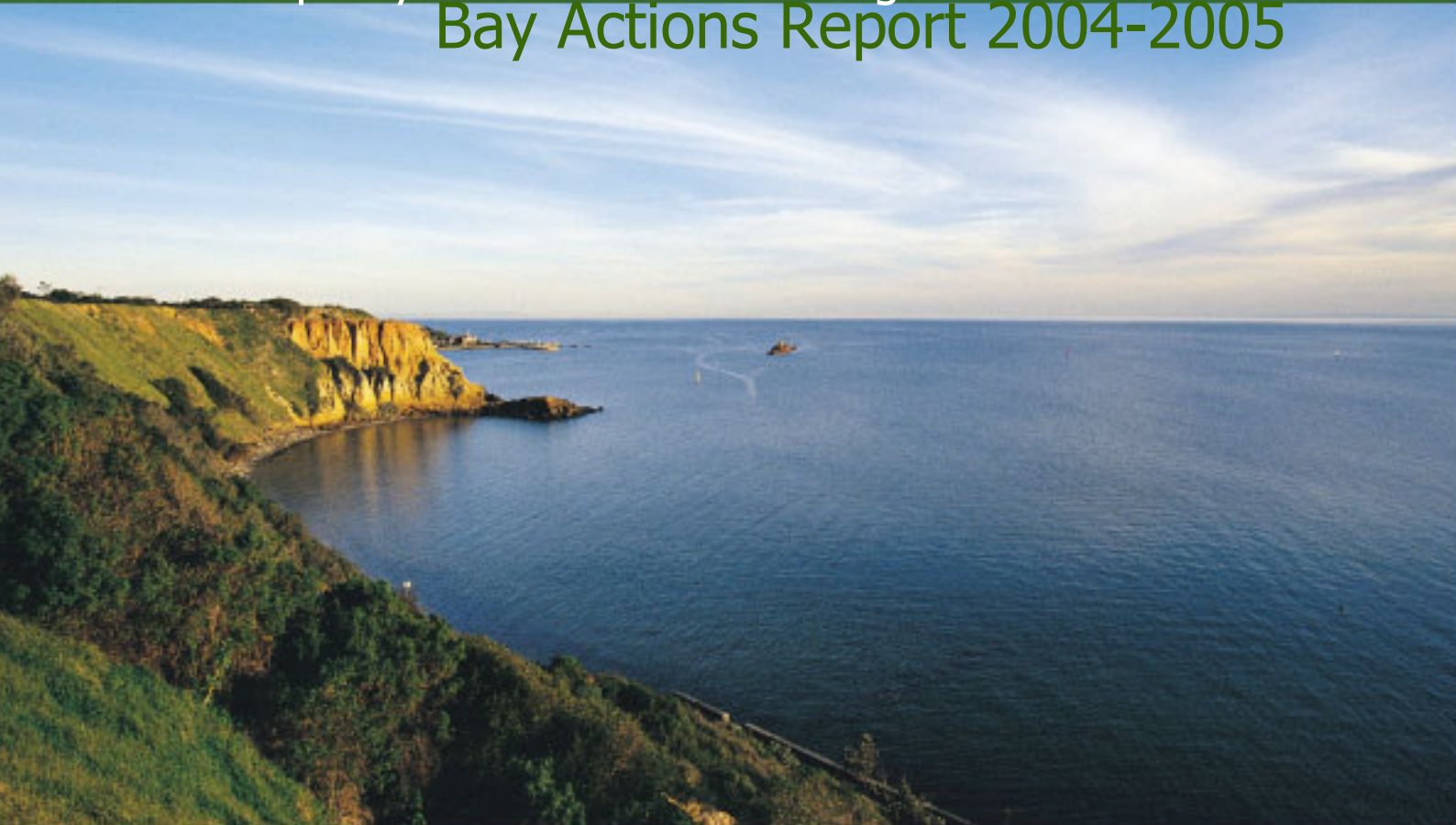


Port Phillip Bay Environmental Management Plan Bay Actions Report 2004-2005



This report should be read in conjunction with the Port Phillip Bay Environmental Management Plan (EMP). It is a key element of the EMP's performance reporting framework.

June 2007

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, June 2007 on www.dse.vic.gov.au

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ISBN 978-1-74152-705-8

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PREFACE

The Bay Environmental Management Plan (EMP)¹ is a key element for implementing the State environment protection policy (Waters of Victoria) - Schedule F6 (the Waters of Port Phillip Bay). The EMP provides a framework for the identification of issues, co-ordination of management efforts, determination of priorities and development of actions to implement the objectives of the Schedule. The EMP has identified the two risks of *nutrients* and *marine pests* as priorities to be addressed. It also establishes broad programs for mitigating these risks and the environmental management framework surrounding these programs. The Bay Actions Report (BAR) is the key element of the EMP's framework for reporting on progress of these programs and, in the longer term, achievement of the programs objectives.

The BAR for 2004-05, as previously, provides a progress report on all the tasks in the EMP nutrient and marine pest programs. The EMP envisaged that the BAR reports would only focus on the EMP tasks relating to *the Bay itself, or to activities or inputs that either affect or enter the Bay directly or are transmitted to the Bay via the oceans*. It complements the following two reporting systems:

- **The Port Phillip and Westernport Catchment Management Authority's (PPWCMA) Annual Report** - for tasks relating to Bay inputs from the catchment *transmitted to the Bay via the catchment waterways and drains*.
 - While the PPWCMA's report provides a summary, a more detailed account is considered useful and is included in this year's BAR.
- **The Port Phillip Air Quality Improvement Plan (AQIP) Reporting System** - for tasks relating to Bay inputs from the catchment *transmitted to the Bay via the atmosphere*.
 - As the AQIP is still being developed, these tasks are included in the BAR.

Bay Actions Reports will evolve over time. The historical background featured in 2001-02, is not repeated in the subsequent reports. Refinement of the format for reporting on task implementation will continue. This will become more streamlined and concise as it continues to build on the previous years content, and will be linked with related reporting systems where possible. Reporting on progress with addressing the EMP's objectives can only be incorporated in the longer term. For nutrients, background variability means that reliably interpreting the results of implemented monitoring programs will require long data series¹. No reliable short-term indices are currently available. For marine pests, this reporting component is developmental, with the need to develop appropriate monitoring indicators, approaches and performance measures recognised in the current program². The Bay Actions Reports will provide a more comprehensive picture of progress as these components develop.

The BAR's will assist with both the EMP's implementation and review and the EMP's management framework will also be applied to ongoing review and refocusing of mitigation actions for other priority Bay risks, or risks that are more specific, localised or emerging.

During 2003, the Central Coastal Board conducted an interim review of the EMP's implementation. This review highlighted the complexity of assessing progress in addressing the nutrient and pest risks to Port Phillip Bay and provided a timely articulation of the challenges involved in implementing the EMP towards its statutory timelines and in the longer term. A more comprehensive review of the EMP's implementation is scheduled to commence in 2006.

Note: Since publication of the EMP, re-structuring and name changes have occurred within some of the agencies involved in its implementation. The agency names used within the report are generally those that applied between 1 July 2004 and 30 June 2005.

¹ See Department of Natural Resources and Environment 2002a. *Port Phillip Bay Environmental Management Plan: Plan and Critical Programs to 2003*. Department of Natural Resources and Environment, Melbourne, Australia. (available at www.dse.vic.gov.au)

² See Department of Natural Resources and Environment 2002a. *Section 2 - Marine Pest Program and Section 3 - Performance Reporting Framework*. (available at www.dse.vic.gov.au).

INTRODUCTION

The Bay Environmental Management Plan (EMP)³ is a key element for implementing the State environment protection policy (Waters of Victoria) - Schedule F6 (the Waters of Port Phillip Bay). The EMP provides a framework for the identification of issues, co-ordination of management efforts, determination of priorities and development of actions to implement the objectives of the Schedule. The EMP has identified the two risks of *nutrients* and *marine pests* as priorities to be addressed. It also establishes broad programs for mitigating these risks and the environmental management framework surrounding these programs. The Bay Actions Report (BAR) is the key element of the EMP's framework for reporting on progress of these programs and, in the longer term, achievement of the programs objectives. The EMP Background Document⁴ provides further information on the context for the EMP and its programs, including references to more detailed technical documents.

Each of the EMP's programs has a series of sub-programs including:

- objectives for risk mitigation, at program and contributing sub-program levels
- sub-program tasks to address the objectives, which range from planning and implementation to coordination, monitoring, reporting and review.

