12-benzoperylene, benzo (a) pyrene, chrysene, dibenzo (a.h) anthracene, fluorene and indeno (1.2.3-cd) pyrene. All results were less than the detection limit and were calculated at half the given value i.e. <2 = 1).

Discharge to water

The following table outlines the results of our sampling program at the Truemans Road sample point immediately before effluent is discharged to Bass Strait at Boags Rocks. BOD^5 is not a compliance parameter but we sample this parameter for management purposes.

Parameter (units)	Median		90th percentile		Maximum	
	Limit	Result	Limit	Result	Limit	Result
BOD^5 (mg/L)	NS	25	NS	40		54
$CBOD^5$ (mg/L)	20	6	40	10		31
Suspended Solids (mg/L)	30	9	60	18		65
pH (pH units)	7.2			7	6–9	6.6–7.5
Ammonia as nitrogen (mg/L)	30	19		26	40	31
Total combined nitrogen (mg/L)		27		37		42
Total phosphorus (mg/L)		7.5	15	9.2		10
Anionic surfactants (mg/L)	0.4	0.2	0.7	0.4		1.2
Cadmium (mg/L)		0.0001[1]	0.005	0.0001[1]	0.01	0.0003[1]
Chromium (mg/L)		0.006	0.075	0.008	0.15	0.021
Copper (mg/L)		0.014	0.05	0.027	0.1	0.05
Lead (mg/L)		0.002	0.05	0.004	0.1	0.006
Mercury (mg/L)		0.000025[1]	0.00050	0.00005[1]	0.001	0.0001[1]
Phenol (µg/L)		0.5[1]		1[1]	100	1[1]
Toluene (µg/L)		0.5[1]		0.5[1]	50	0.5[1]
Benzene (µg/L)		0.5[1]		0.5[1]	25	1[1]
PAHs total (µg/L)		4[1,2]		4[1,2]	15	4[1,2]
Flow (ML/day)[3]	540	418		445	770	471
Total residual chlorine (mg/L)[4]		0.07		0.11	1.0	0.17
E. coli (org/100mL)	200	14	1000	78		190
Dissolved oxygen (mg/L)	7			7.4	>6.0	6.1–9.5

Notes to Table:

[1] All results found to be less than the detection limits were taken as half the given value i.e. <8 = 4.

[2] Total PAHs are calculated using the sum of the following PAH's: (acenapthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo (k) fluoranthene, 1,12-benzoperylene, benzo (a) pyrene, chrysene, dibenzo (a.h) anthracene, fluorene and indeno (1.2.3-cd) pyrene. All results were less than the detection limit and were calculated at half the given value i.e. <2 = 1).

[3] Outfall flow data corrected for median daily internal plant usage. The flow data is measured at the Eastern Treatment Plant.

[4] Based on 50 samples only due to an industrial dispute limiting access to equipment.

Discharge to land

The following results detail the quality of effluent discharged to land at the Eastern Treatment Plant (for irrigation purposes) as sampled from the final effluent sample point and the treatment plant reuse sample point from 1 July 2002 to 30 June 2003.

Parameter	Unit	Median	90th percentile
E. coli [1]	Org/100mL	33	1140
Electrical conductivity[2]	µS/cm	970	1020
BOD_5[2]	mg/L	28	38
$CBOD_5$[2]	mg/L	6	10

[1] Sample taken from the reuse sample point

[2] Sample taken from the final effluent sample point

Bacteriological monitoring – beach samples

Samples of receiving waters were taken throughout the year at six locations along the Gunnamatta and St Andrews beaches as detailed below:

1. At the first bluff east of the discharge point
2. At Gunnamatta West beach opposite the amenities block
3. At Gunnamatta West beach opposite the Surf Life Saving Club
4. At Gunnamatta East beach approximately 350 metres east of sample point number two
5. At Le Lievres beach 110 metres west of the discharge point
6. Rye back beach – main swimming area.

The results are as follows:

42-day period ending	Geometric (log) mean (org/100mL)[1] SEPP (Waters of Victoria) objective: 200 org/100mL					
	Beach 1	Beach 2	Beach 3	Beach 4	Beach 5	Beach 6
8 August 2002	3.7	3.6	2.2	2.1	1.5	2.0
19 September 2002	1.6	1.8	1.4	1.8	1.6	1.3
28 October 2002	2.8	1.0	1.0	1.0	1.6	1.0
12 December 2002	1.8	2.2	1.5	1.3	3.4	1.7
23 January 2003	1.6	1.0	1.0	1.0	2.9	1.1
04 March 2003	1.7	1.1	1.0	1.3	3.1	1.4
16 April 2003	1.4	1.0	1.0	1.0	2.5	2.7
30 May 2003	5.7	1.7	1.0	1.0	1.5	1.3
30 June 2003	1.8	1.5	1.9	1.8	1.3	1.1

[1] Samples of zero *E. coli* were assumed to have a level of 1.0 to determine the geometric mean

42-day period ending	80th percentile (org/100mL) SEPP (Waters of Victoria) objective: 400 org/100mL					
	Beach 1	Beach 2	Beach 3	Beach 4	Beach 5	Beach 6
8 August 2002	6	2	2	4	2	4
19 September 2002	2	2	2	2	2	0
28 October 2002	2	0	0	0	2	0
12 December 2002	2	2	2	0	6	4
23 January 2003	2	0	0	0	4	0
04 March 2003	2	0	0	2	4	2
16 April 2003	2	0	0	0	6	19
30 May 2003	8	0	0	0	2	2
30 June 2003	3.6	2	5.6	5.2	2	0.4

Discharges to air

Gas emissions from one of the engines in the outfall pumping station were sampled for nitrogen oxides, carbon monoxide, sulphur dioxide, hydrogen sulphide and volatile organic compounds as required by the discharge licence. The following table contains a comparison between the test results and the licence limits.

