Melbourne Water

2000/01

Environment Review

Contents

ENVIRONMENT REVIEW

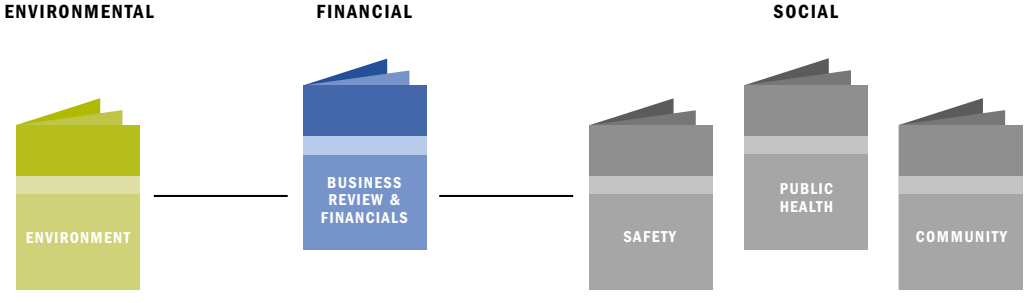
Triple-bottom-line reporting

Our triple-bottom-line approach to reporting places equal emphasis on economic, environmental and social reporting. In this document we report on our environmental performance.

Our financial performance, our statutory and regulatory reporting and summaries of our environmental and social performance are provided in our *Melbourne Water Business Review 2000/01*.

Our social performance is reported in greater detail in our public health, community and safety reviews.

Copies of our public reports can be obtained by calling 131 722 or may be downloaded from our web site at: www.melbournewater.com.au



Melbourne Water Charter

Melbourne Water is owned by the Victorian Government. We manage Melbourne's water supply catchments, remove and treat most of Melbourne's sewage, and manage waterways and major drainage systems. Three retail water companies provide local water and sewerage services to consumers.

Melburnians enjoy drinking water that is among the world's best–thanks primarily to the foresight more than 100 years ago of Melbourne's city planners, who set aside water catchments protected from human contamination.

The city planners also laid the foundations for a sewerage system that continues to lead in technology and environmental sustainability.

These are legacies few other cities in the world can match and Melbourne Water acknowledges the role of its actions in ensuring these resources meet Melbourne's needs, now and into the future.

In managing Melbourne's water supply catchments, sewerage system, waterways and drains, Melbourne Water strives to match the foresight and innovation shown by the city's original planners.

Our aim is to show leadership in water cycle management, through effective, sustainable and forward-looking management of the community resources we oversee.

The business objectives established to realise the vision are to:

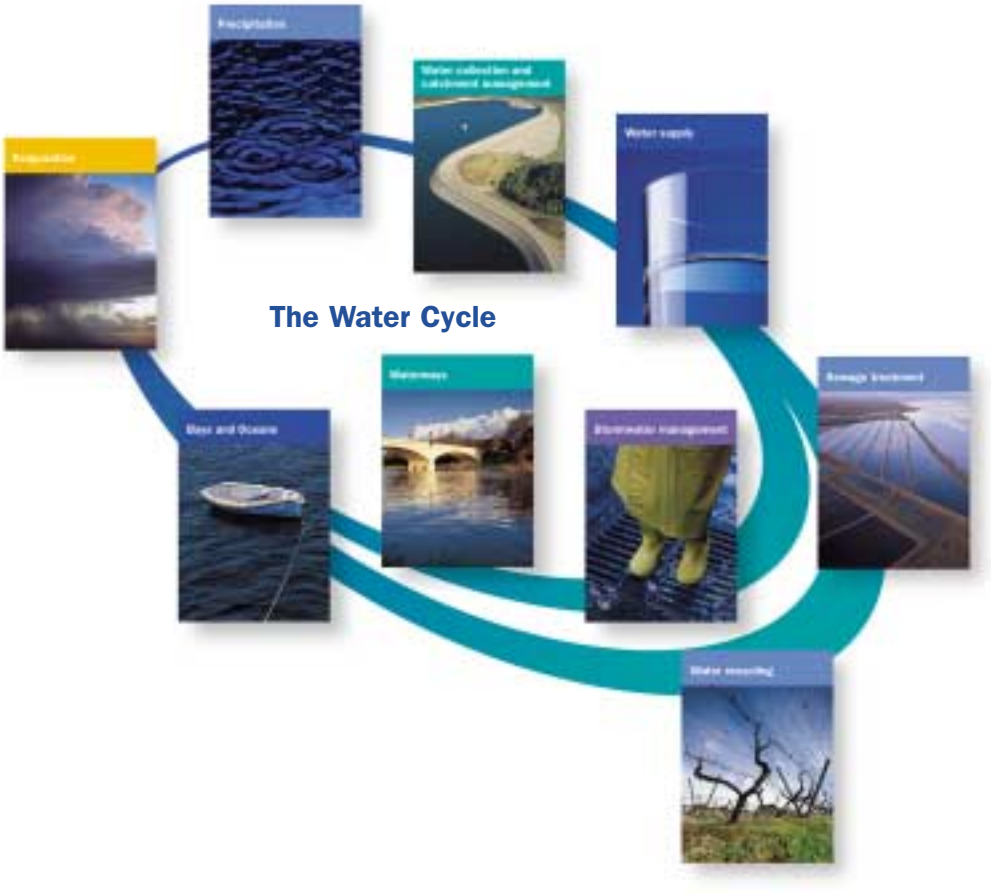
- protect public health
- operate as a successful commercial business
- manage Melbourne's water resources and the environment in a sustainable manner
- provide excellent service and maintain the trust and respect of the community.

At Melbourne Water we understand that partnerships with stakeholders and the community are the key to achieving our vision–leadership in water cycle management. We also appreciate that achievements occur through people. At Melbourne Water we are people who:

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

Through working successfully with others and operating as an efficient commercial business, we will be able to make Melbourne a better place to live both now and in the future.

Leadership in water cycle management



Foreword

At Melbourne Water, we are very conscious of the role we play in protecting and improving the natural and built environment. We want future generations to be able to enjoy what is one of the best urban environments in the world. That is how we define and think about sustainability.

This concept is central to our business objectives and that is why we have introduced a section on sustainable resources into our annual environment review.

As our organisation continues to change and meet community expectations, we are no longer satisfied to simply meet licence requirements. Part of our focus on sustainability is an understanding that we must balance environmental, financial and social goals.

This review outlines our achievements and disappointments in meeting our environmental responsibilities for 2000/01, as well as the key challenges we are facing. It shows that we made significant achievements in some areas. In other areas, we can and will do better.

A beach litter incident and an odour complaint, both of which related to our operations at Eastern Treatment Plant led to EPA Victoria imposing fines for licence breaches. These issues were major disappointments for us.

We unreservedly apologise to residents and the local community for these incidents. We have learned from them and have amended our operating procedures.

The continuing drought led to Yarra River flows falling below the minimum required on 22 days. We also worked hard to manage the water supply system, adjusting operating procedures to ensure sufficient water was in the right place at the right time. We were able to do this without compromising our environmental obligations.

During the year, we made several significant steps towards planning for a sustainable future.

As part of a long-term program designed to reduce water consumption and help defer the need to build new water storages, we undertook a major public education campaign to help conserve water. We also began working with the Victorian Government to develop a long-term framework for Melbourne's water resources.

With our partner, AGL Ltd, we increased the generation of our own power at our Western Treatment Plant. We have formulated strategies to reduce greenhouse gas emissions and developed water recycling schemes.

In addition, we undertook major works at Western Treatment Plant that will help protect Port Phillip Bay and reduce odour in the vicinity of the plant. We also began planning for a significant upgrade at our Eastern Treatment Plant that will improve effluent quality and the marine environment.

Our new reporting style demonstrates how we performed against our environmental goals and responsibilities in 2000/01. The nine report cards in this review are designed to provide meaningful information on which our environmental performance can be judged. We welcome your feedback, comments and suggestions.

Brian Bayley
Managing Director

Environment policy

Melbourne Water will:

- Work towards achieving a sustainable balance between environmental protection and economic development that is in the interests of future generations.
- Implement environmental policies and procedures within the framework of environmental management systems consistent with the Australian water industry environmental management guidelines and ISO 14001.
- Comply with statutory and corporate requirements and, through a continual improvement process, develop strategies to meet expected medium to long term regulatory trends.
- Minimise the environmental impact of the organisation's activities and ensure that management, employees and contractors:
  - are equipped to anticipate and manage the environmental risks and responsibilities in their day-to-day work
  - take all reasonable care to address the environmental aspects of business activities.
- Involve customers, stakeholders and the community in current activities, new projects and strategies through appropriate consultation and education programs.
- Integrate environmental management with business planning, decision making and economic evaluation processes.

Melbourne Water will fulfil this policy by:

- Conducting regular environmental audits and assessments of the corporation's compliance with statutory and corporate requirements and periodically providing appropriate information to the Board, shareholders, customers, employees and the public.
- Undertaking research and development and contributing to the transfer of environmentally sound technology and management methods throughout the water industry.
- Identifying and implementing waste minimisation strategies (including the recycling and reuse of products) to minimise risk and add value to the business.
- Minimising the environmental impacts of Melbourne Water through:
  - using a risk management approach appropriate to the potential for environmental damage
  - carefully evaluating decisions to avoid, wherever practicable, serious and irreversible environmental damage
  - identifying and critically assessing options for proposed projects and strategies
  - sound environmental management of the construction phase
  - developing and implementing environment improvement plans for current operations
  - developing emergency preparedness plans where potential hazards exist.

Performance snapshot 2000/01

ACHIEVEMENTS

Protecting and improving our waterways and bays

- We completed nine wetlands to improve the quality of stormwater flowing into Port Phillip Bay.
- Platypus were found for the first time in Ruffeys Creek, Templestowe, following improvements we made to the creek's bed and banks.
- We began implementing a coordinated approach to managing litter in the Moonee Ponds catchment.
- We met our daily environmental release requirements below dams and weirs at 19 out of 20 sites.
- We constructed fish ladders at four sites to enable migratory fish to pass.
- We completed a study on heavy metals and other toxicants in Merri and Lower Darebin creeks.
- We completed the Western Port Sediment Study's initial phase.

Managing Melbourne's sewerage system

- Our Western Treatment Plant achieved an EPA Victoria accredited licence, which recognises the plant's excellent performance and allows us to determine the initiatives at the plant to improve environmental performance.
- We commissioned our first enhanced lagoon at Western Treatment Plant.
- We began work on a long-term improvement plan for our Eastern Treatment Plant.
- We implemented a major monitoring program for receiving waters around Boags Rocks where our Eastern Treatment Plant's effluent is discharged.
- Monash University completed a year-long microbiological monitoring program at 13 sites around Boags Rocks based on World Health Organization guidelines for recreational waters.
- We implemented the first stage of an ammonia reduction pilot project at our Eastern Treatment Plant to protect the environment at Boags Rocks.
- We developed two key strategies that will eliminate most of our remaining wet-weather sewage spills from our sewage transfer system.
- Our sewerage system, including treatment plants, coped well with a significant storm in April 2001.

Towards sustainability

- We conducted a major public education program on water conservation.
- We project-managed the development of the initial phase of a water resources strategy for Melbourne.
- We completed and trialled a water recycling system at our Western Treatment Plant.
- We completed a feasibility study into developing a major water recycling scheme in the Koo Wee Rup area.
- We developed a greenhouse gas strategy to reduce emissions.
- With our partner, AGL Ltd, we increased the use of biogas to generate electricity at our Western Treatment Plant.
- We developed plans to construct up to 14 additional hydro-electricity generating sites in our water supply system.
- We developed an energy reduction program to be implemented over three years.
- We completed a remediation plan to manage our disused Dandenong Treatment Plant.
- We are planning for the potential impacts of climate change.
- We assessed community attitudes to water conservation and water recycling.
- Our Eastern Treatment Plant secured two new water recycling customers.

DISAPPOINTMENTS

Protecting and improving our waterways and bays

- Some waterways in greater Melbourne did not meet all long-term water quality targets set in the Victorian Government's Environment Protection Policy.
- On one day we failed to meet our requirements for environmental water flow below the Thomson Dam.
- We have made slower than expected progress in completing streamflow management plans.

Managing Melbourne's sewerage system

- We were fined by EPA Victoria after litter washed up on the beach near our Boags Rocks outfall.
- We were fined by EPA Victoria for an odour breach of our Eastern Treatment Plant's discharge licence.
- We had eight spills to the environment, with a total volume of 66.3 megalitres, from our sewerage system.

Towards sustainability

- We do not have our planned energy management system in place.

KEY CHALLENGES

Protecting and improving our waterways and bays

- Balancing competing demands for water including environmental flow requirements.
- Maintaining security of water supply in times of drought.
- Reinforcing community awareness that litter and other pollutants go down drains and sewers into waterways and bays.
- Our requirement to help reduce the amount of nitrogen discharged to Port Phillip Bay by 500 tonnes a year from catchment management initiatives.
- Difficulty in determining adequate flows to ensure stream health.
- The impact of specific pollutants and activities in catchments on waterway plants and animals.
- Understanding why the seagrass meadows in Western Port are declining.
- Balancing increased urban, industrial and agricultural development in the Western Port catchment with the environmental needs of a sustainable tourist industry.

Managing Melbourne's sewerage system

- Developing a works approval program to upgrade our Eastern Treatment Plant and improve the marine environment around Boags Rocks.
- Meeting community expectations regarding discharge standards.
- Minimising impacts, including odour, on communities near our sewage treatment plants.
- Improving community education to reduce the quantities of litter, oil and grease put into the sewerage system.
- Understanding the causes and effects of foam, small fat balls, odour and discolouration associated with the discharge at Boags Rocks.
- Working with South East Water to improve the quality of effluent from its sewage treatment plants that flows to the Boags Rocks outfall.
- Ensuring that the Lake Borrie wetlands at our Western Treatment Plant continue to be an ideal habitat for birdlife when we discontinue traditional sewage treatment practices.
- Recording weather conditions to identify one-in-five-year rainfall events and monitoring flows at critical points in our sewerage system.
- Maintaining high levels of maintenance and asset management of our sewerage system.

Towards sustainability

- Balancing environmental, commercial and social imperatives in all our decision-making.
- Staying in touch with changing community views and expectations on the environment.
- Adopting a holistic view of water resource management and balancing the environmental implications and costs of stormwater, river water, surface water, recycled water and groundwater.
- Meeting our target to recycle 20 per cent of effluent by 2010 and the infrastructure and investment needed for major water recycling schemes.
- Developing a robust water recycling strategy for greater Melbourne that has broad community and government support.
- Managing land use at our Western Treatment Plant as an abundant supply of recycled water becomes available.
- Capturing opportunities to recycle biosolids, and the effect of trade waste and domestic sewage on our ability to recycle biosolids.
- Maintaining efforts to conserve water after the drought.
- Increased treatment requirements in our discharge licences can lead to increased energy consumption.
- As an energy generator, we are eligible for the Australian Government's Renewable Energy Certificates program.

Our waterways and bays

Melbourne Water is responsible for managing waterways in greater Melbourne. We aim to improve the quality and environmental health of these waterways as a key part of our objective to manage sustainably Melbourne's water resources and the environment. Our roles include:

- providing environmental releases from dams and weirs
- monitoring the health and water quality of waterways
- developing streamflow management plans
- licensing and managing diverters who use water from the Yarra and Maribyrnong catchments in their businesses.

We manage 4,381 kilometres of waterways, 677 kilometres of modified waterways and channels, 32 natural and artificial wetlands, 153 monitoring stations on waterways and drains, 98 sediment and litter traps, and 25 lakes.

Merri Creek is one of the waterways for which we are responsible.