The tasks are predominantly high-level and long-term, with implementation often involving further planning stages and actions over a number of years. The monitoring, reporting and review tasks comprise frameworks for coordinated reporting on progress relevant to the objectives of the sub-programs and hence overall programs - for mitigating these key risks to the Bay's environment.

The Bay Actions Report (BAR) was introduced in the EMP as the tool for reporting on progress with EMP tasks *relevant to the Bay itself or to activities or inputs that either affect or enter the Bay directly or are transmitted to the Bay via the oceans*. However, for each BAR to date, it also reports on tasks relating to waterway and atmospheric Bay inputs - which should also be included in the already, or soon to be, established environmental reporting mechanisms for these two other key environments that transmit risks to the Bay⁵.

The EMP's nutrient and marine pest reporting frameworks differ. This is partly due to differences in the nature of these risks, but particularly due to differences in the developmental status of their risk management programs.

The BAR is a key output of both frameworks, and the first, 2001-02 BAR focused on progress with task implementation across both programs. However, the differences in underlying monitoring and reporting approach has, over time, lead to differences in the structure of subsequent BARs.

Nutrient inputs have long been recognised as an important risk to the Bay's environment, and long been a Bay management focus and research issue. Marine pest management has a much more recent history, and the EMP's marine pest program is acknowledged as developmental.

The understanding of Bay nutrient cycling processes built through research culminating in the Port Phillip Bay Environmental Study, along with an established management history, provide for a much more comprehensive nutrient monitoring and reporting approach than is possible for marine pests. This should not be misinterpreted to mean that understanding of the complex nutrient cycling processes is complete; continuing to progressively improve this understanding is recognised among the EMP's key tasks required to mitigate the Bay nutrient risk⁶.

³ See Department of Natural Resources and Environment 2002a. *Port Phillip Bay Environmental Management Plan: Plan and Critical Programs to 2003*. Department of Natural Resources and Environment, Melbourne, Australia. (available at www.dse.vic.gov.au)

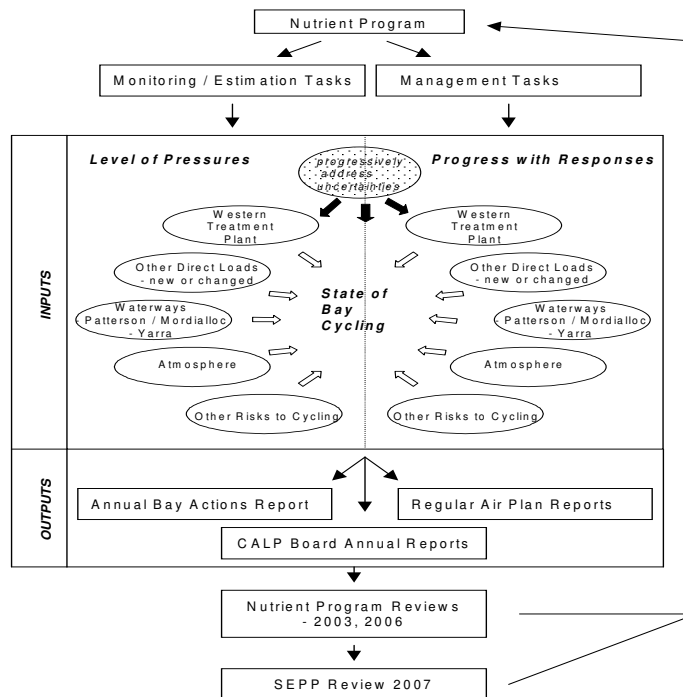
⁴ Department of Natural Resources and Environment 2002b. *Port Phillip Bay Environmental Management Plan: Background Document*. Department of Natural Resources and Environment, Melbourne, Australia. (available at www.dse.vic.gov.au)

⁵ The other two reporting outputs are: *A Catchment Actions Report* (within the *Port Phillip and Westernport Catchment Management Authority's annual report*) and *The Port Phillip Air Quality Improvement Plan (AQIP) Reporting System* (within the *AQIP currently being developed by EPA*). See Department of Natural Resources and Environment 2002a for further detail, particularly Section 3 - Performance Reporting Framework.

⁶ See Department of Natural Resources and Environment 2002a. *Section 1 - Nutrient Program*; See Department of Natural Resources and Environment 2002b.

Nutrient Reporting Framework

The EMP's nutrient reporting framework is based broadly on a pressure-state-response approach (see EMP Figure 3.1, reproduced below). EMP Table 3.1, which summarises how the nutrient program's tasks contribute to each of these reporting elements and where they will be reported, is reproduced in Appendix 1 of this report.



Reporting for the 'response' element focuses on progress with implementing program tasks, including monitoring. The 'pressure' and 'state' elements are based largely on quantitative interpretation of environmental monitoring results. Monitoring programs, based on current scientific understanding supported by a review process, are in progress to support this framework⁷. The 2002-03 BAR introduced reporting on the 'state' element, based on very preliminary interpretation of initial monitoring data - an approach continued in the 2003-04 and 2004-05 BARs. 'Pressure' indicators - namely Bay nitrogen (N) loads - are the main focus of the nutrient program's management objective. Changes in key pressure indicators, along with ongoing assessment of 'state' indicators, will therefore be important inputs to longer-term assessments of progress against these objectives. Levels of some pressure indicators will be reported annually or every few years (see EMP nutrient program and reporting framework). However, their reliable interpretation to assess achievement of the reduction target will require very long data series - estimated at 2010 for Western Treatment Plant (WTP) and 2014-2016 for the key waterway inputs⁸.

⁷ See Department of Sustainability and Environment 2003. *Port Phillip Bay Environmental Management Plan - Bay Actions Report 2001-2002*. Department of Sustainability and Environment, Melbourne Australia.

⁸ Discussed further in Department of Natural Resources and Environment 2002a; Department of Natural Resources and Environment 2002b. See Parslow, J, Sokolov, S. and Murray, S. 1999. *Port Phillip Bay: Baseline, monitoring and analysis for nitrogen load reductions*. CSIRO Marine Research.

Marine Pest reporting framework

The marine pest reporting framework will initially focus on progress with implementing the program's tasks, which include development of environmental monitoring approaches. This was reassessed during the review of the EMP in 2003 (interim implementation review) which concluded that 'while progress has been made on national reform of marine pest management arrangements, the existing developmental approach to the EMP marine pest program and reporting framework is still warranted and the program's focus and existing tasks are still current'. This framework will again be reassessed in the upcoming review of the EMP.

Structure of this Report

This BAR should be read as a companion document to the EMP, reporting directly on progress with the sub-program tasks making up the EMP nutrient and marine pest programs. The tasks and their intended reporting outputs are paraphrased here, but the EMP should be consulted for full descriptions (pages 11 and 18).

Most of the EMP's tasks are long-term. Many are also defined at a high-level and their implementation will involve planning and actions over many years. Each consecutive BAR will therefore provide an update on their implementation. Once a task is completed, it will not be discussed further in subsequent reports.

Appendix 1, reproduced from the EMP, describes how the reporting outputs of the nutrient program's tasks together comprise a pressure-state-response framework. As discussed previously, BARs at this stage focus mainly on 'response' outputs. Those 'pressure' and 'state' outputs that are included are reported within the same structure, but the discussion is preliminary and brief, consistent with the early stage of any underlying monitoring data series.

Both the EMP Background Report⁹ and Bay Actions Reports 2001-02 (2001-02 BAR)¹⁰, 2002-03 (2002-03 BAR)¹¹ and 2003-04 (2003-04 BAR)¹² provide further background information relevant to the EMP programs, sub-programs and tasks. Linkages are also provided throughout this report to websites with further information relevant to the implementation of tasks within the various EMP sub-programs.

⁹ See Department of Natural Resources and Environment 2002b

¹⁰ See Department of Sustainability and Environment 2003.

¹¹ See Department of Sustainability and Environment 2004.

¹² See Department of Sustainability and Environment 2004.

1 NUTRIENT PROGRAM

1.1 Direct Bay Inputs - Western Treatment Plant

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Reduce the Western Treatment Plant's annual Nitrogen (N) load by 500 tonnes (t) by 2006.