Parameter	Maximum rate (g/min)		Maximum concentration (mg/m³)	
	Limit	Result	Limit	Result
Nitrogen oxides	500	104	2600	1311
Carbon Monoxide	300	135	2600	1713
Sulphur Dioxide	7.5	1.5	40	19
Hydrogen Sulphide	0.5	<0.04	2	<0.5
Volatile organic compounds	20	No result*	100	No result*

* From 1 January 2003, EPA Victoria changed their definition of volatile organic compounds and the manner in which they are reported. ºThe compounds must be identified and quantified individually. ºCompounds present were undecane, dodecane, tridecane, tetradecane, pentadecane and hexadecane. Quantification of these compounds will occur in September 2003.

Biological odour control facility

The biological odour control facility on Eastern Treatment Plant's Return Activated Sludge Channel operated continuously during 2002/2003. The plant was sampled three times, with results as follows:

Parameter	Licence limit	Sample result		
	(max concentration)	25 July 2002	6 November 2002	10 February 2003
Outlet odour (average odour units)	200	6,400	2,100	4,418
Outlet hydrogen sulphide (average mg/m³ NTP)	Not specified	0.53	0.04	< 0.3

The plant exceeded its parameters on each occasion. These results were analysed in accordance with the new Australian Standard. Previous results and the licence limits were determined under the old EPA Victoria B2 method. The licence requires the stack to be monitored once each year. We monitored more often than this to populate Eastern Treatment Plant's odour model to assist in odour management. There were no complaints of odour at these times and we are discussing more appropriate stack limits with EPA Victoria.

Western Treatment Plant inputs and discharges

Raw sewage monitoring 2002/03

(All data in mg/L unless otherwise indicated)

Parameter	Median	90th percentile	Maximum
Flow (ML/day)	480	504	744
BOD_5	460	580	830
Suspended Solids	370	440	650
Ammonia as nitrogen	34	37.8	49
Total nitrogen	65.1	80.1	85.1
Total phosphorus	13	15	20
Colour (Pt/Co units)	85	127	130
Anionic surfactants	5.5*	9.07*	9.2
Silicate	13.5	14	14
Electrical conductivity (µS/cm)	1,900	2,100	2,600
TDS	1,100	1,200	1,400
Cadmium	0.0005*	0.00115*	0.0012
Chromium	0.045	0.0646	0.091
Copper	0.14	0.159	0.18
Lead	0.013	0.0199	0.02
Mercury	0.00025	0.00048	0.0007
Nickel	0.0225	0.0518	0.058
Zinc	0.2	0.286	0.35
pH (pH units)	7.05	7.2	7.5
Benzene	0.00075*	0.001*	0.002
Toluene	0.0025*	0.0049*	0.006
Phenol (total)	0.445*	0.53*	0.84
Total PAHs	0.0095*	0.0169*	0.039

*At least one result was below the limit of detection, but the limit of detection value was assumed in the calculations.

Licence compliance

The following tables show the plant's compliance performance. In these tables "limit" is the required performance as stated in the licence and "result" is how the plant performed. The plant-wide limits for all discharge parameters in the licence are based on a weighted average calculated using the formula:

$$\sum \frac{\text{Flow from each discharge point multiplied by the concentration of the waste indicator}}{\text{Flow from each discharge point}}$$

There is a plant wide limit of 700 million litres a day averaged over the year. The environment improvement plan has a target of 3200 tonnes a year of nitrogen by 2005. The Western Treatment Plant complied with licence waste discharge limits for all parameters.

ANNUAL AND AVERAGE DAILY DISCHARGES FOR 2002/03

Outlet	Total flow (millions of litres)	Average daily flow (millions of litres)
15 East	76,789	210
145 West	19,199	53
Lake Borrie	7,813	21
Murtcaim	10,375	28
Total	**114,176**	**313**

Annual discharge to Port Phillip Bay

The results for 2002/2003 are shown below.

FLOW-WEIGHTED PARAMETERS (ALL DATA IN Mg/L UNLESS OTHERWISE INDICATED)

Parameter	Median		90th Percentile		Maximum	
	Limit	Result	Limit	Result	Limit	Result
CBOD	25	8*		12*		17
BOD_5		13*		32*		58
Suspended solids	100	31	130	45	89	
Ammonia as nitrogen	25	6*		12*	40	16
Total nitrogen		17		25		28
Total phosphorus		10	15	11		14
Dissolved oxygen		7.6		9.6		10.3
pH units		8.0		8.2		8.3
Colour (Pt/Co units)		81	600	138		153
Anionic surfactants (as MBAS)	0.5	0.26		0.40	1	0.45
Silicate		12		15		16
Electrical conductivity (S/cm)		2,949		3,854		4,600
Cadmium	0.005	0.0002*		0.0003*	0.01	0.0006
Chromium	0.05	0.008		0.012	0.15	0.015
Copper	0.05	0.011		0.014	0.1	0.019
Lead	0.05	0.003		0.004	0.1	0.008
Mercury	0.0005	0.00006*		0.00013*	0.001	0.00021
Nickel	0.05	0.018		0.019	0.15	0.020
Zinc	0.1	0.014		0.029	0.25	0.034
Benzene		0.001*		0.001*		0.001
Toluene		0.001*		0.001*		0.001
Total phenol		0.048*		0.048*		0.060
Total PAHs		0.004*		0.004*		0.008
E. coli (org/100mL)		988*		4,818*		30,612

*At least one result was below the limit of detection, but the limit of detection value was assumed in the calculations.