Rivers and streams

Managing river flows

We manage river flows to ensure adequate environmental conditions in waterways. We release water from reservoirs and dams under regulatory requirements or agreements with relevant agencies.

On average, we release into waterways about 35 per cent of water flowing into water storages. Releases vary from 54 per cent in the Thomson catchment to 28 per cent in the Yarra catchment and 23 per cent in the Silver/Wallaby Creek catchment.

Maintaining environmental flows

During the year, prolonged drought caused continuing low river flows and reduced water in our storages. We implemented drought response plans, to manage streamflows in times of drought, for Yarra and Maribyrnong river diverters during summer.

On 12 January 2001, we imposed level one restrictions for diverters drawing water from the Yarra and lower Maribyrnong rivers. We raised these to level two restrictions on 25 January 2001. We lifted restrictions in May, when streamflows rose due to improved streamflow in the catchment of these rivers.

We are required to manage Yarra River flow so that "to the extent practicable" it does not drop below 245 megalitres a day at Warrandyte. Due to drought conditions in the Yarra catchment, flow fell below 245 megalitres a day on four days in January, four days in February and 14 days in March. The lowest daily flow was 190 megalitres a day on 12 March 2001.

During these times, consistent with the Yarra River drought response plan, we introduced water restrictions for diverters and did not pump water from Yering Gorge.

Required environmental flows for the Thomson River at Coopers Creek increased from 150 megalitres a day in June to 216 megalitres a day in July. On 1 July 2000, the flow fell below the required level to 202 megalitres. The average July flow of 250 megalitres a day was above requirements.

After discussions with the Department of Natural Resources and Environment on the difficulties of measuring and timing the amount of water needed to maintain the required environmental flow in the Thomson River at Coopers Creek, operating tolerances have been included in our new bulk water entitlement.

In February 2001, the Minister for Environment and Conservation signed our bulk entitlement to water from Thomson Reservoir. Under this agreement, we are responsible for providing environmental flows below the dam.

In July 2001, the Minister signed a bulk entitlement for our use of water from Rosslynne Reservoir on the Maribyrnong River. Under this agreement, we are entitled to 9.5 per cent of water in the reservoir.

We manage releases from Rosslynne Reservoir for the environment and for diverters, taking into account inflows below the reservoir, to achieve an environmental flow at Keilor of five megalitres a day.

Bulk entitlement reporting requirements

Under the Maribyrnong bulk entitlement order, Melbourne Water is required to report on various aspects of diversion management related to our water entitlement from Rosslynne Reservoir and Maribyrnong River licence holders.

Status of our entitlement to water in the reservoir as at 30 June 2001	Volume ML
Releases made from the reservoir on Melbourne Water's behalf to supply our licence holders	450
Current volume of Melbourne Water's share of storage capacity	483
Volume of inflows attributed to Melbourne Water for the year	882
Estimated volume of transfer and operating losses within the system	225
Melbourne Water's share of the volume released to meet environmental flow requirements	41
Total volume[1] of water taken by licence holders from the Maribyrnong River to satisfy entitlement	552.3

[1]Excludes domestic and stock licences, which are currently unmetered.

LICENCE TRANSFERS

Type	Number	Volume transferred ML	Origin	Destination
Permanent	2	32	Keilor	Keilor
Temporary	12	124	Keilor	Keilor

For the year ending 30 June 2001, Melbourne Water has not temporarily or permanently transferred any part of its bulk entitlement. Likewise we have not received any transfer of a bulk entitlement or other entitlement under the Water Act that alters or may alter the flow of water in the waterway.

There has been no amendment to the bulk entitlement, no alteration to the entitlements or security of entitlements listed under Schedule 1 and Schedule 2 of the Bulk Entitlement Order and no new bulk entitlement granted to Melbourne Water to supply entitlements under licences.

The Bulk Entitlement Order requires a metering program to be prepared and submitted to the Minister within 12 months of gazetting of the order. All irrigators on the Maribyrnong River were already metered prior to gazetting of the Bulk Entitlement Order, with approval of the Department of Natural Resources and Environment.

Overall we have complied with bulk entitlement order provisions across the year.

Streamflow Management Plans

During the year, we continued to develop streamflow management plans for the Yarra catchment. These plans regulate a stream's water resources and specify minimum environmental flow targets and maximum waterway extractions available for diverters.

Under these plans, we bring together all stakeholders, including diverters, through a working group to develop a blueprint for a long-term, sustainable future for the waterway.

During the year, we prepared drafts for consideration by stakeholders. Formal consultation for the Hoddles Creek plan will be held during October 2001. An October 2001 consultation period is scheduled for the Diamond Creek plan. A draft plan for Plenty River is due in December 2001. We will begin developing plans for the Woori Yallock and Olinda creeks by December 2001 and Stringybark Creek by June 2002.

These plans are taking longer to prepare than we expected due to our desire to ensure stakeholders have adequate opportunity to participate. A fee increase for diverters is helping fund these plans.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Environmental flows Monitor flows below dams and weirs and manage water supply diversions to meet environmental flow requirements.		✓		Met daily requirements at 19 of 20 sites despite continuing drought. Did not meet one daily requirement below the Thomson Reservoir. Implemented drought response plans and placed water restrictions on diverters. *Continue to meet environmental flow requirements during 2001/02.*
Streamflow management plans Produce draft streamflow management plans for Hoddles Creek by August 2000, Diamond Creek by November 2000 and Plenty River by end June 2001.		✓		Developed draft plans for Hoddles Creek, Diamond Creek and Plenty River. Consultation has taken longer than expected and will be completed by December 2001. *Prepare information for streamflow management plans for Woori Yallock, Olinda and Stringybark creeks.*

Healthy ecosystems

Our broad objective for waterways is to establish a new, healthy balance between the natural and built environments, given the highly modified condition of urban and rural catchments. This new balance should be based on stable beds and banks, maximum coverage by native vegetation, and diverse and healthy aquatic habitats.

Targeted research

During the year, we continued to support the Australian Platypus Conservancy, which undertook monitoring, three studies of capital works impact on platypus wellbeing, and developed a platypus-reintroduction program.

Monitoring involved regular surveys of waterways to assess how platypus populations change over the long term. Platypus were found for the first time in Ruffeys Creek, Templestowe, probably as a result of stream improvement works.

Investigations in Running Creek near Arthurs Creek, Hurstbridge, found that platypus prefer feeding where there is overhanging indigenous vegetation rather than willows. Further work in Running Creek will establish the long-term benefits of willow removal and revegetation.

In January 2001, streams within the Cardinia Creek catchment were assessed for impediments to the health of fish communities.

Some 1,250 fish, representing 12 species, and two species of freshwater crayfish were collected.

Factors affecting fish communities include degrading instream habitat, clearing land, barriers to migration, and introducing exotic species.

Very low numbers of threatened Australian grayling were found in Cardinia Creek. Further work will identify barriers to fish movement and remove, in particular, those affecting grayling.

Four fish ladders were completed during the year to enable fish to pass around instream obstructions. Two were in Darebin Creek, another on the lower Maribyrnong at McNabs Weir and the other at Coburg Lake on Merri Creek.

The Coburg Lake fish ladder included a rock chute around the lake wall and indigenous vegetation planted to improve the bank habitat. Surveys, after significant flows in the creek, will assess the ladder's effectiveness.

Rehabilitating streams

During the year, we worked with landowners to improve vegetation on stream and creek banks under the Stream Frontage Management Program. We provided funds for fencing 26.8 kilometres of stream frontage, some 50,900 plants, materials, weed control and stock watering facilities. Landowners built and maintained the fences and did the planting.

We continued our three-year partnership with the Landcare Foundation and Amcor to revegetate Melbourne's waterways. During 2000/01, the first 11 projects were carried out in nine municipalities.

Revegetation works were completed at 16 sites across Melbourne, with about 45,000 plants established along seven kilometres of waterways.

Monitoring heavy metals

Toxicants, in particular heavy metals, have a detrimental effect on stream ecology. Our research shows that Merri Creek and Lower Darebin Creek have elevated levels of heavy metals and other toxicants in stream sediments.

A study which began in 2000/01, aims to help identify the source of these metals. We monitored heavy metal concentrations in 15 drains between September 2000 and June 2001.

Each site was sampled during a weekday and a Sunday every month to help isolate the major land use activity contributing to heavy metal pollution. A report is scheduled to be completed by November 2001. This study will provide valuable information to help waterway managers develop a strategy to reduce toxic pollution in urban waterways.

During the year, we also commissioned research into the level of toxicants in Edgar's Creek near Thomastown. The research found high concentrations of zinc throughout the waterway. Further work will be conducted to distinguish between residential and industrial sources of metal contamination.

Metals under the microscope

Melbourne Water is examining the sources and impact of heavy metals and other toxicants in urban waterways to try to understand any links between various land uses and contaminants in waterways. Heavy metals found in waterways include cadmium, copper, lead, mercury, nickel and zinc. Other common toxicants include hydrocarbons and pesticides.

It is using information gathered over the past five years at 200 sites around Melbourne, together with a survey conducted by freshwater ecologist Vin Pettigrove at points along Merri Creek and Lower Darebin Creek, to examine how and which heavy metals enter the waterways. "High levels of toxicants are not unusual in inner city waterways, but we don't know exactly where these contaminants are coming from and which are the most serious," Mr Pettigrove says. "Elevated levels of heavy metals have been found in waterways around Melbourne–certainly in higher levels than rural areas–and these levels are a concern."

As part of the research, Melbourne Water is working with the Australian Government-funded Centre for Environmental Stress and Adaptive Research to understand the impact of heavy metals and other toxicants on plants and animals in streams. The biomonitoring project is using moths, wasps and aquatic insects, mosquito fish and aquatic plants reared in the centre's La Trobe University laboratories to measure stress effects using trait variability in the organisms.

The research revolves around experiments in which identical aquatic plants (or animals) are placed in pristine conditions and in contaminated conditions. Changes on their leaves, for example, caused by the contamination are photographed and recorded, and compared with what is found in the field.

The centre's director, Professor Ary Hoffmann, says a key objective of the project is to develop sensitive indices that can help detect and measure stress in organisms. "Our research was very much laboratory-based, and when we heard about Vin's work out in the field, it made sense for us to collaborate," he says.

We are involved in laboratory–based research on the impact of heavy metals on plants and animals in streams.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Targeted research Improve understanding of ecological conditions in waterways to help determine work programs			✓	Supporting research into platypus in urban waterways. *Reintroduce platypus into Cardinia Creek.* Assess streams in Cardinia Creek catchment for impediments to fish communities. *Improve the existing fish ladder at Thompsons Road and reconstruct fishways around small weirs downstream on Cardinia Creek*
Rehabilitation projects Provide assistance to landowners through the Stream Frontage Management Program.			✓	Provided funding to rehabilitate 27 kilometres of stream frontage and for 51,000 plants. *Rehabilitate 26 kilometres of stream frontage and plant 50,000 plants*
Ecological monitoring Undertake biological and toxicant monitoring programs to indicate stream health.		✓		Undertook study in Merri Creek and Lower Darebin Creek on sources of heavy metals. *Report, due in November 2001, will provide information on the sources of toxic pollution in these waterways.*

Index of Stream Condition

The Index of Stream Condition is designed to provide an overall 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 riparian zone and the invertebrate communities living in the stream.

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

- physical form (stream bank and bed condition, presence of and access to physical habitat, artificial barriers)
- 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 compared against Victorian Government environment protection policy water quality objectives)
- aquatic life (diversity of macroinvertebrates).

Each sub-index is scored out of a maximum of 10, so that the overall score for the index will vary between a minimum of 0 and a maximum of 50. Stream condition is then allocated to one of five classifications: very poor, poor, moderate, good or excellent.

The Department of Natural Resources and Environment developed the index with the intention of providing a high-level reporting process on the state of Victorian streams. We are modifying the index to assist us in prioritising our stream rehabilitation works program based on reach condition and the perceived threats to retaining that condition.

Index of Stream Condition

Water quality

Alert levels

The Victorian Government, under its Environment Protection Policy, has established long-term water quality targets for waterways. Melbourne Water aims to meet these targets.

We monitor water quality at 72 sites in greater Melbourne and report performance against Victorian Government targets including dissolved oxygen, turbidity, nutrients, metals and *E.coli*. We have established agreed alert levels with EPA Victoria that apply when these targets are exceeded by a specified amount.

During 2000/01, we advised EPA Victoria of 511 alert levels, and used this information to prioritise water quality improvement works. Water quality performance, which is directly affected by weather conditions and catchment activity, was similar to previous years. The number of alert levels tends to increase following rainfall.

Even though all Victorian Government Environment Protection Policy requirements were not met, the long-term trend for water quality is generally improving, especially for nutrients and electrical conductivity, a measure of salinity (see *Victorian Water Quality Monitoring Network Annual Report 1998*).

Reducing litter

A major initiative to remove litter from Moonee Ponds Creek was announced in January 2000. This initiative will focus on establishing an integrated approach to litter management. Our partners in the project, which we are managing, are four local councils, the Australian Government, EPA Victoria, Clean-Up Australia and EcoRecycle Victoria.

Large quantities of litter affect lower reaches of the creek, which is undergoing significant redevelopment in association with City Link, Docklands and Melbourne Ports Corporation. This project includes a waste-accreditation program for businesses to reduce litter entering the creek and litter traps being installed across the catchment.

During June 2001, we installed two litter traps and called tenders for the design of a wetland to be built in the Jacana Retarding Basin in Broadmeadows.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Monitoring water quality Report on the results of waterway, biological and toxicant monitoring programs.			✓	Conducted monitoring at 72 sites (see pages 15-18), reporting 511 alert levels to EPA Victoria. *This is an ongoing requirement.*
Managing litter Retrofit water quality treatment systems in existing urban areas.			✓	Launched the Moonee Ponds Litter Initiative in January 2001. *Project to be completed by September 2002.*

We are involved in a major initiative to reduce litter in Moonee Ponds Creek.

Waterway water quality monitoring results

Summary of compliance with Victorian Government Environment Protection Policy

These tables refer to waterway monitoring sites shown on the map on page 15. Relevant compliance levels are detailed in the tables below. Monitoring data is from 2000/01 and is more fully reported on Melbourne Water's website.

ENVIRONMENT PROTECTION POLICY OBJECTIVES FOR GREATER MELBOURNE'S WATERWAYS

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* **org/100mL** 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[c]/30[d]	<25[c]/50[d]	<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 Bay 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:
(c) Yarra mainstream upstream of Diamond Creek confluence
(d) 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. Policy 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).

All results in the following tables are annual medians, except for *E.coli*, which is an annual geometric mean.