- *Annually report on implementation and predicted load reduction*
- *Maintain an appropriate N load monitoring system*
- *Annually provide monitoring data to DSE; estimate loads in at least 2002, 2004, 2006; report to DSE*

The upgrade of the Melbourne Water (MW) Western Treatment Plant (WTP) was completed in 2004-05. In addition, the 55E and 25W Activated Sludge Plants were commissioned during this period. The N output load from WTP to the Bay for 2004-05 was 2,713 t. The three-year rolling average load based on this period is 2,547 t/yr.

The N load monitoring system is an ongoing requirement of the WTP's Accredited Discharge Licence obtained through the EPA, and was maintained during 2004-05. It enables the WTP load reduction to be assessed against the agreed Bay N baseline, which consists mainly of 1991-1995 Bay inputs¹³. Nitrogen loads from WTP vary substantially from year to year due to inter-annual variations in rainfall. The measurement of a 500 tonne reduction relative to the baseline therefore requires long term averaging of a time series of monitoring data, which will not be available until at least 2010.

The monitoring data from the WTP is stored on a MW database and is provided to EPA as part of the licence agreement. MW also provides annual reports on the progress of the WTP on their website.

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)

Over 2004-05, WTP's estimated N load to the Bay over its four licensed outlets, based on results of this monitoring program, was 2,713 t. This is within expectations following the completion of improvements to the 25 W Activated Sludge Plants. Load reductions will continue in the short term due to increased water recycling, however human population increases will lead to increased N inputs. Further augmentation or additional recycling would then be needed to maintain the load at 3,100 t as required in the plant's discharge licence.

Sources of more information:

www.melbournewater.com.au

1.2 Direct Bay Inputs - New Proposals

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Ensure that any EPA works approvals and licences, and any consents, permits or licences issued under the Fisheries Act and Coastal Management Act, are consistent with the EMP nutrient program.

- *Annually collate relevant consents including predicted load implications*

In reporting on any new N discharge approvals, it is important to first emphasize that discharge of waste to the environment remains the lowest preference in Victoria's hierarchy of waste management options, to be considered only after waste avoidance and reuse opportunities have been fully explored. Existing licence holders operate within a context of continual improvement in environmental performance.

¹³ Further information on the Bay N baseline is available from EPA.

EPA works approvals and licences:

No works approvals were issued for new or existing licensed Bay N discharges.

Fisheries licences and permits:

No new licences or permits were issued under the Fisheries Act in 2004-05 that would influence N loads discharged to the Bay.

Coastal Management Act consents:

The following is a list of consents that were issued during 2004-05 that may affect Bay N inputs or cycling. The net implications for nutrient inputs cannot be accurately predicted.

Proposals that may have reduced nutrient inputs include:

- The Tooradin Village Island Bank Works on the Tooradin Foreshore,
- Groyne extension, drainage, landscaping works near Princes Pier at Beacon Cove,
- Stormwater drainage upgrade, at The Esplanade & adjacent foreshore reserve at Indented Heads
- Upgrade to stormwater drainage infrastructure at Corinella Foreshore
- Upgrade to access ramp & steps, and stormwater treatment at Cape Woolamai, Phillip Island
- Stormwater treatment at Ricketts Point North Car Park,
- Installation of Stormwater Drainage Pipe Alongside Existing Infrastructure at Cowes Foreshore Reserve
- Reconstruction of Outfall Drain Edithvale

Proposals that may have increased nutrient inputs or affected nutrient cycling include dredging at:

- Rosebud motor boat squadron Mooring Basin
- Dredging at Kananook Creek Frankston
- Newhaven Entrance & Newhaven Marina

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)

The predicted load implications of approvals issued in 2004-05, where they can be meaningfully estimated, are incorporated within the implementation summary above.

Investigate the detailed implications of, and technical basis for, development of an N offset system

- ***Report within 12 months***

In June 2003, the revised *State Environment Protection Policy* (Waters of Victoria) included a specific clause on offset measures. This clause complements the powers under the *Environment Protection Act 1970* to develop tradeable permit systems and offsets as a means of minimising harm to the environment.

During 2004-05, the EPA commenced a process to work with protection agencies, businesses and communities to investigate the potential for the use of offsets and other market based instruments to provide cost-effective mechanisms to achieving pollutant reductions within the Port Phillip catchment. This project aims to explore the feasibility of an offsets scheme to assist in achieving Water Quality Improvement Plan load targets for Port Phillip and Westernport and will consider nitrogen inputs as a potential pilot project. The project will be run over approximately 3 years.

Compile key implemented actions affecting direct Bay N loads and annually report

- ***Publish Bay Actions Report (BAR) by October each year***

The 2003-04 BAR was released simultaneously with this one. As with the previous BARs, its scope was slightly different than envisaged in the EMP in that it included the catchment waterway and atmospheric sub-program. This approach was again used for 2004-05.

Sources of more information:

www.citywestwater.com.au, www.ccb.vic.gov.au

1.3 Catchment Waterways

The catchment waterways sub-program aims to reduce annual waterway N load to the Bay by 500 t (Yarra/Maribyrnong Rivers: 350 t; other surface waters focusing on the Patterson River system: 150 t) by 2006, particularly focusing on storm event loads where feasible. Due to the many and varied activities contributing to waterway N loads, and range of management agencies involved, the sub-program is coordinated across three key management themes: Rural Land Management, Stormwater Management and Licenced Waste Discharges.

1.3.1 Rural Land Management

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Contribute to reducing the waterway N load to the Bay by 500 t by working with agricultural industries to develop and encourage the implementation of sound environmental practices and procedures that will reduce N inputs to waterways from land used for cropping, grazing and horticulture.

- *Annually develop /review a 1-3 year works program of planned actions*
- *Annually report on implemented actions including load contribution*

Planning:

The Rural Land Management theme is lead by DPI. Within this theme, the emphasis on developing and implementing BMPs, through property management planning and environmental management systems approaches, will remain the focus over the next few year.

Implementation:

- The project "Improving water quality from the Werribee Irrigation District" continued during 2004-05. The initial project focus was aimed at increasing water use efficiency of irrigation thus reducing runoff through improvements in irrigation scheduling to ensure that irrigation water does not flush nutrients beyond the root zone, or through direct runoff. During 2004-05 the project provided input into the Recycled Water Initiative in Werribee South, which aimed at encouraging best practice in the use of recycled water as an alternative source of irrigation water from the Western Treatment Plant.
- The 'Grow West' landscape change project in the upper Werribee catchment continued during 2004-05, and began its onground works component to assist landholders to restore degraded land and reduce nutrient load via revegetation and erosion work. The project has been initiated and developed by multiple organisations and committees including PPWPCMA, DPI, Moorabool Shire, the Victorian Serrated Tussock Working Party, local landcare groups and landholders. Achievements for the year included: revegetation of approximately 250 hectares of degraded land through direct seeding and planting of local indigenous species, establishment of 215 hectares of commercial tree plantations, a variety of workshops for landowners relating to sustainable land management, research into increasing production on farms using native species and corporate and community volunteer tree planting days.
- Melbourne Water implements the Stream Frontage Management Program in conjunction with landholders. The program aims to rehabilitate stream frontages by improving vegetation and fencing stock to reduce sediment and nutrient loads to waterways. During 2004-05 this program together with the Corridors of Green, Community Grants and Young Watercare programs planted about 380 000 plants to improve rivers and creeks.
- The Enviroveg Program, managed by the Ausveg continued during 2004-05. Enviroveg provides growers with a visible way of demonstrating a responsible attitude towards the environment. Enviroveg is a simple set of tools for growers to assist them to achieve measure and demonstrate good environmental practices on farm. It has evolved to become a national initiative, and continues to change to align itself with the strict Industry Quality Assurance standards. It now has modules covering all aspects of farm management and environmental

Best Practice. The program outlines the principles and practices required for maintaining or improving environmental management on farm and covers Soil Management, Water Management, Nutrient Management, Pest & Disease Management, Chemical Storage, Hydroponic Production, Greenhouse Production, Organic Production, Air Quality, Energy Conservation, Waste Management, Biodiversity and Biosecurity.