Annual nitrogen load to Port Phillip Bay

Total nitrogen discharged from the Western Treatment Plant further decreased in 2002/03. This decrease is attributed to the operation of the 55 East activated sludge plant, a significantly lower annual inflow and increased treated effluent recycling.

ANNUAL LOADS OF TOTAL NITROGEN FROM WESTERN TREATMENT PLANT

Year	2002/03	2001/02	2000/01	3 year average	Interim Environment Improvement Plan target	January 2005 Environment Improvement Plan target
Total nitrogen load (tonnes per annum)	2,160	2,661	3,740	2,853	3,500	3,200

Dioxins and furans

Melbourne Water has changed our method of reporting dioxins and furans. We traditionally reported polychlorinated dibenzo dioxins and furans (PCDD/F), as I-TEQ equivalents of 2,3,7,8 tetrochloro-dibenzo-p-dioxin. This year both the I-TEQ and WHO98-TEQ methods of reporting dioxins and furans have been included to enable a comparison of results. The WHO98-TEQ method is the most current method adopted for reporting dioxins and furans and this will be used in the 2003/2004 report.

Melbourne Water monitors polychlorinated dibenzo dioxins and furans as toxic equivalents of 2,3,7,8 tetrochloro-dibenzo-p-dioxin.

Sampling is carried out at the 15 East outlet in the month of January, 145 West outlet in April, Lake Borrie outlet in July and Murtcaim outlet in October each year. The sum of dioxins and furans present in the sample was calculated and reported excluding and including both full and half limit of detection values.

The total toxic equivalent was then calculated for each sample using the International toxic equivalency factors (I-TEQ) method and the World Health Organisations toxic equivalency factors (WHO98-TEQ) method.

INTERNATIONAL TOTAL TOXIC EQUIVALENTS AND WORLD HEALTH ORGANISATION TOTAL TOXIC EQUIVALENTS OF 2,3,7,8 TETROCHLORO-DIBENZO-P-DIOXIN (ALL RESULTS IN pg/L)

Date	July 2002	October 2002	January 2003	April 2003
Site	Lake Borrie	Murtcaim	15 East	145 West
I-TEQ – excluding LOD values	14.53	3.27	0.10	1.45
WHO 98-TEQ – excluding LOD values	16.39	2.72	0.03	0.99
I-TEQ – Including half LOD values	22.71	4.43	0.32	3.82
WHO98-TEQ – including half LOD values	24.57	5.60	0.28	3.87

Bacteriological monitoring

Melbourne Water conducts bacteriological monitoring by collecting a sample of seawater in 60 centimetre depth of water offshore from the public access points to Port Phillip Bay Beach Road and 160 South Road every seven days and analysed to determine the concentration of *E. coli* in the sample.

	Geometric mean		80th percentile	
42 day period ends	160 South Road	Beach Road	160 South Road	Beach Road
30 July 2002	3	0	4	0
10 September 2002	6	1	100	3
22 October 2002	8	1	10	2
4 December 2002	7	4	26	8
15 January 2003	13	5	24	72
25 February 2003	18	1	40	6
8 April 2003	11	6	42	24
20 May 2003	4	3	50	8

(All results are organisms per 100 millilitres of seawater)

LEGEND

BOD_5	biochemical oxygen demand at five days
$CBOD_5$	carbonaceous biochemical oxygen demand at five days
I-TEQ	international total toxic equivalent
LOD	limit of detection
MBAS as LAS	a measure of surfactants
PAHs	polycyclic aromatic hydrocarbons
pH	a measure of acidity or alkalinity
mg/L	milligrams per litre
S/cm	microsiemens per centimetre
Pt/Co	units-platinum cobalt units (a measure of colour)
g/L	micrograms per litre
org/100mL	organisms per 100 millilitres
NTP	under normal temperature and pressure
ML	millions of litres

Waterway water quality monitoring

The following map and tables summarise Melbourne Water's compliance with the State Environment Protection Policy for water quality.

Waterway water quality targets

The State Environment Protection Policy sets targets for water quality, detailed in the following table.

Catchment	Dissolved oxygen mg/L min	Turbidity NTU/FTU median	Suspended solids mg/L median	Total nitrogen mg/L max	Total phosphorus mg/L max	*E. coli* organisms /100 mL geomean	Lead mg/L max	Zinc mg/L max
Waters of Yarra catchment								
Rural eastern waterways	>6.0	<15	<20	<0.60	<0.50	<200	<0.002	<0.005
Rural western waterways	>6.0	<25	<25	<0.60	<0.05	<200	<0.002	<0.005
Yarra tributaries – southern	>6.0	<25	<25	<1.00	<0.10	<1,000	<0.002	<0.005
Yarra tributaries – northern	>6.0	<25	<25	<1.00	<0.10	<1,000	<0.002	<0.005
Urban waterways – Yarra mainstream	>6.0	<25[a]/30[b]	<25[a]/50[b]	<0.90	<0.08	<200	<0.002	<0.005
Waters of Dandenong Valley								
Dandenong Creek and major tributaries	>4.5	<25	<25	<0.75	<0.1	<1,000	<0.05	<0.25
Mordialloc and Kananook Creeks	>4.0	<20	<25	<0.75	<0.1	<1,000	<0.02	<0.04
Mordialloc and Kananook Creek tributaries	>4.5	<20*	<25	<0.75	<0.1	<1,000	<0.05	<0.25
Waters of Western Port and catchment								
Western Port waterways – peninsula	>6.0	<25*	<25*	<0.75	<0.1	<1,000	<0.01	<0.005
Western Port waterways – eastern	>6.5	<25*	<25*	<0.75	<0.1	<200	<0.01	<0.005
Waters of Victoria								
Balcombe Creek	>5.0	<25*	<25	<0.75	<0.1	<1,000	<0.01	<0.02
Maribyrnong River and tributaries	>5.0	<25*	<25	<0.75	<0.1	<1,000	<0.025	<0.05
Maribyrnong River – estuarine	>5.0	<25*	<25	<0.75	<0.1	<1,000	<0.01	<0.02