YARRA CATCHMENT–RURAL EASTERN AND WESTERN WATERWAYS

Site no.	**Description**	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
17	Arthurs Creek at Burkes Bridge, Hurstbridge	8.1	37	12	1.032	0.047	140	0.002	0.010
11	Cockatoo Creek at Tschampions Road, Macclesfield	9.1	21	23	1.666	0.048	117	0.001	0.006
18	Diamond Creek at Cottles Bridge-Strathewen Road, Cottles Bridge	7.5	82	14	1.642	0.083	260	0.004	0.021
15	Lillyponds Creek at Melba Highway, Yering	7.1	22	14	1.773	0.068	178	0.001	0.006
8	Little Yarra River at Corduroy Road, Yarra Junction	9.6	17	13	0.752	0.032	307	0.001	0.006
20	Merri Creek at Summerhill Road, Craigieburn	7.3	98	17	2.228	0.140	989	0.004	0.015
19	Plenty River at Plenty Gorge, South Morang	7.9	89	13	2.239	0.175	429	0.004	0.020
14	Steels Creek at Healesville Road, Yarra Glen	7.8	37	13	1.459	0.065	243	0.002	0.010
12	Wandin Yallock Creek at Killara Road, Gruyere	8.3	24	16	2.307	0.150	326	0.001	0.006
16	Watsons Creek at Henley Road, Kangaroo Ground	7.4	26	9	1.563	0.052	395	0.002	0.011
13	Watts River at Healesville-Kinglake Road, Healesville	8.3	13	5	0.940	0.036	290	0.001	0.007
10	Woori Yallock Creek at Macclesfield Road, Yellingbo	8.7	20	13	1.313	0.035	167	0.001	0.005
9	Woori Yallock Creek at Warburton Highway, Woori Yallock	8.1	22	10	1.273	0.045	152	0.001	0.005

YARRA CATCHMENT–SOUTHERN URBAN TRIBUTARIES

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
24	Andersons Creek at Everard Drive bridge, Warrandyte	7.3	27	15	1.802	0.155	747	0.004	0.040
22	Brushy Creek at Lower Homestead Road bridge, Wonga Park	7.6	18	8	7.607	0.340	590	0.001	0.053
28	Gardiners Creek at South Eastern Freeway, Hawthorn	9.4	12	8	1.617	0.105	1,337	0.004	0.068
23	Jumping Creek at Jumping Creek Road bridge, Wonga Park	9.2	30	10	1.848	0.090	381	0.003	0.014
27	Koonung Creek at Bulleen Road, Bulleen	5.7	33	16	2.414	0.155	2,338	0.006	0.098
25	Mullum Mullum Creek at Deep Creek Reserve, Warrandyte	7.2	26	15	1.697	0.115	609	0.005	0.040
21	Olinda Creek at Macintyre Lane, Coldstream	7.2	22	13	2.618	0.220	393	0.002	0.014
26	Ruffy Creek at Parker Street, Templestowe	8.0	18	9	2.777	0.235	2,360	0.005	0.079

YARRA CATCHMENT–NORTHERN URBAN TRIBUTARIES

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
31	Darebin Creek at Clark Road footbridge, Ivanhoe	9.4	8	6	1.581	0.098	824	0.003	0.052
29	Diamond Creek at Main Road, Eltham	7.0	74	19	1.578	0.100	1,010	0.004	0.038
32	Merri Creek at Roseneath Street, Yarra Bend	9.8	12	8	1.869	0.155	345	0.005	0.077
33	Moonee Ponds Creek at Mount Alexander Road, Parkville	6.6	9	10	2.363	0.125	708	0.004	0.027
30	Plenty River at Henty Road bridge, Lower Plenty	6.4	97	28	2.001	0.155	1,168	0.007	0.042

YARRA CATCHMENT–YARRA MAIN STREAM AND ESTUARY

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
6	Yarra River at Chandler Highway, Kew	7.6	31	23	1.134	0.078	322	0.003	0.017
2	Yarra River at Don Road, Launching Place	9.2	10	8	0.600	0.025	251	0.001	0.005
5	Yarra River at Kangaroo Ground-Warrandyte Road bridge, Warrandyte	8.5	27	17	1.390	0.069	287	0.002	0.008
3	Yarra River at Maroondah Highway, Healesville	8.7	17	9	0.892	0.032	212	0.001	0.005
1	Yarra River at McKenzie-King Drive, Millgrove	10.3	9	4	0.540	0.022	146	0.001	0.004
7	Yarra River at Princes Bridge, South Melbourne	6.0	13	18	1.382	0.096	779	0.004	0.028
4	Yarra River at Spadonis Reserve, Coldstream	8.3	20	18	1.080	0.051	229	0.001	0.006

WATERS OF DANDENONG VALLEY

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
38	Corhanwarrabul Creek at Wellington Road, Rowville	8.8	35	13	1.652	0.081	258	0.005	0.031
35	Dandenong Creek at Boronia Road, Wantirna	7.8	22	21	1.430	0.110	639	0.006	0.095
37	Dandenong Creek at Pillars Crossing, Dandenong South	8.0	25	24	1.589	0.094	531	0.006	0.065
36	Dandenong Creek at Stud Road, Dandenong North	7.7	34	15	1.552	0.100	345	0.005	0.049
34	Dandenong Creek u/s Sheffield Road, Doongalla Forest	8.6	11	14	1.299	0.032	89	0.002	0.008
45	Elster Creek at Cochrane Street, Elwood	8.1	12	8	2.669	0.130	1,106	0.004	0.190
42	Eumemmerring Creek at Worsley Road, Bangholme	7.9	33	19	3.779	0.285	327	0.003	0.034
41	Hallam Main Drain at Sth Gippsland Highway Hampton Park	6.4	26	23	1.851	0.072	882	0.003	0.014
39	Mile Creek at Cheltenham Road, Keysborough	7.6	6	6	1.425	0.078	1,145	0.004	0.170
40	Patterson River at NWSC outlet, Bangholme	7.7	48	30	2.414	0.175	86	0.007	0.044

MORDIALLOC AND KANANOOK CREEKS AND MORNINGTON PENINSULA WATERWAYS

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
46	Balcombe Creek at Uralla Drive footbridge, Mount Martha	6.2	11	7	1.36	0.053	377	0.001	0.016
48	Chinamans Creek at Eastbourne Road, Rosebud West	3.3	6	5	1.72	0.042	203	0.001	0.010
47	Dunns Creek at Marine Drive, Safety Beach	8.0	8	6	0.99	0.056	302	0.001	0.010
44	Kananook Creek at Wells Street, Frankston	5.6	7	35	1.04	0.155	405	0.004	0.036
49	Main Creek at Boneo Road, Flinders	9.4	7	5	0.80	0.029	239	0.001	0.004
51	Merricks Creek at end Bridge Street, Merricks	7.3	12	10	1.05	0.052	337	0.001	0.008
43	Mordialloc Creek at Wells Road, Mordialloc	7.1	29	24	1.97	0.160	592	0.005	0.063
52	Warrangine Creek at Frankston-Flinders Road, Hastings	7.3	15	8	1.43	0.060	347	0.002	0.016
50	Watsons Creek at Dandenong-Hastings Road, Somerville	4.6	52	100	105.8	2.600	635	0.012	0.045

WESTERN PORT WATERWAYS

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
62	Bunyip River at Healesville-Koo Wee Rup Road, Koo Wee Rup	9.6	22	18	0.872	0.046	204	0.001	0.006
61	Bunyip River at Little Road, Iona	8.8	21	12	0.782	0.044	357	0.001	0.006
59	Bunyip River at North Labertouche Road, Tonimbuk	8.9	11	10	0.713	0.032	161	0.001	0.006
60	Bunyip River d/s Cannibal Creek, Longwarry North	9.3	17	11	0.693	0.042	370	0.001	0.006
54	Cardinia Creek at Ballarto Road, Cardinia	9.0	17	5	0.912	0.058	122	0.002	0.008
53	Cardinia Creek at Cadwick Road, Upper Beaconsfield	8.8	14	8	0.688	0.033	263	0.001	0.006
57	Deep Creek at Ballarto Road, Rythdale	6.0	24	21	1.136	0.120	117	0.002	0.012
65	Lang Lang River at Douin-Poowong Road, Athlone	7.9	14	8	1.626	0.100	268	0.001	0.005
64	Lang Lang River at South Gippsland Highway, Lang Lang	7.8	18	12	1.570	0.109	199	0.001	0.006
58	Tarago River at Morrisons Road, Labertouche	8.6	9	10	0.692	0.054	510	0.001	0.005
56	Toomuc Creek at Ballarto Road, Rythdale	6.5	33	28	1.541	0.340	246	0.002	0.012
55	Toomuc Creek at Princes Highway, Pakenham	8.6	19	6	0.935	0.056	462	0.001	0.010
63	Yallock Outfall at South Gippsland Highway, Monomeith	6.8	39	45	3.618	0.180	146	0.002	0.010

MARIBYRNONG RIVER AND TRIBUTARIES AND OTHER WESTERN WATERWAYS

Site no.	Description	Dissolved oxygen	Turbidity	Suspended solids	Total nitrogen	Total phosphorus	*E.coli*	Lead	Zinc
66	Maribyrnong River at Brimbank Park Ford, Keilor	7.0	19	16	1.565	0.072	119	0.001	0.008
67	Maribyrnong River at Canning Street Ford, Avondale Heights	7.4	22	14	1.595	0.062	134	0.001	0.007
68	Steele Creek at Rose Avenue, Niddrie	8.7	6	4	0.748	0.045	484	0.001	0.038
70	Kororoit Creek at Millbank Drive, Deer Park	6.5	22	18	1.023	0.071	167	0.002	0.012
71	Kororoit Creek u/s Racecourse Road Ford, Altona	6.4	17	28	1.585	0.200	204	0.004	0.021
72	Skeleton Creek at Ayr Street, Laverton	6.3	12	10	1.000	0.140	285	0.002	0.014
69	Stony Creek at Bena Street, Yarraville	5.7	13	10	3.606	0.740	2536	0.006	0.097

Performance against our operating charter

In 1999, with community input, we created a Waterways Operating Charter to define our goals, responsibilities and service commitments for these activities. We use this charter as a benchmark for our annual performance.

PERFORMANCE 2000/01

Commitment as set out in the charter	Result	Notes
Asset management There will be minimal instances of asset failure causing significant flooding, serious damage or personal injury.	✓	No instances occurred.
Flood mitigation (progress) Annual expenditure on flood mitigation works will be sufficient to reduce the number of vulnerable properties by 800 over 10 years.	✗	We reduced capital spending on this program to meet peak requirements in other programs. We will increase expenditure in 2001/02 and the following two years to bring the program back on schedule by July 2004.
Flood mitigation (project management standards) All projects undertaken in any one year will fully comply with the project management requirements.	✗	There was insufficient evidence that the priority setting procedures were fully applied. We will implement more rigorous recording and tracking procedures.
Flood event monitoring The Bureau of Meteorology will receive the initial notification and subsequent forecast information for all notifiable events on the stipulated waterways.	✓	We reported all notifiable events satisfactorily to the Bureau of Meteorology.
Property information statements All urban properties affected by flooding will have up-to-date flooding information available by June 2001 and continuously thereafter.	✓	We completed our initial rollout of improved information. We are providing regular updates as circumstances change or new properties are created.
Planning scheme updates All municipalities will have up-to-date flood related information in their planning schemes by June 2002.	✓	This program is on schedule, with amendments exhibited for 23 of the 31 municipalities where they are required.
Waterway works approvals No works will be approved unless appropriate measures are in corporated to protect waterway values.	✓	The commitment was implemented, and a supplementary audit of works approvals indicated compliance.
Unauthorised waterways works All significant instances of unauthorised works will be strenuously pursued.	✓	We took action to resolve cases of unauthorised works adversely affecting waterways. In several cases, unauthorised works were dismantled.
Waterway maintenance The maintenance program will be completed annually in accordance with targeted priorities and the project management requirements set out in Section 5.3.	✓	We implemented this program in accordance with the approved business plan. Internal audits verified compliance with the relevant standards.
Stream frontage protection At least 50,000 plants and 25 kilometres of fencing will be established each year to protect rural waterways under the Stream Frontage Protection program.	✓	We met these targets, constructing 27 kilometres of fencing and establishing 51,000 plants.
Streamflow management plan preparation Streamflow management lans will be produced each year to achieve full coverage by June 2003.	✗	Progress was made, but increasing complexity in plan production means that the program is behind schedule.
Streamflow management plan review From June 2003, sufficient previous plans will be revised each year to keep all plans up to date thereafter (ie no older than five years).	✓	Automatically achieved because no plans are yet old enough to require updating.

PERFORMANCE 2000/01 continued

Commitment as set out in the charter	Result	Notes
Waterway capital works Full implementation of the annually budgeted program will be achieved in accordance with waterways and drainage project management requirements	✗	We spent $4.05 million on waterway rehabilitation projects, slightly over the approved budget. However, there was insufficient evidence that the priority setting procedures were fully applied.
Waterway condition reports The condition of a proportion of waterways will be re-assessed and the results will be published each year to cover all waterways every five years using the Victorian Index of Stream Condition.	✓	The program is on schedule, with data now produced for 38 per cent of waterways and work in hand to cover well over 60 per cent by June 2002.
Waterway management plans 1. New plans will be produced each year to complete the required coverage by 2002. 2. Previous plans will be revised each year from 2002 to ensure that all waterways have up-to-date plans available.	✓	Six plans were completed during 2000/01, bringing completed plans to 37 of 42 required by June 2002. The program is on schedule, with no plans yet due for revision.
Codes of practice–status review The status of codes of practice relevant to stormwater quality protection will be reviewed and reported each year.	✗	A schedule of relevant codes was updated during the year, but code "status" assessment was not sufficiently detailed to satisfy the auditors.
Codes of practice–preparation and revision Waterways and Drainage will work with other agencies and industry bodies to complete new codes or revise old ones at the average rate of one each year to 2009.	✓	We made significant contributions to developing ResCode 2000 and Code of Practice for Protection of Council Assets and Control of Building Sites, both prepared by the Department of Infrastructure.
Stormwater management plans Sufficient stormwater management plans will be produced each year to ensure all 32 municipalities are covered by June 2003.	✓	Of the 32 scheduled stormwater management plans, 24 are complete or under way. The remaining eight are scheduled to commence during 2001/02.
Toxicant control recommendations A technical report and recommendations will be provided on at least one new toxicity issue each year.	✓	During the year, we produced three substantial reports, with conclusions on the effects of toxicants on receiving waters. Report recommendations were incorporated into waterway management plans.
Water quality improvement facilities New water quality improvement facilities will be constructed each year in accordance with the approved program and Waterways and Drainage project management standards.	✗	We constructed wetlands and other water quality improvement facilities costing $2.9 million, We did not reach our approved expenditure target of $3.35 million. There was insufficient evidence that priority setting procedures were fully applied.
Water quality reports–ambient monitoring The results of the previous calendar year's ambient monitoring program and trend analysis will be published by the end of May each year.	✓	We prepared a detailed report in May 2001, and posted it on our web site.
Water quality reports–investigative monitoring Results of the previous calendar year's investigative monitoring will be published by the end of September each year.	✓	We completed five reports covering water quality and fish populations in seven individual waterways during the financial year.
Water quality data standards All specified scientific and quality control standards, as assessed by periodic independent audit, will be complied with.	✓	We identified standards and verified compliance assurances.
Waterwatch strategy A forward strategy will be developed by June 2000 in collaboration with stakeholders.	✓	We finalised the strategy in May 2000.
Waterwatch strategy implementation Implementation of the Waterwatch strategy will be reported annually.	✓	A detailed internal report on the implementation of the Waterwatch Strategy was prepared, showing that good progress had been made on all components of the strategy.
Drainage schemes All new growth areas in development corridors will have drainage schemes in place within three years of significant subdivisional activity commencing.	✗	Seven drainage schemes were finalised during the year, and the overall program is well ahead of schedule. However, one scheme exceeded the three-year requirement because of unusually protracted negotiations with the local council.