- The development of the Environmental Management System project for the Yarra Valley agricultural industries (see 2001-02 BAR), lead by DPI in partnership with agricultural industries, DSE, EPA, MW and local government, concluded in December 2004. Achievements for the year included the trial implementation of the EMS Environmental Best Management Practice and Self-Assessment tools by 14 vineyards in the Yarra Valley.
- Other projects operating in the Yarra Valley since this time include Wine for Life (delivered by Greening Australia) that built on some of the learnings from the Yarra Valley EMS in viticulture and assisted growers to implement on farm actions. Wine for Life began in December 04.
- The facilitation of awareness raising and implementation of best management practices by horticultural industries (see 2001-02 BAR) continued through 2004-05. Organisations involved have included DPI, Victorian Strawberry Fruit Industry Development Committee, Australian Rubus Growers Association, fruit and flower industries, Australian Rubus Growers Association, Werribee South Vegetable Young Growers Group and MW. 2004-05 achievements included:

Awareness - Awareness raising activities focused on;

- the vegetable industry in the Werribee Irrigation District and the strawberry industry in the Yarra Catchment to improve farm fertiliser use and reduce nutrient runoff by modifying irrigation techniques. Activities focused on promoting best practice recycled water use, which has implications for the volume of waste water discharged to Port Phillip Bay from the Western Treatment Plant.
- the Australian Rubus Growers Association to promote best practice in irrigation. The Association ran workshops in May 2004 and October 2004 to further encourage and support adoption of best practice. Participants were principally from the Yarra Valley.

On-ground works - Onground works included;

- Strawberry Growers - following the successful development of best practice soil, water and nutrient guidelines, the strawberry industry in partnership with DPI, piloted a whole farm planning program, which focused on assisting farmers implement the drainage component of the guidelines across the farm landscape. Ten plans were developed in this year covering an area of 137 hectares.
- The Swan Bay Integrated Catchment Committee continued to undertake erosion mitigation works associated with local waterways flowing into Swan Bay and Port Phillip Bay during 2004-05. This included fencing and revegetating waterway to improve in-stream water quality reaching Swan Bay and Port Phillip Bay.
- Provision of advice on BMPs through statutory planning, including EPA's advice for wineries and DPI's application of land management conditions on development proposals processes continued through 2004-05.

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)

While the above projects target activities and practices known/predicted to deliver N to the waterways, their actual effects on N loads entering the waterways, and more broadly the Bay, cannot be meaningfully estimated. Predictions can at best focus on long term implications of wide ranging activities targeted at N reductions (subject to assumptions on uptake rates). These include awareness raising (ie extension programs) to the broadscale implementation of on-ground actions that significantly reduce N.

Two models have been used to make predictions of the reductions to N in the Bay.

The *FILTER model*¹⁴, was used to predict potential N reductions from implementing cropping, grazing and horticulture BMPs across the whole catchment/sub-catchments. These predictions are listed below and include various assumptions about uptake rates and effects on nutrient-generation rates across a land use type.

- *Irrigated horticulture BMPs across the Port Phillip region* - ≈ 60 t reduction in annual N load within the catchment, with 32 t of this reduction apportioned to Yarra/Maribyrnong catchments.
- *Dryland agriculture (grazing and cropping) BMPs across the Port Phillip region* - ≈ 43 t reduction in annual N load within the catchment, with 23 t of this reduction apportioned to Yarra / Maribyrnong catchments.

The *AEAM model* specified in the Werribee River Catchment Nutrient Management Plan (2002) was used to make predictions of N reduction in the Werribee catchment. These included:

- *Irrigated agriculture program in the Werribee catchment* - ≈ 13 t reduction in annual N load within the catchment, based on projected loads in 2030.
- *Dryland agriculture (grazing and cropping) program in the Werribee catchment* - ≈ 0.7 t reduction in annual N load within the catchment, based on projected loads in 2030.

The 2004-05 activities listed above focus on a subset of the industry groups/practices/ nutrient sources/locations implicated in these N reduction estimates. Although their proportional contribution cannot be estimated, it appears that a significant increase in the adoption of best management practices will be needed to approach the N reductions estimated as achievable from catchment/sub-catchment wide implementation.

Environmental monitoring is in progress that will, in the long term, provide for assessment of progress with N reduction targets for the Yarra/Maribyrnong and Patterson/Mordialloc inputs to the Bay (see section 1.3.4).

Sources of more information:

www.ccma.vic.gov.au; www.dpi.vic.gov.au; www.dse.vic.gov.au; www.ausveg.com.au/enviroveg.cfm; www.melbournewater.com.au; www.ppwcm.vic.gov.au; www.epa.vic.gov.au

¹⁴ See Read Sturgess & Associates. 2000. *Economic benefit in nutrient load reduction in the Port Phillip Catchment - Scoping Study*. Read Sturgess & Associates Agricultural & Resource Economists, Melbourne, Australia.

A decision-support system (the 'FILTER model') has been developed to assist identification of key nutrient and sediment sources, and evaluation of load reduction opportunities in the Bay's catchment through a joint initiative between Melbourne Water, the then NRE, then Port Phillip and Westernport CALP Board and EPA. It is underpinned by a GIS-based program integrating water quality and flow data for 62 hydrologic zones within the catchment according to their land use, and each land use's nutrient and suspended solid generation rates (See Rosrakesh, S. & Argent, R. 1999, *An assessment of FILTER: Decision Support for the Port Phillip Catchment*, Centre for Environmental Applied Hydrology, University of Melbourne, CEAH REPORT 03/99.) A database of nutrient and sediment abatement opportunities for each hydrologic zone (the 'FILTER database') has been compiled, and is held by Melbourne Water. The contribution of these opportunities to N load reduction, and their relative cost-effectiveness, has also been estimated. This assessment could not include opportunities relating to septic tank management, reticulated sewerage connection and non-structural stormwater management tools such as education, due to the extent of information available on both the extent of these problems and benefits in terms of Bay N loads.

1.3.2 Stormwater Management

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Contribute to reducing the waterway N load to the Bay by 500 t through targeted stormwater action.

- *Annually develop/review a 1-3 works program of planned actions*
- *Annually report on implemented actions including load contribution (and including report on uptake or stormwater management plans by relevant local government)*

Planning:

- This theme is lead by MW and focuses on both:
 - contributing to the waterway 500 t reduction target (against the agreed baseline)
 - preventing, reducing and/or compensating for the future increases in stormwater N loads (above the designated baseline for the N reduction target¹⁵) expected from ongoing urban development within the catchment¹⁶.
- MW has adopted a target of reducing annual Bay N inputs from the stormwater system by 100 t by 2010 through constructing wetlands that capture and treat stormwater. It plans to design and construct 2-3 wetlands per year for 10 years. MW is also targeting other stormwater management mechanisms - eg BMPs, education, stormwater management plans and water sensitive urban design (WSUD) - whose implications for N loads is more difficult to predict. MW also continues to research alternatives to determine the most effective way to reduce N loads.
- In order to meet the 500 t target load reduction, additional work will be required in other areas of the catchment. A review of additional nitrogen reduction opportunities from the catchment will be conducted during 2005-06 to determine the most effective way to reduce the nitrogen to the target load.
- Melbourne Water will review current programs for nitrogen reduction in the context of the emerging river health and water quality programs. This review will consider additional actions that could be taken to reduce the nitrogen load further. Agreed works are built into MW's Corporate Plans and public reporting on performance occurs through MW's Annual Reports. Agreed works are built into MW's Corporate and Business Plans. Public reporting occurs in MW's Annual Report and Environment Report. Planning will also be included in the WQIP (see section 1.3.1).

Implementation:

WETLANDS -

- Melbourne Water completed three additional wetlands to remove an additional 2.7 t of nitrogen:
 - the Heritage Hills Wetland,
 - wetlands in the Jones Creek drainage scheme and
 - the Huntingdale Rd retarding basin wetland.
- The review discussed in the planning section will use the cost of nitrogen removed through wetlands as a baseline for comparing to additional actions.

Further research on nitrogen behaviour in designed wetlands is being conducted using information collated during this program.

¹⁵ The Bay N baseline was established by EPA consistent with the Bay SEPP schedule and consists largely of 1991-5 input loads; more information on the Bay N baseline is available from EPA.

¹⁶ The development expected within the next 20 years is expected to lead to annual load increases of 247 t, or 136 t if accompanied by water sensitive urban design best management practices. See Read Sturgess and Associates 2000.