Note:
(a) Yarra mainstream upstream of Diamond Creek confluence
(b) Yarra mainstream downstream of Diamond Creek confluence
*Policy does not stipulate an objective, therefore this report has assumed a commonly accepted figure for the catchment. Policies for the south-eastern and western waterways do not stipulate an objective for total nitrogen or total phosphorus. Therefore ANZECC figures have been used (<0.75 mg/L and <0.1 mg/L respectively)

Waterway water quality monitoring results

These tables refer to the 72 waterway monitoring sites shown on the map on the previous page. All results are annual medians, except for *E. coli*, which is an annual geometric mean.

Site no.	Description	Dissolved oxygen mg/L	Turbidity NTU	Suspended solids mg/L	Total nitrogen mg/L	Total phosphorus mg/L	*E. coli* organisms /100 mL	Lead mg/L	Zinc mg/L
Yarra Catchment – rural eastern and western waterways									
17	Arthurs Creek at Burkes Bridge, Hurstbridge	6.4	11	3	0.646	0.037	88	0.003	0.010
11	Cockatoo Creek at Tschampions Road, Macclesfield	9.4	12	7	1.579	0.033	61	0.001	0.004
18	Diamond Creek at Cottles Bridge-Strathewen Road, Cottles Bridge	3.9	11	4	0.766	0.075	65	0.004	0.008
15	Stringybark Creek at Melba Highway, Yering	6.7	12	8	0.704	0.035	79	0.001	0.007
8	Little Yarra River at Corduroy Road, Yarra Junction	10.2	12	16	0.684	0.034	359	0.001	0.006
20	Merri Creek at Summerhill Road, Craigieburn	4.1	6	8	1.006	0.061	109	0.003	0.006
19	Plenty River at Plenty Gorge, South Morang	5.2	6	5	0.901	0.043	63	0.003	0.006
14	Steels Creek at Healesville Road, Yarra Glen	6.7	12	8	0.704	0.035	79	0.001	0.007
12	Wandin Yallock Creek at Killara Road, Gruyere	8.0	8	9	1.003	0.037	254	0.001	0.005
16	Watsons Creek at Henley Road, Kangaroo Ground	8.3	5	3	0.413	0.022	189	0.002	0.005
13	Watts River at Healesville-Kinglake Road, Healesville	8.1	7	5	0.696	0.041	314	0.001	0.009
10	Woori Yallock Creek at Macclesfield Road, Yellingbo	9.0	14	11	1.234	0.034	170	0.001	0.005
9	Woori Yallock Creek at Warburton Highway, Woori Yallock	8.8	17	13	1.113	0.041	119	0.001	0.005