Commitment as set out in the charter	Result	Notes
Property development controls 1. Ninety-five per cent of all referrals will be processed within the statutory 28-day period. 2. Ninety-five per cent of all agreement applications will be processed within the 60-day period agreed with the development industry.	✓	1. Ninety-nine per cent of 8,153 referrals were processed within 28 days; and 2. Ninety-nine per cent of 4,283 agreement applications were processed within 60 days
Research results Research expenditure will be maintained at a level of at least $450,000 per annum.	✓	Our research expenditure for the year was $520,000, most of which was for research undertaken through the cooperative research centres for Catchment Hydrology and Freshwater Ecology.
Research implementation Two significant improvements to work methods will be achieved each year as a result of research findings.	✓	We implemented improvements to flood level estimation, stormwater quality modelling, drainage scheme design, and works programming for aquatic habitat improvement during the year.
Community education The approved community education program will be fully implemented each year.	✓	We delivered a full program of activities, based on TV advertising, distributing newsletters and information sheets, additions to our website, displays at Melbourne Aquarium and additions to our schools education program.
Community attitude surveys Community attitude survey results will be reported for at least one new topic each year.	✓	Additional questions asked this year focused on how people prefer to access information about water and waterway related issues. Results indicated that despite expanding use of the Internet, the majority prefers to inquire over the phone.
Incident response preparation A program of incident response training, and preparation and review of contingency plans will be fully implemented each year.	✓	Our activities included reviews of contingency plans and emergency response training for 80 staff.
Incident response performance In each year, the service will operate as planned for all incidents that require emergency response.	✓	A satisfactory response was achieved for all incidents, though the full response system was only activated on two occasions, both of which involved flooding.
Innovation 1. Specific innovation targets will be developed and incorporated in each year's business plan. 2. Achievements against the previous year's innovation targets will be reported each year.	✓	We incorporated three projects into our 2001/02 business plan, and made good progress on six projects outlined in our 2000/01 business plan. We conducted a substantial Innovation Program with participation from 19 staff.

The operating charter assessed our performance in maintaining and improving the health of Melbourne's waterways.

Port Phillip Bay

Since European settlement, agricultural, industrial and urban development has significantly changed the quality of water in streams flowing into Port Phillip Bay. We have established wetlands to improve the quality of stormwater–runoff from catchments into streams and bays following rainfall–and of downstream receiving waters such as Port Phillip Bay.

We monitor stream-water quality and publish the results in our annual reviews. We also work with community groups and organisations whose activities affect water quality, including developers and local government.

Most of Melbourne's streams and drains flow into Port Phillip Bay. Discharge licences issued by EPA Victoria meet Victorian Government Environment Protection Policy objectives for relevant receiving waters.

We commissioned the Port Phillip Bay Environmental Study, which was completed in 1996. This study provided the basis for improved environmental management of the bay.

An EPA Victoria review of Victorian Government Environment Protection Policy for Port Phillip Bay, conducted in 1997, incorporated recommendations from the study, in particular a recommendation to reduce the total load of nitrogen entering the bay.

Managing stormwater

The Port Phillip Bay Environmental Study of 1996 recommended reducing nitrogen entering the bay by 500 tonnes a year through catchment management initiatives.

We will contribute to this reduction through targeted stormwater initiatives such as pollution-reducing wetlands.

During the year, we completed earthworks and began planting aquatic vegetation on nine wetlands in the south-east growth corridor. The wetlands are due to be completed by June 2003. We also completed design work for another wetland and will begin earthworks in 2001/02.

We worked closely with land developers on additional wetlands constructed at new housing estates in Mill Park North, Roxburgh Park, Berwick East, Beaconsfield, Narre Warren South and Laverton South.

Aquatic plants help improve the quality of stormwater entering Port Phillip Bay.

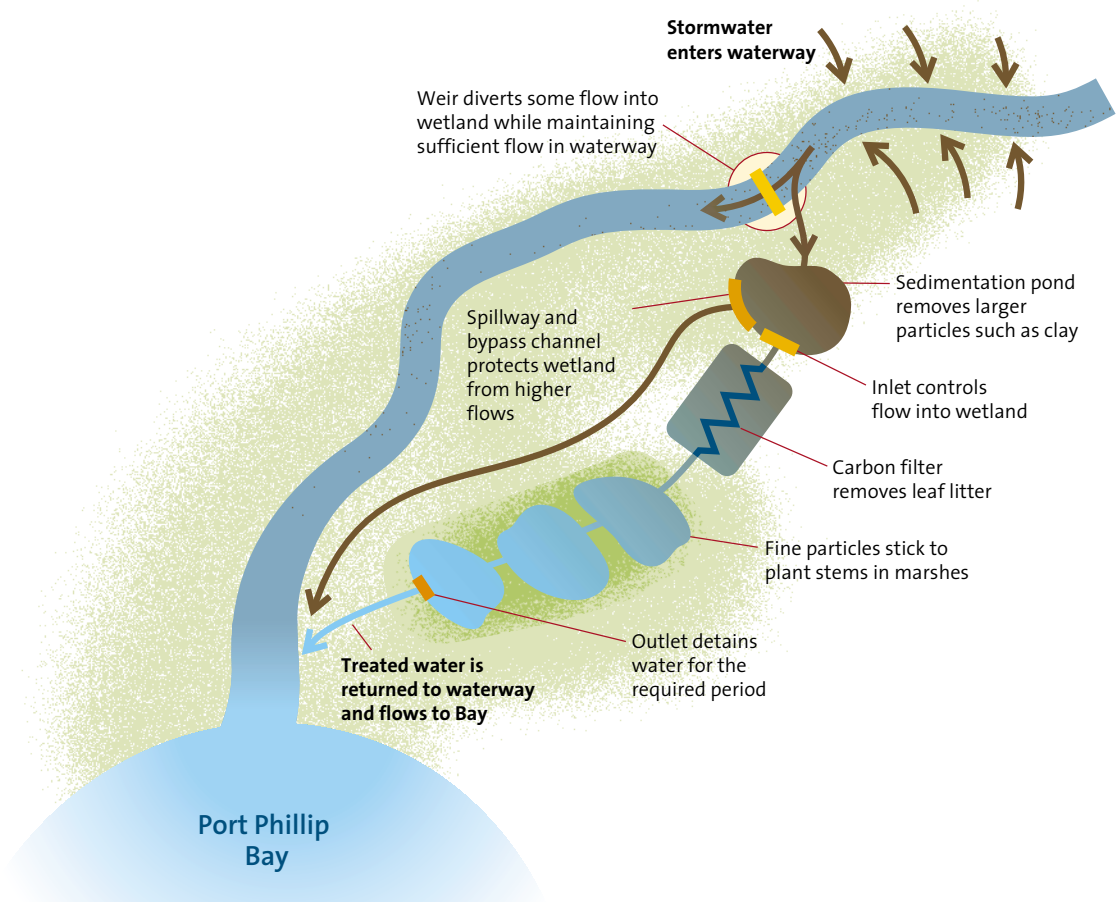
The plants that protect Port Phillip Bay

More than one million aquatic plants are to be put to work to improve the quality of stormwater entering Port Phillip Bay. The plants are being established in 10 wetlands in Melbourne's south-east growth corridor as part of the $7.5 million Healthy Bay Initiative. When complete, the wetlands will cover more than 80 hectares and treat stormwater runoff in the cities of Casey, Kingston, Knox and Greater Dandenong.

Melbourne Water designed the wetlands, with assistance from engineering consultants. The concept revolves around several methods of treatment, including sedimentation ponds, carbon filters (leaf traps) and marshes.

The wetlands are designed to slow down and store the flow of water for about three days. During this time, the sediment is settled and biological actions on the plant stems, along with sunlight and time, cleanse the water. Various types of biofilm including a range of bacteria and algal species grow on the stems of the plants. Sediment sticks to this film, allowing the bacteria and algae to transform and absorb nutrients and other pollutants from the stormwater.

The plants, including sedges, rushes, herbs and some woody species, have been selected because they are robust, adapt well to the growth conditions in wetlands and urban waterways, and provide efficient treatment of stormwater as it passes through the wetlands. The plants, which have been propagated in specialist nurseries, are of varying sizes, with the largest growing up to 1.2 metres out of the water.



Peter Breen, Project Leader with the Cooperative Research Centre for Freshwater Ecology, says the plants create a roughness in the flow path, which allows particles to be trapped. "Without the plants, the wetlands would be like lakes and the flow rate would be too fast to trap the pollutants," Peter says. "The plants provide a framework for the biofilm to grow on."

Over time, the plants transform nutrients and lock them up in the sediment or within the plants' own biomass. The plant roots also modify chemical reactions that occur in the wetlands, and reduce the amount of pollutant released. Flow control structures direct the required amount of water into the wetland, and ensure that water is retained and treated for the specified period.

The CSIRO Port Phillip Bay Environmental Study, completed in 1996, identified stormwater as one of the major sources of nitrogen to the bay. This stormwater, which drains from streets, footpaths and gardens, often carries litter and sediment into rivers, creeks and the bays. Toxicants and nutrients are attached to the sediment particles.

The three-year Healthy Bay Initiative is funded by Melbourne Water and the Australian Government's Natural Heritage Trust.

Working with local councils

We provide advice to developers and councils on how new urban development can improve stream-water quality. Councils are responsible for local stormwater management. We help them develop stormwater management plans to improve stormwater quality by preventing pollution at the source.

During the year, we helped the Banyule, Knox, Hume, Manningham, Maribyrnong and Maroondah councils develop stormwater management plans, and the Moreland Council complete its plan.

We are also working with EPA Victoria and local councils on the Victorian Stormwater Advisory Committee, which is guiding implementation of the $22.5 million Victorian Stormwater Action Program. It first met in October 2000.

Best-practice developments

During the year, we worked with local councils and property developers on 13 residential estates featuring water-sensitive design concepts that improve stormwater quality. These included Lynbrook Estate, a modern subdivision at Lyndhurst, which has applied innovative techniques to manage stormwater.

The estate has swales or shallow grassed depressions to collect rainfall and then infiltrate the water to the ground where an underground system of gravel and perforated pipes takes it to wetlands for further treatment before disposal to the nearest waterway. Water quality is much improved and runoff to waterways and Port Phillip Bay is slowed, allowing sediment to fall out.

Similarly, we worked closely with the developer of The Waterways estate in Braeside to construct what is believed to be the largest man-made wetlands in Victoria. The 46 hectares of wetlands contain more than one million aquatic plants and reduce pollution in Mordialloc Creek and Port Phillip Bay by treating catchment runoff. We helped select the most appropriate plant species and contributed to the design of the wetlands.

Baywide monitoring

We worked with the Department of Natural Resources and Environment to plan a water quality monitoring program to provide early warning of detrimental changes to critical elements of natural nitrogen reduction processes in Port Phillip Bay.

We provided $110,000 to buy monitoring equipment during the year and will provide annual funds to conduct the program over the next three years.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Managing stormwater Complete Healthy Bay Initiative in south-east growth corridor by June 2003.			✓	We constructed nine wetlands and began planting. *Complete project by June 2003.*
Work with local councils Develop four more stormwater management plans by June 2001. Achieve complete coverage by June 2003.			✓	Developed plans for six councils and completed an additional plan. *Develop seven more stormwater management plans by June 2002.* *Achieve complete coverage by June 2003.*
Best practice developments Work with councils and developers to apply best-practice environmental management guidelines for urban stormwater management at residential estates.			✓	Worked on 13 estates during the year. Tested the performance of innovative stormwater management techniques at Lynbrook Estate, Lyndhurst. Initial results indicate that the techniques are meeting expectations for improved stormwater quality. *Use test results to modify the next stages of the development.*
Bay-wide monitoring Contribute to developing a Port Phillip Bay water quality monitoring program.			✓	Worked with the Department of Natural Resources and Environment to develop this project. *Contribute 70 per cent of the program's annual operating costs for the three years from 2001/02.*

Western Port

Recreational and tourist activities are highly significant to Western Port and its surrounds with the marine environment's health critical to these activities.

We are responsible for managing streams that enter Western Port. Our aim is to minimise the impact of these waterways to help manage Western Port in a sustainable manner.

We are examining the impact of these streams on Western Port. In particular, the possibility that sediment entering the bay is contributing to the poor state of seagrass meadows.

During the year we helped develop a proposal for a broader environmental assessment of Western Port.

Sediment study

During 2000, a three-year research project began investigating the nature and source of sediments in Western Port, and how they are transported. In the first year, the focus was on assessing sedimentation rates and sediment processes in the bay. The aim is to understand the history of sediment delivery from the catchment and what happens to sediment when it enters the bay.

Study to help solve seagrass puzzle

A three-phase study of sediment in Western Port could help solve the mystery of declining seagrass meadows in the bay. At least 70 per cent of seagrass in Western Port has died during the past 20 years, although there has been some recovery recently.

The $250,000 study by the CSIRO, in collaboration with Melbourne Water and EPA Victoria, will help determine the history of sediment delivery and how sediment moves around Western Port. The study may help identify "hotspots" in the catchment most in need of erosion control works.

As part of the study, CSIRO has collected sediment and suspended solids samples from Western Port, and analysed particle size, major elements, nutrients, organic matter and pesticides. Sedimentation rates are being determined using various dating techniques.

Melbourne Water freshwater scientist Rhys Coleman says: "We want to reduce sediment entering Western Port, and we need to understand to what extent erosion is occurring in streams and on the land throughout the catchment. At the end of the study, we will have a more complete picture of what is going on in the catchment and bay."

The second and third phases of the study will focus on modelling erosion and sediment dynamics in the catchment, as well as identifying the main sources of sediment in Western Port.

A joint study should tell us why seagrass meadows are declining in Western Port.

Broader environmental study

A management model of Western Port will be developed to evaluate options for improving its environmental condition. Research needed to develop the model will be coordinated through a multi-agency group including Melbourne Water, EPA Victoria, Central Coastal Board, Catchment and Land Protection Board and the Department of Natural Resources and Environment. The project is to be completed by June 2006.

The first step, during 2001/02, will be a workshop of experts to identify additional information needed to establish the model.

As a result of concern about the environmental condition of Western Port, a portfolio coordination group has been established to provide a forum to discuss common issues. A research program will be developed by December 2001.

Bunyip Main Drain project

During the year, we began works on a long-term improvement plan for the Bunyip Main Drain (the Bunyip River between Longwarry and Koo Wee Rup).

The plan details works to control how a stream winds around, reduce erosion, improve the environmental condition of the bed and banks and maintain the level of flood protection to adjacent properties.