OTHER TOOLS FOR IMPROVING STORMWATER QUALITY -

- *Encouraging water sensitive urban design (WSUD) continued during 2004-05 - work by MW, the development industry and local government to encourage WSUD included:*
 - Training on WSUD implementation to local government and industry professionals. This is part of VSAP's 'Clearwater' capacity building program, project-managed by MW.
 - Internal capacity building within councils through the development of a local structure plan to manage drainage infrastructure. These programs focused on green fields projects in Whittlesea and Whyndam Councils.
 - Development of published engineering design guidelines for WSUD.
 - Incorporation of offset concepts into Water Plans meaning that offsets could be used when considering urban development referrals to MW. As a result all developments over 0.4 Ha will achieve storm water quality objectives.
 - Emphasising the key role that WSUD plays in protecting rivers and creeks through research findings by the CRC for Freshwater Ecology on the impact of impervious surfaces. Additional data on this was collected in the Little Stringybark Creek during the year.
 - Revision of State Planning Policy Clause 56 on subdivision which now includes the achievement of storm water quality objectives for all developments down to two lot subdivisions.
 - Trialing of a planning approach to incorporating WSUD. MW worked with six local councils. One outcome of the trials was the development of a tool to assess the impact development proposals have on water quality.
- *Neighbourhood Environment Improvement Plans (NEIPs) - There are a number of pilot NEIPs being developed for waterways in the Bay's catchment by EPA with local government, industry, government agencies and the community. These include:*
 - the Stony Creek NEIP for which there is a long history of pollution entering from the multiple industrial sites located throughout the catchment and through diffuse urban stormwater runoff. This was the first NEIP to be approved by EPA and was launched in 2004. Implementation of NEIP during 2004-05 included:
 - Maribyrnong City Council and Hobsons Bay City Council subscription to Greenfleet Australia to reduce the environmental impact of their cars. Greenfleet is a non-profit organisation that plants native trees on behalf of motorists to absorb the greenhouse gas emissions that their vehicles produce. A total of 1,700 native trees have been planted alongside Stony Creek as a result of the combined Greenfleet subscriptions of both councils.
 - Friends of Cruikshank Park has conducted a number of tree planting days.
 - Focus on Stony Creek including;
 - Development of a Stony Creek Water Quality Monitoring Program Report.
 - Development of a Stony Creek Corridor Revegetation Strategy by Melbourne Water and Maribyrnong City Council.
 - Development of the Edwardes Lake NEIP. This plan is due for completion in 2005-06.

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)

N load reductions from constructed wetlands are relatively predictable, at least for waterway inputs, and are listed in the implementation summary above. Developing each wetland from design to functional maturity takes about 5 years. For projects targeting other stormwater management tools, N load reductions are diffuse and, as for rural land management actions, cannot be meaningfully estimated. The projects involving WSUD particularly (but not only) target the N load increases expected to accompany future catchment urbanisation.

Environmental monitoring is in progress that will, in the long term, provide for assessment of progress with N reduction targets for the Yarra / Maribyrnong and Patterson / Mordialloc inputs to the Bay (see section 1.3.4).

Sources of more information:

www.epa.vic.gov.au, www.melbournewater.com.au

1.3.3 Licenced Waste Discharges

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Contribute to reducing the waterway N load to the Bay by 500t through regulation of licenced waste discharges including sewage treatment plants (STPs) that discharge to catchment waterways.

- *Annually develop / review a 1-3 works program of planned actions*
- *Annually report on implemented actions including load contribution (and including report on any new or increased licenced waterway N discharges)*

Planning:

This theme is lead by EPA Victoria. Its planning framework is guided by the Environment Protection Act 1970 and State Environment Protection Policies (SEPP) developed under the Act (particularly the SEPP Waters of Victoria and its Port Phillip Bay and Yarra schedules). It is also guided by EPA's Corporate and Business planning processes. The PPWWQP (see section 1.3.1) will in future provide a key tool for work program development.

Implementation:

UPGRADES TO LICENCED DISCHARGES INCLUDING STPS -

- *Yarra Valley STPs* - The following upgrades are in progress/complete, with associated expected annual N load reductions to receiving waterways in the Bay's catchment:
 - Works continued on the Yarra Valley Water Limited Whittlesea Sewage Treatment Plant in 2004-05, including works to implement the Whittlesea Recycled Water Scheme to allow for 100% reuse of effluent. These works will ensure there are no further discharges into Plenty River. The scheme's capacity has been designed to cater for a total effluent flow of 400 Megalitres per annum (capacity of 170 ML per annum).
 - Works carried out on the Emerald - Cockatoo pipeline in 2003-4 experienced some delays with decommissioning of Ferres and Symons to be completed in 2004-05 (4 t N/yr). The project was not completed within this reporting period.
- *Amendments to Manufacturing Industry Licences* - EPA continued to amend licences to require the development of stormwater management plans, increased reuse and reduced wastewater to sewers.

PROVISION OF SEWERAGE -

- *Coode Island Industrial Sewer Project* - The project to connect Coode Island companies to the sewerage system commenced in 2004-05 and is due for completion in late 2006.

OTHER TOOLS TO ASSIST ENVIRONMENTALLY SUSTAINABLE WASTE MANAGEMENT-

- *Landfill siting and management* - EPA continues to work with the landfill industry to encourage implementation of a statutory guide for best practice liner construction, leachate and groundwater management.

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)

N load reductions from STP upgrades are relatively predictable, at least for waterway inputs, and are listed in the implementation summary above. For other tools aiming to facilitate and encourage environmentally sustainable waste management, including reduced point-source and diffuse waste discharges, N load reductions are diffuse and, as for rural land management actions, cannot be meaningfully estimated.

Environmental monitoring is in progress that will, in the long term, provide for assessment of progress with N reduction targets for the Yarra/Maribyrnong and Patterson/Mordialloc inputs to the Bay (see section 1.3.4).

Sources of more information:

www.epa.vic.gov.au

1.3.4 Overarching Tools and Mechanisms

This section focuses on tasks within the catchment waterways sub-program which overarches all three of its key management themes:

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Encourage water sensitive design:

See section 1.3.2

Consider the long-term risk of Bay N load in strategic planning processes

- *Issues and directions to be outlined in the final Melbourne Metropolitan Strategy*
- *Aquaculture of filter feeding shellfish is likely to develop significantly and will reduce N (-ve) over long term*
- The Melbourne Metropolitan Strategy, Melbourne 2030¹⁷, was released in October 2002. Improving the environmental health of the bay's and the catchments is included as an important policy to achieve one of Melbourne 2030's nine recognised directions - 'A great place to be'. An implementation program describing progress with all Melbourne 2030's environmental initiatives, with linkages to sources of further information, is available at www.melbourne2030.vic.gov.au. Implementation of these programs continued during 2004-05.
- The 2004-05 activities listed in sections 1.3.1- 1.3.3 include strategic planning elements. Other strategic planning projects relevant to reducing Bay N risk included:
 - Sewer connection project - An EPA, Shire of Yarra Ranges and Yarra Valley Water project targeting septic tanks aims to identify reasons for poor connection rates in sewered areas, develop actions and quantify environmental impact. This project commenced during this reporting period.
 - Aurora Development - The Aurora Estate is the largest subdivision in Victoria. This new development located in Epping, a northern suburb of Melbourne, will have approximately 10,000 new allotments developed over the next 10 years. The properties will be connected to two water pipelines including a clean drinking water pipe and another delivering Class A grade reuse water for use in the garden and other suitable areas. This is relevant to reducing N load increases expected from the new development and has involved VicUrban, Yarra Valley Water, EPA, Melbourne Water, Whittlesea City Council and the development industry.
 - *Report on key actions affecting waterway N load in PPWCMA annual report*
- The PPWCMA launched its revised RCS in December 2004. The reporting framework for the RCS is expected to integrate with and incorporate reporting for the Bay EMP. Progress on the implementation of the 97 actions in the RCS is monitored through a tailored Action Tracking System. This will enable reporting on the PPB EMP to be undertaken in the context of integrated NRM. While the reporting framework had not been finalised in 2004-05, it will be utilised to report on 2005-06 and future updates of the Bay EMP. The PPWCMA's 2005-06 annual report will also include a summary of key catchment actions relevant to reducing waterway N loads across the PPWCMA's region.

Liaise (PPWCMA and CCMA) to provide a coordinated oversight

This is a strategic task that is difficult to include in annual reporting. However, section 1.3.1 describes activities led by the CCMA that are relevant to reducing N loads to waterways that enter the Bay within its region.

¹⁷ See Department of Infrastructure 2002. *Melbourne 2030 Planning for Sustainable Growth*. Department of Infrastructure, Melbourne, Australia.