Site no.	Description	Dissolved oxygen mg/L	Turbidity NTU	Suspended solids mg/L	Total nitrogen mg/L	Total phosphorus mg/L	*E. coli* organisms /100 mL	Lead mg/L	Zinc mg/L
Yarra Catchment – southern urban tributaries									
24	Andersons Creek at Everard Drive, Warrandyte	7.0	13	8	2.320	0.315	742	0.004	0.015
22	Brushy Creek at Lower Homestead Road, Wonga Park	6.9	12	12	6.616	0.595	416	0.002	0.031
28	Gardiners Creek at South Eastern Freeway, Hawthorn	9.9	16	7	1.331	0.120	2722	0.005	0.110
23	Jumping Creek at Jumping Creek Road, Wonga Park	8.9	7	9	1.065	0.053	286	0.001	0.010
27	Koonung Creek at Bulleen Road, Bulleen	7.1	9	10	1.083	0.098	1420	0.004	0.062
25	Mullum Mullum Creek at Deep Creek Reserve, Warrandyte	7.0	15	10	2.086	0.350	471	0.005	0.028
21	Olinda Creek at Macintyre Lane, Coldstream	7.4	12	9	0.905	0.032	149	0.001	0.005
26	Ruffy Creek at Parker Street, Templestowe	8.1	8	4	1.729	0.200	2079	0.005	0.051
Yarra Catchment – northern urban tributaries									
31	Darebin Creek at Clark Road footbridge, Ivanhoe	9.2	8	7	1.349	0.100	1121	0.004	0.072
29	Diamond Creek at Main Road, Eltham	6.2	13	14	1.091	0.096	313	0.004	0.032
32	Merri Creek at Roseneath Street, Yarra Bend	9.7	7	4	1.253	0.115	321	0.004	0.057
33	Moonee Ponds Creek at Mt Alexander Road, Parkville	6.5	8	8	1.998	0.117	1183	0.006	0.062
30	Plenty River at Henty Road, Lower Plenty	6.5	10	14	0.967	0.081	467	0.005	0.022
Yarra Catchment – Yarra mainstream and estuary									
6	Yarra River at Chandler Highway, Kew	7.8	18	20	1.336	0.082	364	0.004	0.024
2	Yarra River at Don Road, Launching Place	9.5	6	7	0.564	0.021	260	0.001	0.005
5	Yarra River at Kangaroo Ground-Warrandyte Road, Warrandyte	8.4	10	7	0.955	0.054	161	0.003	0.007
3	Yarra River at Maroondah Highway, Healesville	9.2	12	10	0.660	0.032	229	0.001	0.005
1	Yarra River at McKenzie-King Drive, Millgrove	10.2	4	4	0.503	0.016	152	0.001	0.004
7	Yarra River at Princes Bridge, South Melbourne	7.1	8	16	1.036	0.100	698	0.005	0.036
4	Yarra River at Spadonis Reserve, Coldstream	8.4	14	13	1.038	0.050	185	0.001	0.005
Waters of Dandenong Valley									
38	Corhanwarrabul Creek at Wellington Road, Rowville	7.6	13	8	1.331	0.071	399	0.002	0.027
35	Dandenong Creek at Boronia Road, Wantirna	7.3	13	18	1.090	0.100	519	0.003	0.120
37	Dandenong Creek at Pillars Crossing, Dandenong South	8.5	25	22	1.271	0.088	820	0.006	0.068
36	Dandenong Creek at Stud Road, Dandenong North	7.6	19	16	1.196	0.077	285	0.004	0.039
34	Dandenong Creek at Sheffield Road, Doongalla Forest	9.5	12	14	1.173	0.028	266	0.001	0.004
45	Elster Creek at Cochrane Street, Elwood	9.8	6	4	1.793	0.086	900	0.004	0.235
42	Eumemmerring Creek at Worsley Road, Bangholme	7.3	16	13	1.555	0.155	307	0.003	0.027
41	Hallam Main Drain at South Gippsland Highway Hampton Park	6.5	10	10	1.130	0.051	185	0.001	0.017
39	Mile Creek at Cheltenham Road, Keysborough	7.3	6	6	1.257	0.082	1053	0.004	0.180
40	Patterson River at National Water Sports Centre outlet, Bangholme	8.1	38	32	1.642	0.120	117	0.005	0.054

Site no.	Description	Dissolved oxygen mg/L	Turbidity NTU	Suspended solids mg/L	Total nitrogen mg/L	Total phosphorus mg/L	*E. coli* organisms /100 mL	Lead mg/L	Zinc mg/L
Mordialloc and Kananook Creeks and Mornington Peninsula waterways									
46	Balcombe Creek at Uralla Rd footbridge, Mt Martha	8.3	11	8	0.974	0.042	220	0.003	0.027
48	Chinamans Creek at Eastbourne Road, Rosebud West	3.7	5	5	1.159	0.110	335	0.002	0.015
47	Dunns Creek at Marine Drive, Safety Beach	7.8	4	6	0.657	0.043	586	0.002	0.009
44	Kananook Creek at Wells Street, Frankston	6.6	4	29	0.773	0.200	297	0.005	0.054
49	Main Creek at Boneo Road, Flinders	9.8	5	4	0.604	0.025	187	0.001	0.006
51	Merricks Creek at Bridge Street, Merricks	6.1	7	10	1.049	0.064	158	0.003	0.021
43	Mordialloc Creek at Wells Road, Mordialloc	7.3	22	32	1.807	0.185	259	0.004	0.050
52	Warrangine Creek at Frankston-Flinders Road, Hastings	7.9	10	9	1.177	0.046	282	0.004	0.030
50	Watsons Creek at Dandenong-Hastings Road, Somerville	8.2	10	11	91.514	0.240	613	0.004	0.034
Western Port waterways									
62	Bunyip River at Healesville-Koo Wee Rup Road, Koo Wee Rup	9.0	14	13	0.773	0.041	259	0.001	0.005
61	Bunyip River at Little Road, Iona	8.2	11	9	0.683	0.039	551	0.001	0.005
59	Bunyip River at North Labertouche Road, Tonimbuk	9.7	12	15	0.755	0.024	56	0.001	0.005
60	Bunyip River downstream Cannibal Creek, Longwarry North	9.3	12	10	0.643	0.035	342	0.001	0.005
54	Cardinia Creek at Ballarto Road, Cardinia	8.8	10	6	0.663	0.042	304	0.001	0.006
53	Cardinia Creek at Chadwick Road, Upper Beaconsfield	8.9	7	5	0.484	0.024	121	0.001	0.003
57	Deep Creek at Ballarto Road, Rythdale	5.1	59	57	1.809	0.345	157	0.004	0.017
65	Lang Lang River at Drouin-Poowong Road, Athlone	6.9	16	13	1.375	0.150	301	0.001	0.008
64	Lang Lang River at South Gippsland Highway, Lang Lang	8.2	39	17	1.477	0.135	244	0.002	0.008
58	Tarago River at Morrisons Road, Labertouche	8.2	9	9	0.575	0.043	532	0.001	0.006
56	Toomuc Creek at Ballarto Road, Rythdale	5.7	19	25	1.310	0.074	69	0.002	0.007
55	Toomuc Creek at Princes Highway, Pakenham	8.0	14	7	0.875	0.069	226	0.001	0.012
63	Yallock Outfall at South Gippsland Highway, Monomeith	6.8	54	62	2.811	0.125	201	0.003	0.008
Maribyrnong River and tributaries and other western waterways									
66	Maribyrnong River at Brimbank Park Ford, Keilor	7.0	7	7	1.076	0.048	60	0.002	0.007
67	Maribyrnong River at Canning Street Ford, Avondale Heights	9.1	18	9	1.101	0.035	220	0.003	0.020
68	Steele Creek at Rose Avenue, Niddrie	7.7	12	10	0.717	0.084	405	0.006	0.071
70	Kororoit Creek at Millbank Drive, Deer Park	6.1	6	8	0.725	0.048	176	0.003	0.014
71	Kororoit Creek at Racecourse Road Ford, Altona	5.9	17	47	1.823	0.180	264	0.007	0.029
72	Skeleton Creek at Ayr Street, Laverton	5.3	8	13	0.882	0.180	396	0.003	0.016
69	Stony Creek at Bena Street, Yarraville	8.8	7	6	2.178	0.240	1226	0.006	0.170