The works include protecting roads, bridges, levee banks and homes; and reducing the transport of sediment to Western Port and risk to the community from flooding. The project will be completed progressively over the next 10 years.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Sediment study Continue a joint investigation into sediment sources to Western Port with CSIRO and EPA Victoria.			✓	During the year, a draft report on the first phase of the sediment study was received and the second phase begun. Continuous turbidity data will be correlated with flow in order to determine problem sources of sediments to be used to guide further research. *Complete a final report on this project by December 2002.*
Broader environmental study Establish an integrated model of Western Port to use in planning management actions.		✓		This was agreed during the year. *Hold a workshop to identify information needed to develop a model by December 2001.*
Bunyip Main Drain project Rehabilitate the Bunyip Main Drain to restore structural integrity and for flood protection.		✓		In June 2001, we completed works to prevent erosion and stabilise the Bunyip Main Drain, as the first part of a 10-year project. *In December 2001, we will begin levee reconstruction and associated bed and bank stabilisation in the section upstream of Cora Lynn.*

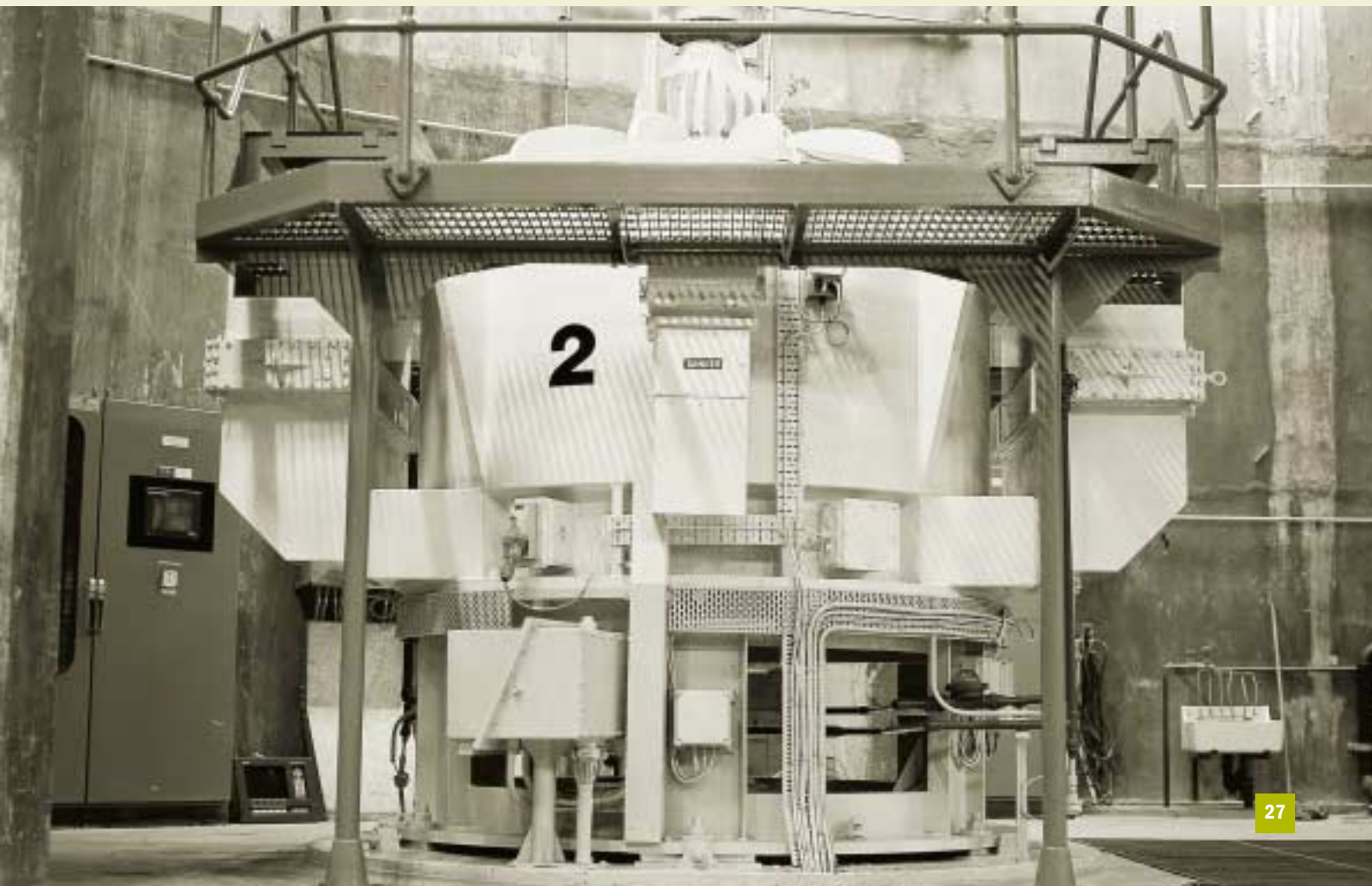
Our sewage

Melbourne Water is responsible for treating most of Melbourne's sewage in a way that minimises environmental impacts and protects public health. Our aim is to reduce impacts on the marine environment, and minimise odour and land contamination.

The retail water companies collect sewage from households, and sewage and trade waste from businesses in greater Melbourne. Some 94 per cent of this waste is transferred to our Eastern Treatment Plant at Carrum and Western Treatment Plant at Werribee. After treatment, it is discharged to Bass Strait and Port Phillip Bay respectively. These treatment plants operate under EPA Victoria licences, which regulate discharges to air, water and land.

Licence requirements must be consistent with Victorian Government Environment Protection Policy quality objectives for receiving waters. These objectives have been developed to balance the value to the community of our sewerage services and to protect the long-term health of the marine environment.

One of eight main pumps at Brooklyn, our operational hub, that pumps a significant amount of Melbourne's sewage.



Western Treatment Plant

Our Western Treatment Plant receives and treats most of the sewage produced in Melbourne's western and northern suburbs, including most industrial waste.

We are transforming the treatment processes we use at the plant by discontinuing unsustainable processes such as the historic land and grass filtration systems. These will be decommissioned by 2005 and replaced with lagoon treatment systems enhanced with activated sludge technology. Effluent from the enhanced lagoons will be used for onsite and offsite recycling schemes.

Environmental regulation

We worked to achieve tighter standards to reduce the amount of nitrogen entering Port Phillip Bay and to improve our odour performance as required by our discharge licence for the Western Treatment Plant. We will achieve these tighter standards by enhancing our lagoons, the first of which we completed during the year.

EPA Victoria granted us an accredited licence in August 2000 in recognition of the plant's excellent environmental performance. The new licence comprises concise statements of discharge limits, an environment improvement plan, an audit program and an environmental management system.

Environment improvement plan

The plan incorporates improvements needed at the plant to meet the revised licence conditions and the accredited licence. We developed this plan with EPA Victoria and the Western Treatment Plant Community Liaison Committee and published it in September 2000. The plan includes enhanced lagoons, water recycling, monitoring programs, odour management and a conservation management plan.

Further information on these initiatives can be found in the licence compliance tables and the water recycling and odour management report cards.

Enhanced lagoons

We are modifying the lagoons at the plant to reduce nitrogen loads to Port Phillip Bay by including a process similar to a return-activated sludge process between the fourth and fifth ponds.

During the year, we monitored modifications on the first lagoon to better understand its potential to treat sewage to the new licence requirements. We found that the new process established nitrification conditions well and showed potential to use less energy and treat higher flows than expected. The new lagoon system was also achieving better than expected disinfection results.

Biological investigations

We are investigating biological communities such as fish, aquatic plants and shellfish to reduce the impact of the discharge from our Western Treatment Plant on these communities.

We also developed a program to evaluate the accumulation of toxicants in commercially and recreationally harvested species. Flathead and mussels were selected for the program. We held several workshops with EPA Victoria to confirm the program's scope. In March 2001, we issued a brief to two consultants, and the program is expected to be completed by December 2001.

Preserving conservation values

Our Western Treatment Plant has significant environmental values. These include habitat for visiting and rare birds and animals. The site is included in Australia's list of wetlands under the international Ramsar convention. Land alongside the Werribee and Little Rivers and Port Phillip Bay also has environmental values.

We completed a conservation management action plan in July 2000 to detail accountability for managing these issues. The plan documents our responsibilities and those of Parks Victoria and is included in the environment improvement plan.

We completed most of the priority actions for the first year. These included a weed and fox control program, assessing the impact of proposals needed under the new licence on Ramsar values and keeping stock out of coastal areas.

During the year, we worked with the Department of Natural Resources and Environment to nominate sections of our Western Treatment Plant to the East Asian-Australasian Shorebird Network. Management of these sites aims to conserve migratory shorebirds and is consistent with existing management for the Port Phillip (Western Shoreline) and Bellarine Peninsula Ramsar site that includes our treatment plant.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Environmental regulation Achieve 100 per cent licence compliance for discharge parameters at our Western Treatment Plant.			✓	We achieved 100 per cent compliance with discharge parameters. *This is an ongoing target.*
Achieve an accredited licence.			✓	Awarded an accredited licence in October 2000. *Retain accreditation status with EPA Victoria.*
Enhanced lagoons Retrofit enhanced lagoon technology to an existing major lagoon system by March 2001.			✓	We retrofitted the 55 East lagoon. Use information gained from this project in retrofitting at least one more lagoon by June 2004.
Improvement plan Identify and construct any further works required to meet EPA Victoria licence conditions that come into effect in 2005.			✓	The environment improvement plan was completed in September 2000. It includes all actions needed to meet the new licence conditions. *Implement specific actions in the improvement plan.*
Biological investigations Develop programs specific to Western Treatment Plant outlets as well as bay-wide monitoring.		✓		Biological studies were completed to help establish a monitoring program and we provided input for developing bay-wide monitoring programs. *Develop a monitoring program for environmental impacts around Western Treatment Plant outlets in consultation with EPA Victoria. Contribute to implementing the bay-wide monitoring program.*
Preserving conservation values Continue to monitor the impact of the plant on the surrounding environment and respond to significant issues with Parks Victoria.		✓		We completed a conservation management action plan during the year. Our implementation focused on priority action items required to be completed during the year. *Include actions from the plan in the first update of the Environmental Improvement Plan.* *Review the plan by June 2003.*

Western Treatment Plant licence compliance

Our Western Treatment Plant, at Werribee, treats about 54 per cent of Melbourne's sewage during 2000/01. Our plant has a licence from EPA Victoria to discharge treated effluent to Port Phillip from four discharge points between the Werribee River and Point Wilson. Our aim to achieve 100 per cent compliance with our licence.

The following tables show compliance performance of the treatment plant during 2000/01 against the parameter limits detailed in the EPA licence. In the tables, the limit is the required performance as stated in the licence and the result is how the treatment plant performed.

During the year, EPA Victoria awarded us an Accredited Licence for the discharge from Western Treatment Plant. The new licence has plant-wide limits for all discharge parameters in the licence based on a weighted average calculated using the following formula:

> Sum (flow from each discharge point multiplied by the concentration of the waste indicator) divided by
>
> Sum of flow from each discharge point.

There is a plant-wide limit on flow of a combined average of 700 megalitres per day over any one year. The licence's Environmental Improvement Plan has an annual average limit for total nitrogen load of 3,500 tonnes by 2001 with a target of 3,200 tonnes by 2005.

Average discharges from each of the outlets during 2000/01 are in the following table.

ANNUAL AND AVERAGE DAILY DISCHARGES

Outlet	Annual discharge ML/annum	Average daily discharge ML/day
15 East	79,728	218
145 West	27,841	76
Lake Borrie	19,854	54
Murtcaim	25,372	70
Total	**152,795**	**419**

Compliance with the flow-weighted parameters is in the following table.

FLOW-WEIGHTED PARAMETERS

Parameter (unit)	Median		90th percentile		Maximum	
	Limit	Result	Limit	Result	Limit	Result
$CBOD_5$ (mg/L)	25	10		12		16
BOD_5 (mg/L)		25		67		82
Suspended solids (mg/L)	100	41	130	58		74
Ammonia as nitrogen (mg/L)	25	11		21	40	23
Total nitrogen (mg/L)		24		36		51
Total phosphorus (mg/L)		9	15	10		11
Colour (Pt/Co units)		143	600	190		222
MBAS as LAS (mg/L)	0.5	0.2		0.3	1.0	0.3
Silicate (mg/L)		13		14		14
Electrical conductivity (µS/cm)		2,572		3,768		7,124
Cadmium (mg/L)	0.005	0.0003		0.0004	0.01	0.0005
Chromium (mg/L)	0.05	0.009		0.014	0.15	0.015
Copper (mg/L)	0.05	0.010		0.014	0.1	0.026
Lead (mg/L)	0.05	0.004		0.006	0.1	0.008

FLOW-WEIGHTED PARAMETERS continued

Parameter (unit)	Median		90th percentile		Maximum	
	Limit	Result	Limit	Result	Limit	Result
Mercury (mg/L)	0.0005	0.0001		0.00012	0.001	0.00018
Nickel (mg/L)	0.05	0.017		0.019	0.15	0.021
Zinc (mg/L)	0.1	0.019		0.026	0.25	0.067
Benzene (µg/L)		1.0		1.0		10.0
Toluene (µg/L)		1.0		1.0		10.0
Phenol (µg/L)		26.0		59.0		95.0
Total PAHs (µg/L)		5.0		8.0		8.0
E.coli (org/100mL)		1,279		8,287		26,183

(All data in mg/L unless otherwise indicated)

Compliance with the total nitrogen load is in the following table.
EPA Victoria's discharge licence Environmental Improvement Plan has an annual three year average limit for total nitrogen load of 3,500 tonnes by December 2001 with a target of 3,200 tonnes by December 2005.

TOTAL NITROGEN LOAD TO PORT PHILIP BAY

Parameter	Units	Maximum	
		Limit	Result
Total annual nitrogen load	Tonnes	4,300*	3,740

*This limit is specified in the previous licence.

Final effluents at the four discharge points were sampled and analysed for polychlorinated dibenzo dioxins and furans (PCDD/F), as toxic equivalents of 2,3,7,8 tetrachloro-dibenzo-p-dioxin. The sampling for PCDD/F is carried out once at each outlet in a specified month each year. Results are shown in the following table.

OUTLET PCDD/F AS TOTAL TOXIC EQUIVALENTS OF 2,3,7,8 TCDD.

Date	July 2000	October 2000	January 2001	April 2001
Site	Lake Borrie	Murtcaim	15E	145W
I-TEQ–Excluding LOD Values	7.97	0.44	0.75	0
I-TEQ–Including Half LOD Values	10.1	5.25	3.20	19.7

(All results in pg/L)

Legend
BOD_5–biochemical oxygen demand at 5 days
$CBOD_5$–carbonaceous biochemical oxygen demand
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
µS/cm–microsiemens per centimetre
Pt/Co units–platinum cobalt units (a measure of colour)
µg/L–micrograms per litre
org/100mL–organisms per 100 millilitres
pg/L–picograms per litre

Bacteriological monitoring

Every seven days, a sample of seawater is collected in 60-centimetre deep water offshore from Beach Road and 160 South Road and analysed to determine the concentration of *E.coli* in the sample. These two points are public access points to Port Phillip Bay within our Western Treatment Plant and outside the designated mixing zones for *E.coli*.

E.COLI–42-DAY GEOMETRIC MEANS AND 80TH PERCENTILES

	Geometric mean		80th percentile	
42-day period ends	160 South Road	Beach Road	160 South Road	Beach Road
19 July 2000	2	4	16	10
30 August 2000	3	5	16	10
11 October 2000	4	1	30	18
22 November 2000	27	9	30	18
02 January 2001	2	1	23	18
13 February 2001	10	2	23	18
28 March 2001	8	1	18	6
08 May 2001	5	6	18	6
20 June 2001	4	4	10	6

(All results organisms per 100 litres)

Raw-sewage monitoring

We monitor the sewage coming into the plant to ensure that plant processes are managed to treat sewage in the best possible manner. During 2000/01 the quality of that sewage was:

Parameter (unit)	Median	90th percentile	Maximum
Flow (ML/day)	511	596	1,479
BOD_5 (mg/L)	523	626	1,397
Suspended solids (mg/L)	379	438	660
Ammonia as nitrogen (mg/L)	31	33	37
Total nitrogen (mg/L)	57	64	72
Total phosphorus (mg/L)	12	13	15
Colour (Pt/Co units)	150	178	180
MBAS as LAS (mg/L)	5.25	6.59	7.40
Silicate (mg/L)	14	15	15
Electrical conductivity (µS/cm)	1,900	2,000	2,200
Cadmium (mg/L)	0.0006	0.0016	0.0027
Chromium (mg/L)	0.048	0.063	0.075
Copper (mg/L)	0.14	0.20	0.41
Lead (mg/L)	0.018	0.024	0.026
Mercury (mg/L)	0.0006	0.0009	0.0013
Nickel (mg/L)	0.026	0.046	0.058

continued

Parameter (unit)	Median	90th percentile	Maximum
Zinc (mg/L)	0.27	0.37	0.47
pH (pH units)	7.0	7.2	7.4
Benzene (µg/L)	1.0	9.0	10.0
Toluene (µg/L)	4.0	10.0	15.0
Phenol (µg/L)	840	2,100	2,600
Total PAHs (µg/L)	8.0	20.0	28.0

The total volume of sewage received at our Western Treatment Plant during 2000/01 was 195,062 megalitres.

Aerators at work in the lagoon system at our Western Treatment Plant.