Monitor waterway N load, including storm-event sampling, to allow for comparison between Yarra-Maribyrnong and Patterson-Mordialloc waterway loads and baselines

- **Annually provide relevant data to electronic data warehouse**
- **Use waterway monitoring data to estimate waterway loads at minimum of 2003 and 2006**
- Monitoring continued, lead by MW with EPA, DSE and the PPWCMA, at five sites, covering ten storm events during the year. This will provide more accurate information on the impact of storms on the N load entering Port Phillip Bay. Data from the monitoring program will be reviewed and interpreted for outcomes during 2005-06. This data may assist development of an improved estimate of the nitrogen load to the Bay from the Bay's catchment, which is expected to be available by the end of 2005-06.

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)

While general waterway monitoring data are included on the data warehouse, there are no current plans to include storm event data as envisaged in the EMP. A model is required to translate these data into storm load estimates for the major waterway inputs. When enough storms have been sampled, MW will report on this with an overview included in the relevant BAR.

Sources of more information:

www.epa.vic.gov.au; www.melbourne2030.vic.gov.au; www.ppwcm.vic.gov.au

1.4 Atmosphere

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

EPA prepares annual air monitoring reports that assesses society's compliance with the air quality policy. This enables assessment of air quality relative to objectives; informs the development of air quality management strategies; and allows evaluation of the effectiveness of air quality management activities.

Oversee implementation of the Port Phillip Region Air Quality Improvement Plan (AQIP).

- ***Regular reporting as per AQIP***
- A draft AQIP released in 1998 recognises NO₂ as a priority common pollutant and proposes objectives and actions to reduce vehicle emissions, the predominant NO_x source. EPA considers the AQIP a critical tool to help manage air quality, including N₂ emissions, and work towards its finalisation is continuing. Oxides of nitrogen (NO_x and its precursor, NO), are recognised in the two relevant State Environment Protection Policies (SEPP -Air Quality Management and SEPP-Ambient Air Quality) as a priority air pollutant. These policies respectively provide air quality objectives to be met and the strategies employed to meet them. EPA's range of statutory tools are continually employed to ensure NO₂ air quality objectives are met in the Port Phillip region.
- EPA continued to implement the Environment Protection (Vehicle Emissions) Regulations, updated in 2003/04. These specify standards for motor vehicle air and noise emissions and also define petrol quality parameters, set construction, maintenance and labelling requirements, set vehicle emission standards and establish offences relating to vehicle fuel and emission controls. These regulations, in combination with collaborative approaches at the national level aimed at new vehicle design will contribute to reducing atmospheric N emissions over time.

Annually collate significant works approvals and licence amendments relevant to Bay atmospheric N load, including predicted load implications.

- ***Annually report***
- There were no major new works approvals or closures that would significantly affect atmospheric Bay N loads.

1.5 Other Risks to Cycling

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Develop and implement a program to monitor the state of Bay N cycling

Establish inter-agency Bay nutrient monitoring technical coordinating committee

- *Publish agreed program on the electronic data warehouse*
- *Publish ongoing monitoring data on the electronic data warehouse*
- This monitoring program is in progress. Reports describing the program, and its technical and statistical rationale, are available on the DSE website (www.dse.vic.gov.au)¹⁸. Benthic nutrient fluxes were continued as planned and continuous physicochemical monitoring was carried out of bottom and surface waters at three sites for the full year.
- The data are maintained by PIRVic, and three interpretive reports have been produced^{19,20,21}. A second interpretive report was published in December 2004, covering monitoring carried out from August 2002-June 2003. A third report is in preparation, covering monitoring in the period July 2003-June 2005.
- The inter-agency nutrient monitoring technical committee continued to operate in 2004-05.
- Two research projects considering biological linkages to nutrient cycling managed by PIRVic continued in 2004-05:
 - "Building effects of marine pests into nutrient management strategies."
 - "Assessing the impact of declining nutrient inputs on fish production".

'STATE' INDICATORS - MONITORING TO DETECT DETRIMENTAL CHANGES TO BAY N CYCLING PROCESSES (See Appendix 1)

The objective of the Bay nutrient monitoring is 'To detect, as early as possible with current scientific understanding, detrimental changes to critical elements of Bay N cycling processes that indicate an increased risk of eutrophication at Bay-wide and regional scales'.

The 2002-2005 PIRVic monitoring report¹⁷ provides an interpretation of early results and included the following data:

- Measurements of benthic nutrient fluxes and denitrification efficiency in Spring 2004 and Autumn 2005.
- Continuous monitoring of physicochemical water quality parameters in near-bottom and near-surface waters from July 2004 - June 2005, although some data was missing for some parameters at various times between September 2004 and January 2005 due to equipment failures.

Some of the conclusions drawn from these data are given below, however the report should be consulted for more detail including assumptions, rationale and data.

¹⁸ Longmore, A.R. (2000). Port Phillip Bay Nutrient Monitoring Proposal - Scientific and Technical Advice. Marine and Freshwater Resources Institute Report No 16. Fisheries Victoria, Victoria Australia.; See Longmore, A.R., and Gason, A., 2001, Port Phillip Bay Nitrogen Monitoring Proposal - Statistical Advice. Marine and Freshwater Resources Institute Report No. 32 Fisheries Victoria, Victoria, Australia. (available at www.dse.vic.gov.au)

¹⁹ Longmore AR (2004) Port Phillip Bay Environmental Management Plan: Monitoring the state of Bay nitrogen cycling (2003). Marine and Freshwater Systems Report Series No. 3. Primary Industries Research Victoria, Queenscliff.

²⁰ See Longmore, A.R., 2003, Port Phillip Bay Environmental Management Plan: Monitoring the state of Bay nitrogen cycling. First report (2002). *Marine and Freshwater Resources Institute Internal Report No. 41*. Marine and Freshwater Resources Institute: Queenscliff. (available at www.dse.vic.gov.au)

²¹ See Longmore AR (2005) Port Phillip Bay Environmental Management Plan: Monitoring the state of Bay nitrogen cycling (2002-2005). Marine and Freshwater Systems Report Series No. 07. Primary Industries Research Victoria, Queenscliff.

- Benthic nutrient fluxes during 2003-2005 were low in central Port Phillip Bay and denitrification efficiencies high. Fluxes in Hobsons Bay were 2-3 times those in central Bay, and though denitrification efficiency dropped from exceptionally high levels in Hobsons Bay in spring 2002 and autumn 2003 to lower levels in autumn 2004 and 2005, it was still well within the range of previous observations. The changes do not appear to be part of a longer-term decline in Bay health.
- The Bay has been saltier than at any time since 1983, because of low runoff, but the rains over winter 2004 and February 2005 led to a small decline in salinity. Dissolved oxygen and chlorophyll concentrations complied almost completely with SEPP objectives, though bottom oxygen concentrations fell below the SEPP objective for a substantial number of samples at Hobsons Bay and Long Reef sites.
- There was an observable denitrification efficiency reduction in Hobsons Bay immediately after the flood, but the decline was not statistically significant. Denitrification efficiency at the central bay site in Autumn 2005 was lower than the long-term average, but similar to Autumn 2004, suggesting no impact could be attributed to the flood. The impact of the flood was considered to be varied between locations, but was short-lived.
- On the basis of the data collected so far there is nothing to indicate a baywide decline in denitrification efficiency; nor have there been changes to the other indicators (chlorophyll, dissolved oxygen, dissolved organic nitrogen concentrations) that would accompany such a change.

Contribute to the integrated Bay nutrient monitoring program by maintaining current long-term monthly nutrient monitoring at existing Bay fixed sites.

- ***Publish monitoring data on the electronic data warehouse***
- ***Provide summary and detailed interpretive reports at technically appropriate timelines***

EPA continued its fixed site monitoring program, and maintained the data on its database. These data are publicly available. The program focuses on assessing long term trends in Bay water quality.

MW continued to participate in and provide funding for a monitoring program to provide early warning of Bay eutrophication which was coordinated by DSE.

Through targeted research, resolve key uncertainties that limit the interpretation of Bay monitoring results.

Investigate the impacts of marine pests on Bay nutrient cycling processes.

- ***Publish summary reports in BAR with detailed technical reports and papers at technically appropriate timeframes***

The three-year collaborative research project between University of Melbourne, PIRVic, DSE, DPI and the Australian Research Council's Linkage program formally finished in 2004-05, although there will be some further data analysis, interpretation and preparation of scientific papers.