KEY PERFORMANCE INDICATORS

Indicator	2002/03 Plan	2002/03 Actual
Renewable energy generation (percentage of renewable energy generated as a percentage of total energy use)	41%	37%
Reduction in greenhouse gas emissions (greenhouse gas emitted as a percentage compared with 2000/01)	7.5%	7.6%
Sewage spills		
• wet weather	0	0
• dry weather	4	0
Compliance with EPA Victoria licence requirements at Eastern Treatment Plant and Western Treatment Plant (number of breaches)	0	1
Water harvesting points meeting environmental flow requirements to rivers (number of breaches of compliance with catchment obligations)	0	1
Use of biosolids in sustainable applications (percentage of biosolids used beneficially from each treatment plant)	33%	104%*
• Eastern Treatment Plant		
• Western Treatment Plant	n/a	n/a
Proportion of water recycled (percentage of water recycled from the total volume discharged from sewage treatment plants)	8.5%	11%
Nitrogen discharge reduction (tonnes per annum of nitrogen discharge savings through the construction of wetlands)	20	22.3
Water conservation (percentage reduction in demand from retail water companies)	1.5%	2.1%

* Equivalent of one year's production plus use of some stored biosolids

MELBOURNE WATER ENVIRONMENT POLICY

Purpose

To manage Melbourne's water resources and the environment in a sustainable manner.

Objective

To ensure that Melbourne Water meets its environmental obligations and community expectations.

Melbourne Water will:

- Comply with statutory and corporate requirements.
- Involve customers, stakeholders and the community in current activities, new projects and strategies through consultation and education programs.
- Integrate environmental management with decision making, business planning and economic evaluation processes.
- Apply an integrated water cycle approach to our water resource management.
- Develop strategies consistent with broader community expectations to deliver environmental improvements, which go beyond compliance.
- Contain all sewage flows during a 1-in-5-year rainfall event and have no sewage spills due to the operational failure of Melbourne Water's systems from either equipment breakdown or human error.
- Achieve the following key environmental objectives:

100 per cent compliance with statutory and agreed environmental requirements	Continuously
Implement best-practice stormwater performance objectives for urban development	Continuously
Generate the same amount of green energy as grid imported electricity	2006
Achieve a 35 per cent reduction in the organisation's greenhouse gas emissions	2006
Reduce the annual nitrogen load entering Port Phillip Bay from Western Treatment Plant by 500 tonnes and contribute to a reduction of 500 tonnes from catchment sources	2006
Recycle 20 per cent of effluent from sewage treatment plants	2010
Recycle 100 per cent of biosolids produced at our sewage treatment plants	2010
Contribute to the Government's target for a 15 per cent reduction in water consumption	2010
Ensure all of greater Melbourne's natural waterways are in good condition	2025

Melbourne Water will fulfil this policy by:

- Balancing environmental protection and economic development in the interests of both the present and future generations.
- Implementing this policy and procedures within the framework of an environmental management system certified to ISO 14001.
- Applying Melbourne Water's risk management framework by targeting areas of highest environmental risk
- Minimising the environmental impact of the organisation's activities and ensuring that its people and contractors:
  - are equipped to anticipate and manage the environmental risks and responsibilities of day-to-day work as well as more infrequent work such as construction activities; and
  - take all reasonable care to address the environmental aspects of business activities.
- Undertaking research and development and contributing to the transfer of environmentally sound technology and management methods throughout the water industry.
- Applying the waste management hierarchy when identifying and implementing waste minimisation strategies (including the recycling and reuse of products) to minimise risk and add value to the business.

Related Policies/Procedures

Community/Environmental/Public Health Impact Assessment and Management Policy

External Environment and Public Health Policy

Risk Management Policy

Responsible Person

Group Manager, Research and Technology

Authority

Managing Director

VERIFICATION STATEMENT

URS
Corporate Sustainable Solutions

To the Stakeholders of Melbourne Water: Melbourne Water commissioned URS to provide independent assurance on this, Water Resources and Environment Review 2002/03, which has also been published on its corporate Internet site (the 'report'). Melbourne Water has the responsibility for the preparation of the report. This assurance statement represents the URS' independent opinion. URS has undertaken a number of other commissions for Melbourne Water in the reporting period. Hence independence was ensured by selecting a team of assurance providers that had no other involvement with Melbourne Water during the reporting period.