Eastern Treatment Plant

Melbourne Water's Eastern Treatment Plant treats sewage predominantly from Melbourne's south-eastern suburbs, including some trade waste from industry and commerce.

The plant uses a return activated sludge treatment process. Sludge from this process is digested on site, dried and stockpiled as biosolids.

Effluent is discharged under EPA Victoria discharge licence requirements to Bass Strait at Boags Rocks, between St Andrews and Gunnamatta beaches, via a pipeline from the plant. Businesses along the pipeline recycle about one per cent of the effluent for golf course irrigation and horticultural activities. A small proportion is used onsite.

The EPA Victoria discharge licence specifies the quality of effluent discharged by the plant and also describes other requirements relating to off-site impacts such as odour and litter, and site research such as monitoring and improvement investigations.

During the year, we implemented actions required by EPA Victoria following the CSIRO Effluent Management Study we commissioned. This study, released in June 1999, focused on reviewing disposal options for effluent from the plant. It showed that the effluent, especially ammonia and freshwater, had affected the marine environment.

Effluent quality

During the year, we were fined by EPA Victoria for litter which was washed up on St Andrews beach next to our outfall and for an odour complaint received from a resident near the plant, although we complied with all discharge parameter limits of our EPA Victoria discharge licence.

Process improvements

The CSIRO Effluent Management Study found that process improvements at the plant could reduce the impact of the effluent we discharge at Boags Rocks on the surrounding marine environment. We have used the study's findings to investigate improvements and worked with communities and EPA Victoria on an environment improvement plan.

Fine over beach litter

After several days of very wet weather, litter was found at St Andrews Beach near Boags Rocks in November 2000. The litter included cotton bud stems and plastic from sanitary products.

An EPA Victoria investigation found that the litter had originated from our Eastern Treatment Plant. This led to us being fined $5,000 by EPA Victoria for breaching licence condition 1.5(a), which relates to visible floating litter.

It was the first time that Melbourne Water has been fined for a licence breach. Managing Director Brian Bayley said: "We acknowledge that this incident should not have occurred and was completely unacceptable."

We commissioned an independent review of operating procedures immediately after the discovery of litter. This review revealed that microscreens, a measure to prevent litter from entering the outfall pipeline, had been partly or fully bypassed to allow the treatment process to deal with the wet weather flows.

In response, we amended operating procedures at Eastern Treatment Plant, withdrawing the discretion to fully or partly bypass the microscreens regardless of weather conditions. We also installed additional fine screens on the outlet to the pipeline.

In addition, we have since spent some $50,000 on improved security and surveillance along the Eastern Treatment Plant pipeline to prevent illegal dumping into the system.

We regularly inspect St Andrews and Gunnamatta beaches to monitor our performance regarding litter and we update water quality data weekly on our website. We are also working to educate the community to reduce the quantities of litter, oil and grease that households and industry put into the sewerage system.

The Effluent Management Study found that ammonia in the effluent was affecting the marine environment at the discharge point. In response, we began a project during the year in one of our aeration tanks to reduce ammonia in the effluent.

We worked with the CSIRO to establish a long-term receiving water-monitoring program. We will apply to EPA Victoria for approval of works as part of our preferred ongoing approach to managing effluent from the plant. This application is due in November 2001.

Ammonia project aims to improve effluent

During the year, we began a $5 million project to examine the impact of ammonia-reducing technology in treated effluent from our Eastern Treatment Plant. The project aims to achieve a significant improvement in the marine environment around Boags Rocks and could reduce ammonia levels by more than 75 per cent.

The project involves separating one of our six 20,000 cubic metre aeration tanks into aerated and unaerated (anoxic) zones, resulting in a process known as nitrification/denitrification. This process encourages ammonia-consuming microorganisms to grow in aerated zones and removes nitrates subsequently formed in the unaerated zones. Initial results have been good with ammonia levels reducing from about 20 milligrams per litre to less than five milligrams per litre. If the project proves successful, we will upgrade all the tanks.

In June 2001, we presented an interim report to EPA Victoria. A final report on the pilot project is due by October 2001.

We also completed works on the pretreatment area to reduce the potential for litter to pass through the plant by upgrading screens at the front of the plant to collect more material. We de-water the screenings and take them to an EPA Victoria-approved disposal facility. Litter collected here does not pass through the plant, improving downstream processes and reducing the amount of litter to be collected before being pumped from the plant to the outfall.

Treated effluent from our Eastern Treatment Plant is discharged into Bass Strait at Boags Rocks.

Monitoring programs

We have contracted the CSIRO to plan and deliver a long-term monitoring program of receiving waters at Boags Rocks. This program, which began in May 2001, received close scrutiny from a peer group of experts before being approved by EPA Victoria in December 2000.

The program monitors sub-tidal reefs, effluent dispersion and toxicity and bio-accumulation in crustaceans. We will use the program to measure the impact of process improvements at the plant and to enhance knowledge of the impact of the effluent on the marine environment.

During the year, researchers from Monash University's Centre for Epidemiology and Preventive Medicine completed a year-long microbiological monitoring program at 13 sites around Boags Rocks.

The research, which compared water quality at the sites with draft World Health Organization guidelines for recreational bathing water, found that surfers or swimmers at Gunnamatta Beach are unlikely to be at increased risk of illness due to faecal microorganisms in the water compared with swimmers at other ocean beaches around Melbourne.

We also began a project to better understand the causes and effects of foam, small fat balls, odour and discolouration associated with the discharge. These effects from the discharge occur intermittently and are becoming of greater concern to some communities.

The investigation of aesthetic impacts, including improvement options, is part of a study examining the feasibility of upgrading our Eastern Treatment Plant to tertiary treatment.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Effluent quality Achieve 100 per cent licence compliance for our Eastern Treatment Plant.		✓		While our discharge parameters for effluent met EPA requirements, we were fined over a litter complaint. *We aim to meet community expectations and our licence requirements at all times.*
Process improvements Develop cost-effective plans to implement environment improvement program.		✓		We began work with EPA Victoria and the community to establish an agreed improvement plan to address issues from the CSIRO study and to manage effluent for the plant in a sustainable manner. *Complete works approval application by November 2001.*
Conduct a major project into improved aeration efficiency and nitrogen removal performance by December 2001.		✓		We began the ammonia reduction project in May 2001. Initial results were encouraging. *Issue a final report on the project by October 2001.*
Complete upgrade works for the enhanced removal and handling of grit and screenings by December 2000.		✓		We have installed more efficient screens at the front of the plant. *Complete site clean-up and adjustments to improve screening efficiency by December 2001.*
Monitoring programs Undertake further studies to finalise response to the Effluent Management Study and develop an effective long-term monitoring program by December 2000.		✓		We began a long-term monitoring program developed by CSIRO in May 2001. Began research into the aesthetic impacts of discharge around Boags Rocks in April 2001. *Complete project by December 2001.* *Use data as part of a works approval submission to EPA Victoria by November 2001.*

Eastern Treatment Plant licence compliance

Our Eastern Treatment Plant, at Carrum, treated 40 per cent of Melbourne's sewage during 2000/01. Our plant has a licence from EPA Victoria to discharge treated effluent to Bass Strait at Boags Rocks.

The tables on pages 37 to 40 show our plant's compliance performance during 2000/01 (results) against the parameter limits detailed in the EPA Victoria licence (limit). Our aim is to achieve 100 per cent compliance with our licence.

Michael Harding, team leader of our south east operations, in front of improved screening for litter at the Eastern Treatment Plant.

Discharge to water

The following results represent samples taken from the final effluent sample point and flow measurements at the outfall pumping station at Eastern Treatment Plant from 1 July 2000 to 30 June 2001.

Parameter, (units)	Median		90th percentile		Maximum	
	Limit	Result	Limit	Result	Limit	Result
BOD_5 (mg/L)	20	13	40	27		54
$CBOD_5$ (mg/L)		5		12		18
Suspended solids (mg/L)	30	12	60	29		36
pH (pH units)		7.4		7.5	6 – 9	6.9 – 7.6
Ammonia as nitrogen (mg/L)	30	19		27	40	31
Total combined nitrogen (mg/L)		30		35.5		37
Total phosphorus (mg/L)		7.3	15	8.6		9.5
MBAS as LAS (mg/L)	0.4	0.2	0.7	0.35		0.5
Cadmium (mg/L)		0.0001	0.005	0.0002	0.01	0.0004
Chromium (mg/L)		0.005	0.075	0.008	0.15	0.011
Copper (mg/L)		0.013	0.05	0.02	0.1	0.029
Lead (mg/L)		0.003	0.05	0.006	0.1	0.01
Mercury (mg/L)		0.000025	0.0005	0.000025	0.001	0.000025
Phenol (µg/L)		0.5		2.35	100	3
Toluene (µg/L)		2.5		4	50	8
Benzene (µg/L)		0.5		2.3	25	2.5
PAH's total (µg/L)*					15	4
Flow (ML/day)	540	412		509	770	640
Flow corrected by 45 ML/day effluent used in the plant (ML/Day)		367		464		595

*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].

Note:

All results found to be less than the detection limit were taken as half the given value for example, if the detection limit is two we use one as a result.

The following results represent samples taken from the Truemans Road sample point from 1 July 2000 to 30 June 2001.

Parameter (units)	Median		90th percentile		Maximum	
	Limit	Result	Limit	Result	Limit	Result
Total residual chlorine (mg/L)		0.1		0.2	1.0	0.2
E.coli (org/100mL)	200	14.5	1,000	149		7,500
PH (pH units)		7.2		7.3		6.9 - 7.5
Dissolved oxygen (mg/L)		6.9		7.6		4.8 - 7.7

During December 2000, samples of raw sewage and final effluent were taken and analysed for Polychlorinated dibenzo-p-dioxins (PCDDs) and Polychlorinated dibenzofurans (PCDFs). The final effluent result gives a combined international toxic equivalent (I-TEQ), of 2.58 picograms per litre. Eastern Treatment Plant does not have a licence limit for this parameter.

Discharges to land

The following results detail the quality of effluent discharged to land on site at Eastern Treatment Plant as sampled from the final effluent sample point and the treatment plant's reuse sample point from 1 July 2000 to 30 June 2001.

Parameter	Unit	Median	90th percentile
*E.coli**	Org/100mL	28	441
BOD_5**	mg/L	13	27
$CBOD_5$**	mg/L	5	12
Electrical conductivity**	mS/cm	960	1,000

* Sample taken from Eastern Treatment Plant reuse sample point. Recycling guidelines specify *E.coli* to have a median of less than 1,000 organisms per 100 millitres and an 80th percentile of less than 4,000 organisms per 100 millitres for Class C effluent.
** Sample taken from Eastern Treatment Plant final effluent sample point.

Bacteriological monitoring–beach samples

Samples of receiving waters were taken at six locations along the Gunnamatta and St Andrews beaches and analysed for *E.coli.* The sample points are:

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

42-day period ends	Geometric (log) mean (org/100mL)* SEPP (Waters of Victoria) objective: 200 org/100mL					
	Beach 1	Beach 2	Beach 3	Beach 4	Beach 5	Beach 6
11 August 2000	7.8	1.3	1.3	1.3	21.2	1.3
22 September 2000	3.6	1.6	1.1	1.3	13.6	1.0
3 November 2000	4.3	1.0	1.3	1.5	13.5	1.4
15 December 2000	27.4	1.0	1.3	1.0	47.9	3.5
26 January 2001	3.4	1.0	1.0	1.0	24.7	1.1
9 March 2001	5.3	1.1	1.1	1.0	13.9	1.3
20 April 2001	5	1.6	1.1	1.0	14.3	4.0
1 June 2001	8.9	2.2	2.4	1.9	37.5	1.8
30 June 2001	6.9	3.0	2.4	3.5	10.4	1.2

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

42-day period ends	80th percentile (org/100mL) SEPP (Waters of Victoria) objective: 400 org/100mL					
	Beach 1	Beach 2	Beach 3	Beach 4	Beach 5	Beach 6
11 August 2000	14.0	2	2	2	18	1
22 September 2000	4.0	2	1	1	14	1
3 November 2000	10.0	1	1	1	16	2
15 December 2000	340.0	1	2	1	68	4
26 January 2001	6.0	1	1	1	40	1
9 March 2001	13.6	1	1	1	27	2
20 April 2001	8.0	2	1	1	30	4
1 June 2001	32.0	2	4	1	130	4
30 June 2001	12.0	9	4	5	15	1

Note:
SEPP is State Environment Protection Policy–Waters of Victoria.

Legend
BOD_5–biochemical oxygen demand at 5 days
$CBOD_5$–carbonaceous biochemical oxygen demand
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
µS/cm–microsiemens per centimetre
Pt/Co units–platinum cobalt units (a measure of colour)
µg/L–micrograms per litre
org/100mL–organisms per 100 millilitres
pg/L–picograms per litre

Raw-sewage monitoring

Sewage entering the plant is monitored to ensure that plant processes are managed to treat sewage in the best possible manner. During 2000/01, the quality of that sewage was:

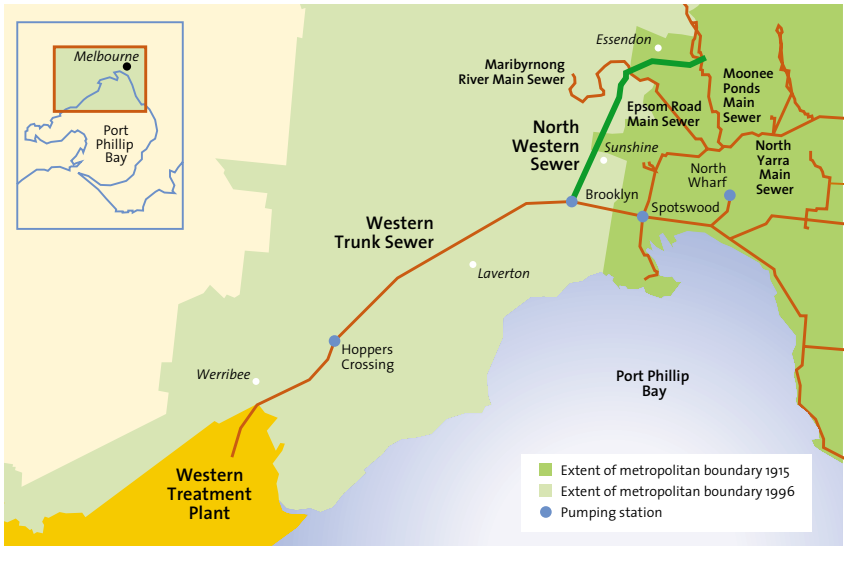
Parameter (units)	Median	90th percentile	Maximum
BOD_5 (mg/L)	310	470	580
Suspended solids (mg/L)	370	608	700
pH (pH units)	6.9	7.2	6.5–7.3
Ammonia as nitrogen (mg/L)	35	39	40
Total combined nitrogen (mg/L)	62	71	87
Total phosphorus (mg/L)	14	17	18
MBAS as LAS (mg/L)	4.1	8.3	14
Cadmium (mg/L)	0.001	0.0023	0.007
Chromium (mg/L)	0.033	0.061	0.087
Copper (mg/L)	0.1	0.23	0.29
Lead (mg/L)	0.03	0.09	0.11
Mercury (mg/L)	0.00013	0.0002	0.0003
Phenol (µg/L)	0.5	16.6	28
Toluene (µg/L)	3	4.9	7
Benzene (µg/L)	0.5	2.4	2.5
PAH's total (µg/L)	3.75		4

*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].

Note:

All results found to be less than the detection limit were taken as half the given value for example, if the detection limit is two we use one as a result.

The total volume of sewage received at our Eastern Treatment Plant in 2000/01 was 139,930 megalitres.