Key preliminary findings include the observed dramatic changes over time of the distribution and abundance of some marine pests and implications to nutrient cycling. Research focussed on the following marine pest species that had feeding, structure or other characteristics with particular potential to affect parts of the nutrient cycle and were amenable to study:

- the fanworm *Sabella spallanzanii*
- the ascidian *Styela clava* (although numbers declined dramatically during the study)
- the bivalve *Raeta pulchella*
- the seastar *Asterias amurensis*

The study revealed that some marine pest species can have some effects on nutrient cycling. An overview report of the results - including the size of these effects and how they can vary with factors such as the pest's density, spatial arrangement and location - and a summary will be available on DSE's web site with technical details in the scientific literature. Other information was collected as a by-product of addressing the study's key objectives (such as aspects of marine pest ecology, how sediment denitrification efficiency varies in space and time, methods to measure sediment denitrification) that will also be relevant to Bay management.

This research also highlighted the substantial risk that the introduction of *Maoricolpus roseus* (New Zealand screw shell) would pose to the Bay's habitats and nutrient cycling. Collaborative research established between researchers from this project and from University of Tasmania will help clarify the likely impacts. This further emphasises the importance of a preventative approach to marine pest management (see EMP marine pest program).

Develop and implement defensible, complementary project-specific monitoring at relevant scales for projects and/or programs particularly relevant to N cycling risk.

No relevant projects or programs arose over 2004-05.

'PRESSURE' INDICATORS - INFORMATION FOR LONG-TERM ASSESSMENT (See Appendix 1)
The pressure indicators for this sub-program relate to progress with the two preceding tasks, whose implementation is discussed above.

1.6 Reporting on Progress

Tasks and reporting embedded within the previous sub-programs.

1.7 Progressively Improving Understanding

Tasks and reporting embedded within the previous sub-programs.

1.8 Review

The Central Coastal Board's (CCB) review of the EMP's implementation is scheduled to commence in 2006.

2 MARINE PEST PROGRAM

2.1 Vector Management - Ballast Water

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Establish a ballast waste management regime that reduced risks from internationally and domestically sourced ballast water that is proposed for discharge to the Bay

- *Annually collate progress*

Consider the risk of marine pests in long-term strategic planning; advocate action by port and ship managers that helps reduce the risk of marine pests.

The Australian Quarantine Inspection Service (AQIS) requirement that high-risk ballast water is not discharged into Australian ports or waters²² continued to be applied in 2004-05. Ballast water is regarded as 'high risk' if the ballast water was taken up in an international port where there is the likely presence of three target pest species that are not recorded in the Bay *Gymnodinium catenatum*, *Crassostrea gigas* (feral) and *Mytilopsis sallei* (see Appendix 1).

In December 2002, the 18-month Hastings National Demonstration Project I concluded at the Port of Hastings. Given the broad success of the trial to manage the risk of spreading pests in ballast water through domestic shipping, arrangements in place at Hastings have remained throughout the 2004-05 period.

On 1 July 2004, the Waste Management Policy (Ships' Ballast Water) came into effect. The key purpose of the Policy is to reduce the risks of spreading marine pests through domestic ballast water. Under the Policy, high-risk domestic ballast water must not be discharged into Victorian state waters. These Victorian arrangements, administered by EPA, complement regulations administered by AQIS for international ballast water. These arrangements will ensure that high-risk ballast water, regardless of its source, is not discharged into Victorian waters. The Policy applies to all ships entering a Victorian port, including the Port of Melbourne and the Port of Geelong. In the first year of operation, there were over 4300 ship visits to Victorian ports. 100% of ships complied with the key policy objective preventing the discharge of high-risk ballast.

Develop and implement environmental management plans that addresses the risks of marine pests in operating the Ports of Geelong and Melbourne

- *Publish plans (and associated periodic implementation reports)*

The Government's Review of Port Reform Process has led to significant changes to the way that all Victorian ports are managed. In 2003, the *Port Services Act 1995* was amended to include requirements for all ports in Victoria, including all local ports, to introduce Port Safety and Environment Management Plans (SEMP) by 2005. These plans build on existing arrangements and are designed to ensure that the risks of port operations to safety and the environment are assessed and management strategies are developed. The SEMPs take a risk based approach and complement existing environmental requirements in the Environment Protection Act 1970, SEPP (Waters of Victoria) and other environmental legislation. In 2004-05 all ports in Victoria, including all commercial ports and local ports, developed SEMPs in accordance with the legislation. This included SEMPs for the Port of Melbourne (Port of Melbourne Corporation), Port of Geelong (Toll) and Port Phillip (Parks Victoria).

Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of ballast water.

- *Annual progress report in BAR*

The identification of effective risk indicators will be assisted by the National System for the Prevention and Management of Marine Pest Incursions which, in the coming years, will address

²² Australian Quarantine and Inspection Service 2001. Australian Ballast Water Requirements. Australian Quarantine and Inspection Service, Canberra, Australia.

monitoring arrangements for marine pests in Australian ports.

Sources of more information:

www.epa.vic.gov.au/water/ballastwater; www.dse.vic.gov.au/marinepests

2.2 Vector Management - Fouling of Large Ships

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Assess the feasibility of establishing a hull fouling management regime

- *Report, including summary in BAR*

Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of fouling of large ships.

- *Annual progress report in BAR*

In 2004-05, the risk associated with fouling of large ships continued to be managed through the application of antifoulants and by the ban on in-water hull cleaning under the *Marine Act 1988*. Existing arrangements for antifoulants continued to be applied.

2.3 Vector Management - Fouling of Small Vessels

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Establish a management regime to reduce the risk that small vessels and their associated gear introduce marine pests and transfer them within the Bay

- *Annual progress report in BAR*

Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of fouling of small vessels.

- *Annual progress report in BAR*

During 2004-05, an awareness campaign focusing on preventative measures to avoid spreading pests was continued. This campaign was based on the scientific analysis of the way in which small vessels could be infected with marine pests that was published in 2002-03²³.

Sources of more information:

www.dse.vic.gov.au/marinepests

2.4 Vector Management - Aquaculture

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Ensure that the aquaculture of translocated aquatic biota within the Bay conforms to Victoria's translocation policy.

Ensure that marine farming equipment introduced to the Bay from other marine areas is treated to ensure that it is free of marine pests.

- *Annual report on consents, conditions and compliance in BAR*

Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving management of aquaculture.

- *Annual progress report in BAR*

²³ Hayes K. R. 2002. *Identifying hazards in complex ecological systems. Part 2: Infections modes and effects analysis for biological invasions*. *Biological Invasions* 4 (251-261).

During the year the *Victorian Mussel Translocation Protocol* for the Movement of Mussel Ropes and Equipment between Port Phillip Bay and Westernport continued to be applied.²⁴

The incidental movement of marine pests via aquaculture gear will also be addressed by actions outlined in the '*National System for the Prevention and Management of Marine Pest Incursions: Australian Strategic Plan 2002-2006*'.²⁵

The *Victorian Guidelines for Assessing Translocations of Live Aquatic Organisms* in Victoria were implemented during 2004-05 including the adoption of management actions to reduce the risk of spreading marine pests.

Sources of more information:

www.dse.vic.gov.au/marinepests; www.dpi.vic.gov.au/fishing

2.5 Early Detection

Design and trial a monitoring system that maintains the currency of information on the status of 'target species'.

- *Annually report on progress and on detection of new 'target species' and new exotic species in BAR*

No new marine pest introductions were reported in Port Phillip Bay over 2004-05. (Note that during this year reporting of new pest introduction was reliant on general observations by the public rather than a systematic program dedicated to detecting the introduction of a new pest species).

Early detection provides the best opportunity for eradication or control of a newly established species. DSE in collaboration with Australian State and Commonwealth Governments, CSIRO and the Bureau of Rural Sciences is developing practical monitoring guidelines for the early detection of marine pests. This project was completed in 2005.

The *National Introduced Marine Pest Information System* (NIMPIS) released in July 2003 continued to operate in 2004-05. Included within this system are species known to be introduced to Australian waters and species that are considered to be likely future introductions ('next pests')²⁶.