Assurance Objectives

There are currently no statutory requirements or generally accepted standards for the preparation, public reporting and attestation of non-financial stakeholder reports. In the absence of such standards, our approach to assurance provision has been based on AA1000 Assurance Standard and requirements of the Global Reporting Initiative's Sustainability Reporting Guidelines.

The scope included:

- a review of the report for any major anomalies;
- an overview of the embeddedness of Melbourne Water's key social and environmental policies;
- an examination of Melbourne Water's measurement and reporting procedures, background documentation and data collection and reporting procedures; and
- the execution of an audit trail of selected material claims and data streams to determine the level of accuracy in collection, transcription and aggregation processes.

In addition, compared to previous years, the scope incorporated reviewing reported performance against the three principles of the AA1000 Assurance Standard: materiality, completeness and responsiveness.

Assurance Process

The assurance engagement was undertaken in August 2003.

The process involved:

- a series of interviews with key personnel responsible for collating and writing various parts of the report in order to ensure selected claims were discussed and substantiated;
- a review of Melbourne Water's policies, objectives, management systems, monitoring and reporting procedures and an examination of selected data sets, including several drafts of the report; and
- the examination of the aggregation and derivation of, and underlying evidence for, data presented and statements made in the report.

Our Opinion

- A similar moderate rate of errors within the material inspected was found compared to last year.
- The embeddedness of the independent verification program at Melbourne Water, which is now in its sixth year, means that report writers and contributors are conscious of the need to ensure that material presented is accurate and unambiguous. However, it was noted that some systemic issues continue to give rise to a relatively high level of transcription and aggregation errors.

Overall, the auditor is satisfied that: the report is a fair and accurate representation of the organisation's policies, management systems and performance. The report is fairly presented and materially not mis-stated. Further:

- all errors identified during the audit process were satisfactorily addressed before report finalisation;
- the report is a good reflection of management commitment towards sustainability performance, and a fair account of performance achieved during 2002/03;
- the systems and processes in place to generate the numerical data presented in the report are sound, but require further improvement to the data aggregation and interpretation, transcription and review processes; and
- the written statements made in the report accurately reflect the results and progress achieved during the reporting period.

General Findings and Recommendations

The following observations and recommendations are made as a result of the assurance process to assist in further improving the standard of reporting:

- The auditor recommends a Reporting System Diagnostic and Audit through a review of quality standards and reporting processes in order to ensure the potential for human error in reporting is reduced. An internal training program on quality controls in reported information may also be beneficial.
- Changes in the report formats each year means that there is some level of disparity and associated lack of clarity over broader progress of Melbourne Water towards sustainability. It is suggested that a suitable format for sustainability reporting, aligned with the Global Reporting Initiative be chosen with emphasis on comparability between reporting periods.
- Materiality: Issues material to stakeholders have been considered and reported within the suit of reports.
- Completeness: The suit of reports represents a complete account of organisational performance. It is suggested that supplier and customer level impacts be reviewed in the future.
- Responsiveness: The responsiveness to stakeholder concerns at Melbourne Water is considered high. Notwithstanding, the organisation would benefit from further developed systematic response mechanisms to stakeholder mapping and survey processes.

The above findings represent a summary of a more detailed assessment report presented to Melbourne Water.

On behalf of the audit team, 10th September 2003
Melbourne, Australia

Terence Jeyaretnam
Principal, URS

GLOSSARY

Activated sludge process This process involves using naturally occurring micro-organisms to feed on the organic material in the sewage. Activated sludge is a rich mixture of bacteria and minerals. The process is used in sewage treatment plants to break down organic matter and nitrogen compounds.

Aeration Adding oxygen (usually in air) by mixing air into sewage processes or water bodies by mechanical aerators or blowing air through diffusers to ensure that aerobic processes are maintained.

Algae Large group of generally aquatic, non-flowering plants, many microscopic.

Algal bloom A rapid increase in the numbers of algae, usually caused by a change in the flow, light, temperature or nutrient levels of the water in which it lives.

Ammonia A chemical compound made up of carbon and hydrogen that can be toxic, and also contribute to the nutrient enrichment of waters.

Aquifer A layer of porous rock that both stores water and allows it to drip through. Aquifers provide natural underground storages of water.

Aquifer recharge Build-up of water in a natural underground storage.

Bacteria Bacteria are sometimes called germs. Many of them are useful for water or sewage treatment processes. Some cause disease. A huge population of them exists on human skin and in the human intestine.

Biodegradable Capable of being broken down by natural chemical or biological processes into simple substances not harmful to the environment.

Biodiversity The range of plants and animals, and the habitat that they live in.

Biogas A by-product of the sewage treatment process that includes carbon dioxide and methane. Melbourne Water uses biogas as a source of renewable energy.

Biosolids Biosolids are the treated and stabilised solids in sewage.

Blue-green algae One form of algae properly called Cyanobacteria. Blooms of blue-green algae have occurred in some important Australian waterways.

Catchment The area of land drained by a creek or river system, or a place set aside for collecting water which runs off the surface of the land. Catchments provide the source of water for the dams and reservoirs in which our drinking water is collected.

Coliforms Coliforms are bacteria that are used to indicate the presence of pathogens from faecal contamination of water. They are not generally pathogenic themselves.

CSIRO Commonwealth Scientific and Industrial Research Organisation.

Dam Technically, the dam is the wall that holds the water in and the reservoir is the water. Commonly, though, the words are interchanged.

Disinfection Any process that destroys or removes disease-causing organisms such as viruses, bacteria or protozoa. It is used as part of the purifying of drinking water.