Our sewerage system

Melbourne Water's sewerage system collects some 94 per cent of the sewage and trade waste generated by homes and businesses in greater Melbourne from the retail water companies and transfers it to our major treatment plants at Carrum and Werribee. The remaining sewage is collected and treated by the retail water companies at their local treatment plants.

We are responsible for more than 380 kilometres of sewers and eight sewage pumping stations.

Wet weather sewage spills

During the year, we had eight spills totalling 66.3 megalitres from our transfer system.

One spill of 10 megalitres was due to hydraulic deficiency and seven spills, totalling 56.3 megalitres, were due to extreme rainfall.

During a major storm in April 2001, our North Western Sewer and the rest of our system, including the treatment plants, performed well, with only four spills to the environment. Flows in our system were about two-and-a-half times greater than for dry weather.

Setting the standards

We work to eliminate sewage spills resulting from overflows and leakages and by preventing collapses in our sewerage system. We upgrade our infrastructure progressively, and have developed a program to achieve our one-in-five-year flow containment standard–targeting spill points with the most potential for adverse environmental impact.

During the 1990s, we reduced our historical "non-compliant" wet weather spills by 95 per cent. We achieved most of this improvement by building the North Western Sewer and enhancing the Kew pumping station.

During 2000/01, we undertook studies with the relevant retail water companies on two key projects that will remove most of Melbourne Water's remaining wet weather spills. These projects will ease pressure on ageing sewers that were designed for smaller populations.

With Yarra Valley Water, we completed a plan in December 2000 for the northern suburbs that aims to reduce spills to Merri Creek. Under the project, which is expected to be completed by 2008/09, flows from the Merri Creek sewerage system will be diverted to the North Western Sewer.

The second plan, being developed with City West Water and Yarra Valley Water, is due to be finalised in 2001/02. Works, which are expected to be completed by 2007/08, will address wet-weather spills in the Upper Moonee Ponds catchment.

Maintaining and monitoring the system

Each year we conduct an asset condition review. The goal is to ensure our system remains in excellent condition.

During the year, we monitored sewers for defects. For example the Hobsons Bay main sewer was built before the turn of the century and we rehabilitated it as a result of our monitoring program.

We assessed critical sewers for capacity and removed sediment to maintain adequate capacity. Removing sediment enhances a sewer's capacity, reducing the potential for spills and enabling us to convey sewage efficiently.

Managing trade waste

Trade waste is a critical part of our business because of its potential impacts on occupational health and safety of sewer workers, the long-term integrity of sewers, and its impact on effluent quality and our ability to develop water recycling schemes.

During the year, we received 335,000 megalitres of sewage collected by the metropolitan retail water companies. This included waste collected from industry by the retailers under trade waste agreements.

Changes to acceptance standards

In response to industry requests to vary existing standards, we also worked with the committee to review and make recommendations on trade waste acceptance standards for ammonia, boron and manganese.

We provided input to a preliminary report on developing a trade waste standard for total dissolved solids (a measure of salt level in water, and a key determinant of the suitability of water recycling from treatment plants).

We based this input on current levels of total dissolved solids in flows received at our Eastern Treatment Plant, and the existing influent limit of 1,250 milligrams per litre at Western Treatment Plant.

A committee management group has been established to set agendas, timeframes, allocate resources and to better define the process for reviewing and implementing revised trade waste standards. It will review the standards for copper, nickel and zinc in 2001/02.

Pollution load tariffs

At present, we charge the retail water companies based on the volume of sewage that we treat. During the year, we considered pollution load tariffs to provide the retailers with appropriate price signals on waste.

We sent the proposed tariffs, which cover the critical parameters of biochemical oxygen demand, suspended solids and nitrogen, to the retail water companies, and we used the proposal in our pricing submission to Government. It was not included in the Government's pricing decision, but we will continue to pursue this proposal.

Sewage load estimates and forecasts

During the year, a Melbourne Water and retail company working group reviewed the methodology used to estimate waste loads delivered to our sewage treatment plants.

Information from the review was built into an improved methodology for forecasting future loads. These load estimates and forecasts help planners ensure adequate treatment capacity is maintained in the future.

We test the quality of sewage we receive from the retail water companies to better understand pollutant loads. We use this information in planning treatment plant capacity, to protect our sewer workers and sewerage infrastructure, and to ensure environmental compliance.

We reviewed the sewage quality monitoring contract and implemented a revised monitoring program. This program has been used to build up a database of sewage quality, and during the year, the focus shifted to trend analysis of sewage quality. This will enable an improved capacity to detect and better manage significant changes in sewage quality.

Customer risk profiles

The retail water companies are required to obtain risk assessments from their high-risk trade waste customers. We have worked with the retailers to establish guidelines for the type of information required in these profiles, and to enable assessment of the risk each trade waste customer poses to the sewerage system.

We are continuing work with the retail water companies to establish guidelines for assessing these profiles and to improve the overall risk assessment process.

Target for 2000/01	Progress			Performance *Target for 2001/02*
	Little or none	Some	Achieved	
Maintaining the system Maintain and enhance a model to assess effectively the sewerage system's hydraulic performance.			✓	We used an hydraulic model to manage system performance. We used information from the model to prioritise improvement works to avoid spills. *This is an ongoing requirement.*
Addressing sewage spills Manage flows in the sewerage system to avoid sewage spills due to operational failures.			✓	No spills were due to operational failure. *Our policy is to have no spills due to operational failure.*
Limit spills to the environment to those of greater than one-in-five-year rainfall events.		✓		One spill was due to hydraulic deficiency (less than one-in-five-year rainfall events) with another seven due to extreme rainfall. *Our policy is to have no spills due to hydraulic deficiency.*
Work with the retail water companies to develop joint improvement projects to reducing significant spills.			✓	Complete plan to reduce spills in northern suburbs developed in December 2000. *Implement Melbourne Water components by 2009.* Complete plan to reduce spills in Upper Moonee Ponds Creek. *Implement Melbourne Water components of strategy by 2008.*

Odour

During the year, odour complaints were made, comprising 27 from our sewerage system, 14 from our Eastern Treatment Plant and four from our Western Treatment Plant.

We maintain an odour-complaint procedure to monitor and respond to complaints from the community as soon as possible so that the source of the odour can be identified accurately. When the source is attributable to us, we take corrective action.

Odour management framework

During the year, we reviewed the odour performance of our Eastern and Western treatment plants and our sewerage transfer system. The review examined recent works and their impact and identified shortcomings.

As a result, we developed a framework for odour management and established a steering group to manage odour issues. The framework includes priority actions to minimise odour at our facilities and its impact on the community.

Western Treatment Plant

Actions to reduce odour in the environment improvement plan for our Western Treatment Plant include:

- covering the anaerobic sections of lagoons
- collecting gas (principally methane) and using it to generate electricity
- stopping land applications of raw or sedimented sewage by 2005
- decommissioning tanks used to sediment raw sewage
- investigating the potential for covering the anaerobic sections of other lagoons.

Eastern Treatment Plant

We have completed an odour management framework and will implement works over the next few years.

We commissioned a new biological odour treatment facility in January 2000. The facility treats foul air collected from the return-activated sludge channel. Initial results were variable and further investigations are required to establish its optimum performance.

We also refurbished the sludge drying pans to reduce the potential for anaerobic conditions to establish in the pans. These conditions add to odour emissions from the plant.

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Odour management framework Improve odour management.			✓	We completed a new odour management framework during the year. *Establish timeframe for priority actions and implement these actions.*
Investigate odour complaints Investigate and respond to all odour complaints received.			✓	We investigated and responded to all complaints during the year. *This is an ongoing requirement.*
Western Treatment Plant Provide odour reduction works progressively by 2005.		✓		We completed covering the anaerobic section of three main lagoons. We applied 650 megalitres of recycled effluent in place of raw sewage during 2000/01. *Progressively stop applying raw sewage to land and close the West Sedimentation Tanks by 2005.*
Eastern Treatment Plant Achieve the licence requirement of no discharge of offensive odours beyond the plant's boundaries.	✓			EPA Victoria fined us $5,000 for a licence breach over a complaint regarding odour from the plant. *Continue to investigate and respond to all odour complaints.* Gained experience in operating the new odour control facility. Refurbished sludge drying pans to reduce their potential for odour. *Conduct a community odour survey by June 2002.*

Sustainable resources

One of Melbourne Water's key objectives is to manage resources in a sustainable manner. Sustainable activities are those that can continue into the future, reduce impacts on the environment over time and balance environmental, economic and social factors.

We manage our core activities of water supply, sewerage, waterway and drainage services for the long term, with community assets established for future generations. Several of our major activities involve using scarce resources such as water and energy that are critical to global sustainability. Areas where we are developing specific sustainability initiatives include managing energy, waste, water resources, greenhouse gas emissions and water recycling.

Managing resources

Energy

Melbourne Water aims to use as little energy as possible to minimise its impact on the environment and to reduce costs. We also explore ways to generate our own energy.

We use electricity, natural gas, diesel, petrol, LPG, solar and biogas (methane and other gases) to meet energy needs at our sites. We use energy in our offices, for pumping water and sewage, in treatment processes, and for transport, construction and other works. Energy represents more than eight per cent of our operating expenses, with electricity alone costing us more than $9 million a year.

Renewable energy

Hydro-electricity

During the year, we identified up to 14 potential hydro-electricity generation plant sites in our supply system. We will build the first plant by June 2003 and expect to complete the 14 plants by June 2006. This project will add to our existing hydro-electricity plant at the Thomson Dam and on the pipeline supplying water to Cardinia Reservoir.

Benefits include electricity sales to the grid and reduced greenhouse gas emissions.

As a generator of renewable energy through our hydro-electricity and biogas plants, we are eligible to take part in the Australian Government's Renewable Energy Certificates program. We will register as an eligible generator by December 2001 and develop separate baselines for each generating site as it is established, starting with our existing sites.

Under this program, organisations generating renewable energy receive certificates for each kilowatt-hour that they produce, enabling them to sell surplus certificates to other generators.

Using biogas

Biogas, a byproduct of our sewage treatment process, is a significant greenhouse gas. Using biogas prevents methane emission while providing an energy source.

Our process improvement program at Eastern Treatment Plant includes upgrading biogas use. During the year, we began designing this project.

Most construction, including replacing dual-fuel engines at our outfall pumping station with more efficient electric engines and upgrading the existing power station to use biogas and natural gas, will be completed during 2001/02. We expect all project works to be complete by August 2003.

Under a partnership, AGL Ltd has constructed additional biogas generation facilities at our Western Treatment Plant. These facilities generate electricity from biogas collected from the covered lagoons.

The total constructed capacity is now 3.8 megawatts and we will buy all the electricity generated to run the aerators in our lagoons. More than 16.8 million cubic metres of biogas was captured and used, equivalent to about 9,600 tonnes of methane saved from emissions to the atmosphere.

Cutting energy and costs

During the year, we negotiated a new three-year electricity contract. General electricity cost increases will raise our energy costs by more than 45 per cent over the contract period, or an extra $4 million a year.

As part of a program to improve our energy management, we analysed where we could make savings. Operational, capital and risk-reduction projects planned for the next three years will save up to 35,000 megawatts an hour of energy and about $780,000 a year.

These projects include:

- Complete incorporating an energy management module into the new process control system at our Eastern Treatment Plant.
- Complete installing dissolved oxygen probes to improve the aeration process to reduce electricity use at our Eastern Treatment Plant.

- Began optimising energy use in the first enhanced lagoon at our Western Treatment Plant.
- Maximising availability of water in our Maroondah Aqueduct to reduce pumping from the Yarra River into Sugarloaf Reservoir.

We also assessed energy management software systems and considered appropriate key performance indicators for our energy-consuming sites and activities.

ENERGY

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Renewable energy Develop a plan to generate hydro-electricity from the water supply system.			✓	Our board approved a program for constructing 14 hydro-electricity plants, costing more than $11 million. *Complete the first plant by June 2003.*
Participate in the Australian Government's renewable energy program.		✓		We considered the benefits of government renewable energy programs. The program became effective in April 2001. *We will register our first site by October 2001.*
Using biogas Upgrade biogas use system at our Eastern Treatment Plant by September 2003.		✓		Completed design work including the feasibility of commissioning the biogas storage facility. *Complete most construction by June 2002.*
Establish a power generation scheme for 25 West and 55 East lagoons at our Western Treatment Plant by March 2001.			✓	Our partner, AGL Ltd, began generating electricity from biogas during the year bringing to 3.8 megawatts the generating capacity of the plant. *Fully commission the scheme by December 2001.*
Management initiatives Analyse areas of our business with the greatest potential for energy savings.		✓		We identified operational, capital and risk-reduction projects and completed some activities during the year. *Works are planned for the next three years.*

Water resources

We are committed to managing, in a sustainable manner, the water supply for current and future generations. We draw water from the Yarra, Thomson and Goulburn river catchments. During 2000/01, we supplied a total of 505,500 megalitres of water from our catchments to the three metropolitan retailers and to Western Water. These retailers then supply the water to the community.

To ensure there is enough water to meet the long-term environmental and community needs, the Victorian Government established a committee to develop a long-term water resources strategy for Melbourne. The strategy will provide a framework under which high-quality water is delivered to Melburnians at an acceptable cost without relying on constructing additional dams.

Sustainable framework

During the year, the Victorian Government established a Water Resources Strategy committee to formulate a long-term framework for directing and managing Melbourne's water resources.

Our Managing Director represents Melbourne Water on this committee and we support the committee by chairing a project management group and an industry working group.

In June 2001, a discussion starter was launched as the beginning of community consultation. A website, www.watersmart.vic.gov.au, was developed to provide information about the strategy, along with a multi-lingual pamphlet. A telephone service was also provided for community comments or questions.

Recommendations from the committee will be presented to the Minister by mid-2002.

During the year, we worked with the retail water companies on major water conservation programs to reduce demand on Melbourne's water supply system by raising community awareness of the value and scarcity of water.

WATER RESOURCES

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Sustainable framework Develop a water resources strategy to provide a long-term management plan for Melbourne's water resources by July 2001.			✓	Discussion starter was released in June 2001 and the first consultation period began. *Completed recommendations for a water resources strategy by June 2002.*
Water conservation Establish a major program to reduce demand on Melbourne's water resources.			✓	We established a media, advertising and education program. Water storages stayed just above levels that would have led to restrictions. *Continue and consolidate water conservation program, especially in schools.*

Greenhouse gas emissions

Melbourne Water is contributing to global efforts to reduce the impacts of climate change by reducing its greenhouse gas emissions.

Our main greenhouse gas emissions are methane–directly from sewage treatment and livestock, and carbon dioxide–indirectly through electricity we buy to pump water and sewage and in treatment processes.

An assessment we completed during the year indicated that we emitted about 467,307 tonnes of carbon dioxide equivalent during 1995/96, the first year of our current structure, and 520,205 tonnes during 1998/99. We began a baseline assessment for 1999/2000 as part of preparations to join the Australian Government's Greenhouse Challenge.

Setting a benchmark

Melbourne Water established the sources and total of its greenhouse gas emissions as part of an inventory conducted during the year. This information will be used to compare the impacts of future improvements completed as part of a greenhouse gas strategy.

The inventory was based on actual energy use together with an estimate of direct emissions.

The inventory, completed by an energy consultancy in August 2000, found that emissions during 1998/99 were elevated due to higher energy use from managing drought, principally through increased water pumping. The report noted that our greenhouse emissions would continue to be influenced significantly by external factors such as climatic conditions and regulatory requirements for wastewater treatment.

A projection for 2002/03, based on planned activity and capital works, and assuming average flow conditions for water and sewage, found that our emissions would fall to 314,000 tonnes of carbon dioxide equivalent.