Sources of more information:

www.marine.csiro.au/crimp/nimpis

2.6 Mitigate Effects of Introductions

Key Tasks, Reporting Outputs and Key 2004-05 Actions:

Mount rapid response to the introduction of new pest species to the Bay where feasible technically and beneficial environmentally, economically and socially;

- *Annual report on action in BAR*

Implement and support targeted research to better understand existing pest populations (with a particular emphasis on the impacts of pests on Bay nutrient cycling processes), with the aim of mitigating their impacts in the longer term where feasible technically and beneficial environmentally, economically and socially

²⁴ See also Gunthorpe, L., Mercer, J., Rees, C. and Theodoropoulous, T. 2001. *Best practices for the sterilisation of aquaculture farming equipment: A case study for mussel ropes*. Marine and Freshwater Resources Institute report No. 41. Marine and Freshwater Resources Institute, Queenscliff

²⁵ Department of Agriculture Fisheries and Forestry 2002. *National System for the Prevention and Management of Marine Pest Incursions*: Australian Strategic Plan 2002-2006. AFFA, Australia.

²⁶ Hewitt C.L., Martin R.B., Sliwa C., McEnnulty, F.R., Murphy, N.E., Jones T. & Cooper, S. 2002. Editors. National Introduced Marine Pest Information System. Web publication <www.marine.csiro.au/crimp/nimpis>, Date of access: 3-Sep-2003

- *Publish summary reports in BAR with detailed technical reports and papers at technically appropriate timeframes*

Implement actions to mitigate the impact of established pests in the longer term where feasible technically and beneficial environmentally, economically and socially.

- *Annual report on action in BAR*
- As noted in section 2.5, no new marine pest introductions to the Bay were reported over 2004-05. (Note that this reporting was reliant on general observations rather than a systematic program dedicated to detecting the introduction of a new pest species.)
- As noted in Section 1.5, a research project began in 2002, with funding support of the Australian Research Council, to investigate the links between nutrient cycling in the Bay's sediments and marine pests (see progress report in Section 1.5). This project has now been completed.
- Control efforts continue to focus on the Northern Pacific Seastar in accordance with the National Control Plan. In the absence of readily available technology to reduce Seastar numbers, priority continues to be given to reducing the risk of its introduction to new areas of Victoria and elsewhere in Australia. In 2005, research was completed by DSE in partnership with CSIRO Marine Research to address three key knowledge gaps in the Control Plan. First, temporal and spatial patterns of larval abundance in Port Phillip Bay and the Derwent River Estuary were recorded to assess potential opportunities to use larvae free ballast windows for risk mitigation. Secondly, characteristics of non-ballast, human-mediated vectors, other than ballast, that pose risks of spreading exotic species across southern Australia were investigated. Aquaculture and commercial fishing were found to be high risk vectors based on anecdotal evidence. Observations are currently being investigated with gene-probe by CSIRO Marine Research. Thirdly, a new national port survey system is being developed to manage the risk of marine pests, including *Asterias* spreading around Australian ports. This is due for completion in 2006. (see www.deh.gov.au/coasts/ for a downloadable pdf).
- The information arising from the above projects are currently being used by CSIRO to evaluate the implications of various management options to deal with the Seastar (see www.environment.gov.au/coasts/imps/publications/pacific-seastar-impacts).
- Efforts have also focused on investigating a risk-based approach to reducing the spread of marine pests around Australian ports from domestic shipping traffic. Port Phillip and Western Port have served as a case study. Studying the advection and dispersal of modelled larvae suggest that exchanging ballast on the most eastward mid-point of Bass Strait shipping routes significantly reduces the risk of marine pests establishing compared to a point source discharge in Port Phillip or Western Port.

Sources of more information:

www.dse.vic.gov.au/marinepests

2.7 Reporting on Progress

Tasks and reporting embedded within the previous sub-programs.

2.8 Progressively Improving Understanding

Tasks and reporting embedded within the previous sub-programs.

2.9 Review

The Central Coastal Board (CCB) completed the interim review of the EMP's implementation in 2003. This review highlighted the complexity of assessing progress in addressing the pest risks to Port Phillip Bay and provided a timely articulation of the challenges involved in implementing the EMP towards its statutory timelines and into the longer term. The more comprehensive review of the EMP's implementation is scheduled for 2006.

ABBREVIATIONS

AQIP	Port Phillip Air Quality Improvement Plan
BMP	Best Management Practices
BRS	Bureau of Rural Sciences
CCB	Central Coastal Board
CCMA	Corangamite Catchment Management Authority
PPWCMA	Port Phillip and Westernport Catchment Management Authority
CRIMP	Centre for Research on Introduced Marine Pests
CSIRO	Commonwealth Science and Industrial Research Organisation
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EIP	Environmental Improvement Plan
EMP	Environmental Management Plan
EPA	Environment Protection Authority
MAFRI	Marine and Freshwater Resources Institute
NEIP	Neighbourhood Environment Improvement Plan
NRE	Department of Natural Resources and Environment
PIRVic	Primary Industries Research Victoria
PPWWQP	Port Phillip and Western Port Water Quality Plan
RCS	Regional Catchment Strategy
SEPP	State Environment Protection Policy
SMP	Stormwater management plan
STP	Sewage treatment plants
VSAP	Victorian Stormwater Action Program
WSUD	Water sensitive urban design
WTP	Western Treatment Plant

APPENDIX 1

Reproduced from Bay EMP²⁷ (Table 3.1)
 Relationships Among Nutrient Monitoring and Reporting Tasks, within a Pressure-State-Response Framework.

Sub-Program	Pressure	Response	State
1.1 WTP	Input: <ul style="list-style-type: none"> • environmental monitoring of flow & N - <i>annual</i> (to EPA, NRE) • compilation of load estimates - <i>2002, 2004, 2006</i> • interpretation of change from baseline - <i>2010</i> 	Input: <ul style="list-style-type: none"> • actions implemented to reduce loads and predicted load implication - <i>annual</i> 	Input: Environmental monitoring of indicators of Bay cycling processes
	Output: Bay Actions Report	Output: Bay Actions Report	
1.2 New Direct Loads	Input: <ul style="list-style-type: none"> • predicted load implication of any approved proposals - <i>annual</i> 	Input: <ul style="list-style-type: none"> • relevant 'permits' issued and predicted load implication - <i>annual</i> • progress with investigation of offset measures - <i>2002</i> 	<ul style="list-style-type: none"> - <i>ongoing (on data warehouse)</i> - <i>annual summary of results</i> - <i>interpretation with timing as technically appropriate for individual monitoring elements</i>
	Output: Bay Actions Report	Output: Bay Actions Report	

²⁷ See Department of Natural Resources and Environment 2002a.

1.3 Catchment Waterways	<p>Input:</p> <ul style="list-style-type: none"> • environmental monitoring of flow & nitrogen, including targeted storm-event sampling - <i>ongoing (on data warehouse)</i> • compilation of load estimates - <i>2003 & 2006</i> • interpretation of change from baseline - <i>2014-2016</i> 	<p>Input:</p> <ul style="list-style-type: none"> • actions implemented to reduce loads and predicted load implication - <i>annual</i> • any significant new waterway loads licenced - <i>annual</i> • mechanism established for coordinated implementation - <i>annual</i> • long term N load risk considered in strategic planning - <i>in finalised Metro Strategy</i> 	Output: Bay Actions Report
	Output: Bay Actions Report	Output: Catchment Actions Report in CALP Board Annual Report	
1.4 Atmosphere	<p>Input:</p> <ul style="list-style-type: none"> • refined load estimate and regularly updated air inventory - <i>regular as per AQIP</i> 	<p>Input:</p> <ul style="list-style-type: none"> • AQIP actions relevant to long term load reduction implemented - <i>regular as per AQIP</i> • any significant new atmospheric loads licenced - <i>annual (Bay Actions Report)</i> 	
	Output: AQIP Regular Reporting	Output: AQIP Regular Reporting	

APPENDIX 2

List of 12 target marine pest species considered to cause severe social, economic or environmental impacts.

Species	Present/Absent in the Bay
<i>Asterias amurensis</i>	<i>Present</i>
<i>Carcinus maenas</i>	<i>Present</i>
<i>Corbula gibba</i>	<i>Present</i>
<i>Crassostrea gigas</i> (feral)	<i>Absent</i>
<i>Musculista senhousia</i>	<i>Present</i>
<i>Mytilopsis sallei</i>	<i>Absent</i>
<i>Sabella spallanzanii</i>	<i>Present</i>
<i>Undaria pinnatifida</i>	<i>Present</i>
<i>Gymnodinium catenatum</i>	<i>Absent</i>
<i>Alexandrium catenella</i>	<i>Present</i>
<i>Alexandrium minutum</i>	<i>Present</i>
<i>Alexandrium tamarense</i>	<i>Present</i>