E. coli *Escherichia coli* is a bacteria/bacterium found in the stomachs of mammals, for example humans, and used as an indicator of recent faecal contamination.

Ecosystem The system of animals and plants and the environment they inhabit.

Effluent Treated sewage that flows out of a sewage treatment plant.

Environmental flow The minimum designated flow in a waterway needed to satisfy specified ecological requirements. Water released from a reservoir to maintain water levels downstream of a dam.

Evaporation The process by which water changes from liquid to gas or vapour and rises, forming clouds. This happens when the temperature increases over large masses of water, such as lakes and oceans.

Greenhouse gases Vapours, including water, in the lower atmosphere, which reflect solar radiation back to earth.

Greywater Sewage from the kitchen, laundry and bathroom (but not the toilet). It usually contains soap, detergents and fats.

Groundwater Water collecting below ground level in an aquifer or water table.

Heavy metals General term for cadmium, chromium, copper, iron, mercury, nickel, manganese, lead, zinc, arsenic and selenium.

Hydrology The study of water occurrence, distribution, movement and balances in ecosystems; the seasonal patterns of a river's flow.

Irrigation The use of water to nourish cultivated land or open space to promote the growth of vegetation.

Mega A factor of one million. So a megalitre of water is one million litres. Melbourne's Thomson Reservoir holds 1,068,000 megalitres.

Methane A chemical compound made up of carbon and hydrogen produced as a by-product of anaerobic sewage treatment. Methane can be used a fuel source for energy generation.

Micro-organisms Microbes that live in soil, air or water. They can be useful or harmful.

Microfiltration Water under pressure passes into pipes constructed of filter membranes with tiny pores too small to admit suspended solids and some pathogens.

Nutrient reduction The removal of nutrients from sewage by chemical or biological processes so that the effluent does not harm the environment.

Nitrogen A chemical element essential for the growth of plants and animals. Our atmosphere is comprised of 79 per cent of nitrogen.

Nutrients Substances such as nitrogen and phosphorus in various forms required for the growth of plants. Excess concentrations of nutrients can be harmful in waterways and bays.

Outfall Pipeline discharging treated effluent.

Pathogens Any organism that causes disease in another organism.

Phosphorous A chemical element essential for growth. It is present in many fertilisers and its overuse may contribute to the formation of algal blooms in waterways.

Pollution The results of activity that is detrimental to beneficial use by plants, animals or humans of water, air or land.

Protected catchment Protected catchments have no farms, houses or factories, so they provide water free of any pollutants these and other human activities produce. Most of Melbourne's catchments are protected.

Reservoir A major body of water created in a river valley by building a dam (see dam).

Run-off Rainfall water which flows from a catchment into a river, stream, lake or reservoir.

Saline Salty. The salinity levels in water affect its usefulness for a range of purposes such as drinking water supply, horticulture and the environment.

Secondary treatment A level of sewage treatment that uses a combination of biological, physical and chemical processes to remove about 85 per cent of Biological Oxygen Demand (BOD) and suspended solids.

Sediment Sand, clay, silt, pebbles and organic material deposited in water.

Sewage and sewerage Sewage is the waste carried in our sewers. Sewerage is the system of pipes, pumps and treatment plants to manage sewage.

Stormwater Rainfall that runs off roofs, roads and other surfaces where it flows into gutters, streams and waterways and eventually into the bays. This water can carry contaminants such as plastic bags, detergents, nutrients and heavy metals.

Suspended solids Solids that float on the surface or are suspended in water, and which are largely removable by filtering.

Tertiary treatment A level of sewage treatment that is beyond secondary treatment by further reducing the level of nutrients and suspended solids.

Toxicants Harmful substances, including heavy metals, chemical compounds and excessive concentrations of nutrients.

Turbidity The presence of fine suspended matter such as clay or silt in water causing the water to be cloudy or muddy in appearance.

Water table The level of water in an aquifer.

Weir A structure across a waterway to stop and raise water levels.

Wetlands Low-lying areas of land intermittently or permanently covered with either fresh or salt water. Wetlands occur naturally and can be constructed.

Melbourne Water®

FEEDBACK FORM

Water Resources and the Environment 2002/03

Please help us to improve our public reporting. Complete this form and return it to Melbourne Water by facsimile (03) 9235 7177 or by sending your comments to inquiry@melbournewater.com.au.

If you include your name and address we will send you a free pass to visit Melbourne Museum!

Your name (optional)

Your address (optional)

Postcode State

Your organisation (if any)

Your position (if any)

Report content

The level of detail in the report was: ◯ too much ◯ about right ◯ too little

The report covered Melbourne Water's performance in a way that was: ◯ easy to follow ◯ hard to follow

The report's design helped make it: ◯ easy to read ◯ hard to read

The most interesting parts of the report were:

The least interesting parts of the report were:

The report could be improved by:

Is there information you would like included in future reports?

How do you think Melbourne Water could improve its reporting?

Thank you for completing our questionnaire. Please fold and moisten seal before returning this pre-paid envelope.

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ISSN 1448-8973

Community Languages

For information on Melbourne's water resources in languages other than English, call 131 722 or visit **www.melbournewater.com.au** and click on the Community Languages link.

Design: Digital Image
Photography: Noel Butcher, Neale Duckworth and Rohan Young
Ceramic Artist: Jan Friedman

Printed on paper manufactured at the Burnie mill in Tasmania, which has ISO14001 environmental system certification. Water at the mill is recycled and reused. The paper is acid free, has neutral pH and is made of pulp from plantation timbers and pre-consumer waste.