GREENHOUSE GAS EMISSIONS–1998/99

Emission type	Tonnes carbon dioxode	Per cent
Methane sewage	239,316	46.0
Methane agriculture	23,930	4.6
Electricity	238,779	45.9
Nitrous oxide	11,077	2.1
Petrol	3,402	0.6
Diesel for electricity, shaft power and heat	3,172	0.6
Diesel for other	897	0.2
Natural gas for electricity, shaft power and heat	1,778	0.3
Liquefied petroleum gas	14	0.0
Carbon sinks (plantations)	- 2,160	
Total	**520,205**	**100**

Lagoon covers at Western Treatment Plant reduce greenhouse gas emissions by trapping methane which is used to power the plant.

Developing a strategy

During the year, we developed a strategy to document initiatives to reduce our greenhouse gas emissions. This strategy includes a commitment to join the Australian Greenhouse Office Greenhouse Challenge.

Our initiatives to reduce emissions include:

- Introducing energy programs at our Eastern and Western treatment plants that significantly reduce methane emissions.
- Discontinuing the application of raw sewage at our Western Treatment Plant to reduce nitrous oxide emissions.
- Introducing energy-efficiency projects such as a program to build hydro-generation plants in our water supply system.

GREENHOUSE GAS EMISSIONS

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Setting a benchmark Determine our 1995 baseline for greenhouse gas emissions by June 2000.			✓	We established emissions for 1995/96 in August 2000. *Update the assessment to 1999/2000 figures to be consistent with Australian Greenhouse Office requirements in August 2001.*
Developing a strategy Develop a greenhouse gas strategy to maximise our reduction of greenhouse gas emissions and to generate electricity from hydro-electricity and biogas plants.			✓	Completed the strategy in February 2001. *Join the Greenhouse Challenge and set key performance indicators to reduce emissions by December 2001.* *Continue implementing strategy actions with full implementation by 2005.*

Land

Melbourne Water aims to reduce waste from its operations to minimise environmental impacts and reduce costs.

Our activities have the potential to contaminate land, and it is common business practice for us to remediate land that is surplus to our requirements. We also analyse land we are considering buying for contamination.

Heritage values

We developed risk assessments as part of a strategy to sell about 200 hectares of surplus land at our Western Treatment Plant. Some parts of this land were included in the Victorian Heritage Register.

We developed a subdivision plan that incorporated heritage values over some five hectares. Assessments included issues of contamination and archaeological, Aboriginal and environmental values.

Dandenong Treatment Plant

During the year, we developed a remediation plan to manage our Dandenong Treatment Plant, which has not been used since 1996. The contamination is due to past sludge treatment and disposal practices at the plant. The remediation plan will be implemented over the next five years.

We began the first stage of our rehabilitation strategy during the year. This involved additional site investigations to quantify the extent of contamination. While this work has increased the cost of rehabilitation, it has also increased the potential value of land that will become available for sale after rehabilitation.

Our next steps to complete the rehabilitation include:

- developing a remediation works program and a town planning application;
- implementing a community stakeholder program; and
- developing detailed design and construction contracts.

LAND

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Heritage values Prepare specific risk assessments on Western Treatment Plant land that is surplus to our needs by December 2000.			✓	We completed the risk assessments. Considered information from the assessments as part of any future disposal of surplus land at our Western Treatment Plant.
Dandenong Treatment Plant Remediate the former Dandenong Treatment Plant site.		✓		We developed a site remediation program. *Undertake further analysis to accurately assess the extent of contamination.* *Begin remediation in June 2003.*

Recycling

Water recycling

We aim to protect and enhance the environment by developing and implementing recycling schemes. We believe that effluent and biosolids, previously regarded as waste, are now potentially valuable resources. A small proportion of effluent from our Eastern Treatment Plant is recycled at golf courses and parkland and in agriculture and horticulture, and to irrigate paddocks at our Western Treatment Plant.

Water is recycled at golf courses and sporting fields.

Western Treatment Plant

In December 2000, we commissioned a system to return treated effluent from enhanced lagoons at our Western Treatment Plant.

The system will deliver at least 100 megalitres of high-quality effluent for recycling on and offsite, and contribute about one-tenth of our target to recycle 20 per cent of annual effluent by 2010.

We trialled the system during summer. Recommendations on irrigation and pasture management, including cattle numbers per hectare and salt and nitrogen balances, have been made to ensure that irrigation is sustainable with effluent from the enhanced lagoons. We also irrigated trial crops during the year to establish yield in different situations.

The trials showed that sustainable irrigation could occur if management takes into account issues related to salinity, cattle and sheep numbers and groundwater levels.

Eastern Treatment Plant

We worked with our partner Aquaforte on a feasibility study for a water recycling scheme for the Koo Wee Rup area.

The study found that the $50 million scheme could use up to six per cent of effluent produced by our Eastern Treatment Plant, or 15 per cent of summer flows. The water would be suitable for a wide range of crops, including salad vegetables, as well as for golf courses, parks, racecourses, horticulture and general farming. We completed an agreement with Aquaforte to investigate implementation issues relating to this scheme.

The potential market for recycled water near the outfall pipeline on the Mornington Peninsula was also investigated. Information from the investigation will be used to develop water recycling schemes in this area.

Two new recyclers were established. These businesses will be growing olives and trees using recycled water.

The revised EPA Victoria guidelines have not yet been published. We have been using the latest draft to develop plans and to manage new and existing reuse schemes.

WATER RECYCLING

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Water recycling Complete the effluent recycle and distribution system at our Western Treatment Plant by December 2002.			✓	We commissioned the first stage of the system in December 2000 and trialled for irrigation effectiveness over summer. *Bring further stages into effect.*
Complete a feasibility study to establish the viability of developing major reuse schemes in the vicinity of our Eastern Treatment Plant by September 2000.			✓	We completed the feasibility study. *Facilitate funding discussions between stakeholders by June 2002 regarding the supply of recycled water to the Koo Wee Rup horticultural area.*
Implement revised EPA Wastewater Reuse Guidelines.	✓			Guidelines not yet published. Implement guidelines when published.

Biosolid recycling

Finding acceptable environmental and economic ways of recycling biosolids is a long-term issue for us. On average, about one-quarter of the biosolids produced at our Eastern Treatment Plant are recycled through a contract with partner KT Soils. The company mixes other material with stored and dried biosolids and sells the mixture as soil conditioner. No biosolids are recycled from our Western Treatment Plant.

During the year, we developed a position paper on how to improve management of biosolids from our Eastern and Western treatment plants, including options to increase the volume of biosolids recycled. We used this to establish a biosolids management strategy. Targets in the strategy include achieving biosolids recycling of 50 per cent at our Western Treatment Plant and 100 per cent at our Eastern Treatment Plant by 2020.

Initially, we failed to obtain planning approval from the local council for a project to use biosolids from our Eastern Treatment Plant in wetlands at the Woodlands industrial estate. This project involves constructing a stormwater management system using an existing borrow pit at the estate. The pit would be converted into a shallow wetland using stockpiled biosolids from Eastern Treatment Plant. The biosolids will be sealed underneath the wetland with an engineered lining system.

We took this matter to the Victorian Civil and Administrative Tribunal, which agreed to the project proceeding. EPA Victoria has approved the project, and we will implement the project after appeal avenues have been exhausted.

We also have an agreement with partner Australian Organic Resources to investigate the potential of a process to remediate biosolids by reducing heavy metal levels and making the product suitable as a fertiliser or soil conditioner.

BIOSOLID RECYCLING

Target for 2000/01	**Progress**			**Performance** *Target for 2001/02*
	Little or none	Some	Achieved	
Biosolids recycling Implement recommendations in our strategic position paper on biosolids management with the long-term aim of reusing all biosolids produced at our Eastern and Western treatment plants.		✓		We used the position paper to establish a biosolids management strategy. *Implement the strategy to support biosolids recycling targets for 2010 and 2020.*
Complete the biosolids reuse project at the Woodlands industrial estate at Braeside.		✓		Project failed to gain initial approval from the local council but our appeal was upheld in the Victorian Civil and Administrative Tribunal. *Recycle biosolids from our Eastern Treatment Plant as landfill for Woodlands wetlands by December 2003.*

A growing concern

For 12 years, Tony Moon has been producing a blended soil product from his Bangholme business next to our Eastern Treatment Plant.

His "secret" ingredient is the plant's sewage sludge or biosolids, which he adds to compost, sand or sandy loam. His business, KT Soils, bought 5,000 cubic metres of biosolids from the plant in 2000/01–some 25 per cent of the plant's annual production–and he is using more each year.

Melbourne Water tests its stockpiles of biosolids under Environment Protection Authority guidelines, and under the Department of Natural Resources and Environment's Australian soil standards and Agriculture, Fertiliser and Chemical Regulations. KT Soils is also required to test every batch of product it creates.

Increasingly rigorous and evolving testing procedures (and costs) can be daunting to some potential biosolids customers, but not Tony Moon, who used to work as a contractor at Melbourne Water's Eastern Treatment Plant, drying and stockpiling biosolids.

"It's like having your fertiliser built in," he says. "It doesn't smell at all and the tomatoes, flowers, garden beds and lawns all love it. Not only that, the biosolid product helps keep the moisture in." He believes the biosolids, which are rich in nutrients and trace elements, have tremendous potential for roadside landscaping, vineyards and other plantations.

Until now, he has made the blended soil available only to wholesale customers, such as nurseries, for $14 a metre (plus GST). He plans to open a garden supply shop for the public this summer.

Tony Moon also uses recycled water from the Eastern Treatment Plant to meet his water needs.

Tony Moon's business, KT Soils, uses biosolids from our Eastern Treatment Plant to produce blended soils.

Verification statement

Melbourne Water commissioned jointly the Sustainable Investment Research Institute (SIRIS) and the Snowy Mountains Engineering Corporation Victoria (SMEC Victoria) to verify the data and content of this Annual Environment Review 2000/01 (the 'report'). Melbourne Water has the responsibility for the preparation of the report and this statement represents the auditor's independent opinion. Neither SIRIS nor SMEC Victoria was responsible for preparation of any part of this report.

Verification scope

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 verification is based on emerging international best practice and this statement is constructed based on the recommended approach by the Global Reporting Initiative's Sustainability Reporting Guidelines.

The verification scope included:

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

The scope of the verification process this year has been extended to include separate verification of each of the environmental, public health, community and safety reviews by the auditor.

Verification process

The report verification was undertaken in August 2001, using an audit process that is based on annual rotation of assessing parameters and sites.

The audit 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 examination of selected data sets including several drafts of the report
- an examination of the aggregation and derivation of, and underlying evidence for, data presented and statements made in the report.

Our opinion

- A high level of data accuracy is presented within the report. Notably, the number of minor anomalies that usually occur were found to be fewer than in previous years.
- Each of the data trails selected was easily identifiable and traceable and the personnel responsible were able to reliably demonstrate the origin(s) and interpretation of data.

Overall the auditor is satisfied, based on the past four years experience in verifying the Melbourne Water stakeholder reports and associated systems, that:

- the report is a fair and honest representation of the organisation's policies, management systems and performance. The report is fairly presented and materially not mis-stated
- the report is a good reflection of management commitment towards environmental performance and a fair description of environmental performance achieved during 2000/01
- the systems and processes in place to generate the numerical data presented in the report are sound
- the written statements made in the report accurately reflect the results and progress achieved during the reporting period.

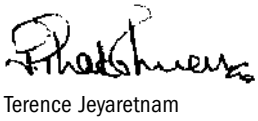
General findings and recommendations

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

- Two environmental prosecutions occurred during the course of the reporting period. Melbourne Water is actioning several mechanisms to ensure that the usually high level of compliance is maintained.
- Melbourne Water's stakeholder reporting process has evolved over the past five years and this year is moving towards a triple bottom line reporting framework.
- Further analysis of key business issues from a triple bottom line perspective is recommended. This is necessary to continue developing a relevant and responsive performance measurement and reporting mechanism that comprehensively addresses Melbourne Water's triple bottom line aspects and impacts.
- Increasing the level of stakeholder engagement throughout the reporting process would result in a more stakeholder-oriented report.

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

On behalf of the audit team, 4th September 2001,
Melbourne, Australia



Terence Jeyaretnam
Accredited Environmental Auditor (EPA Victoria)
Senior Environmental Auditor (QSA)
Principal, SIRIS

Glossary

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

Ammonia Compound consisting of a single nitrogen atom coupled with three hydrogen atoms. It is a nitrogen source for algae.

Anaerobic Anoxic, lacking oxygen. Anaerobic organisms can or must live without oxygen.

Aquatic Living in, growing in, or frequenting water.

Biogas A mixture of carbon dioxide and methane formed by the decay of organic waste (sewage) matter and used as a fuel.

Biosolids Treated and stabilised sewage sludge; may be in semi-liquid or dried form.

BOD Biochemical oxygen demand. Measure of the amount of oxygen required by bacteria and other microorganisms engaged in breaking down organic matter.

Catchment A natural drainage area, bounded by sloping ground, hills or mountains, from which water flows to a low point.

Chlorophyll Green pigments of plants, which capture and use the energy from the sun to drive the process of photosynthesis.

CSIRO Commonwealth Scientific and Industrial Research Organisation.

Denitrification Conversion of bound nitrogen to gas.

E.coli (Escherichia coli) Bacteria/bacterium found in the stomachs of mammals (for example, humans) and used as an indicator of recent faecal contamination.

Ecology The study of the interrelationships between living organisms and their environment.

Ecosystem A term used to describe a specific environment, to include all the biological, chemical and physical resources and the interrelationships between those resources.

Effluent Water discharged by a process, treated or untreated.

Environmental flow The minimum designated flow in a stream or river needed to satisfy specified ecological requirements.

Eutrophication Depletion of oxygen in water, the process by which a body of water becomes rich in dissolved nutrients, thereby encouraging the growth and decomposition of oxygen-depleting plant life and resulting in harm to other organisms.

Extreme wet weather Rainfall events that exceed the heaviest rain that could be expected to occur in a five-year period.

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

Hydraulic deficiency The incapacity of sewers to cope with flows during rainfall events up to those defined as extreme wet weather events, resulting in sewage spills.

Megalitre One million litres.

Model Mathematical equation or series of equations that provides a simplified description of a system or situation devised to facilitate calculations or predictions.

Nutrients Substances such as nitrogen and phosphorus in various forms required for the growth of plants (like fertiliser).

Pollution Water pollution occurs when waste products or other substances, such as effluent, litter, refuse, sewage or contaminated runoff, change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.

Receiving water Waters into which effluent or waste streams are discharged.

Runoff Water that flows over the surface from a catchment area, including streams.

Sewage Strictly speaking household waste but loosely applied to any waste sent to a treatment plant.

Sewage sludge Solid material separated from sewage during processing; remains as a semi-liquid product until further dewatering/drying is undertaken.

Glossary

Sewage treatment plant A place where human and industrial wastes are treated before disposal to land or water.

Sewerage System of mains, pipes and sewers to transport sewage.

Stormwater Technically, all runoff is stormwater. However, the term is generally used in reference to urban runoff in constructed stormwater drainage systems.

Stream A general term for a body of flowing water; a natural watercourse containing water at least part of the year.

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

Toxicant A poison.

Treated effluent Water discharged after processing of sewage at a treatment plant.

Treatment Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.

Water cycle The circulation of water on Earth as it evaporates from the sea and lakes, condenses into clouds and falls again as precipitation (rain, hail, sleet, snow).

Water quality The physical, chemical and biological measures of water.

Waterways All streams, creeks, rivers, estuaries, coastal lagoons, inlets and harbours.

Weir A low structure across a river, stream or creek retaining only a small proportion of the mean annual flow.

Wetland Natural or artificial area of seasonal, intermittent or permanent waterlogged soils or inundated land.

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