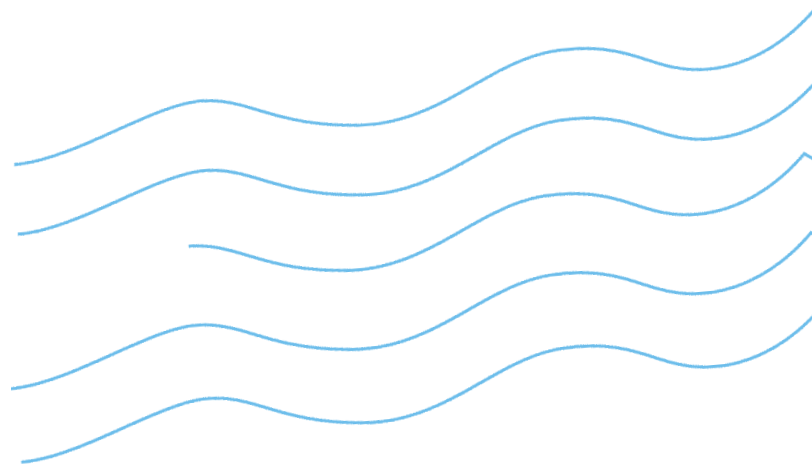




Port Phillip Bay Environmental Management Plan

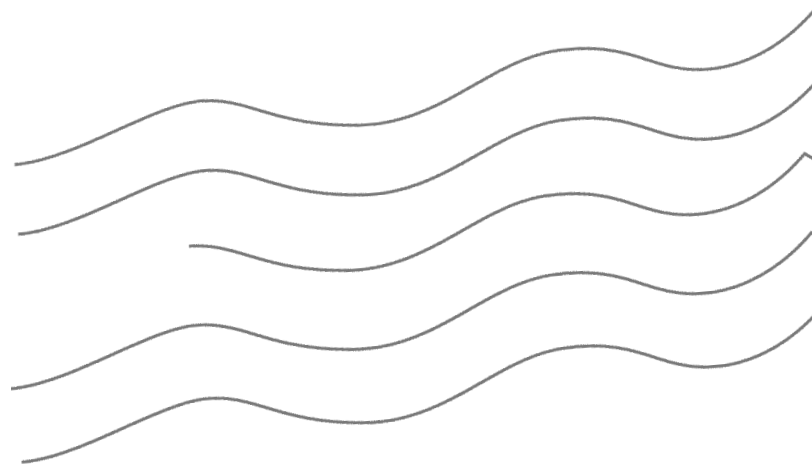
Bay Actions Report 2001–2002





Port Phillip Bay Environmental Management Plan

Bay Actions Report 2001–2002



This report is intended to 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.

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Preface

This Bay Actions Report is the first performance report associated with the Port Phillip Bay Environmental Management Plan (Bay EMP), outlining tasks implemented during 2001–02 that mitigate the risks to the Bay environment from *nutrients* and *marine pests*.

The Bay EMP outlines the overarching framework for managing the Bay's environment. For these two key Bay risks – nutrients and marine pests – it describes our current management objectives and programs of associated tasks to 2003. It also describes the approach that will be used to report on progress with task implementation and environmental performance. This Bay Actions Report is a key element of this performance reporting framework. The report is a companion document to the EMP, reporting directly on progress with EMP programs.

The Bay Actions Report focuses on progress with implementing those 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*. This is the first such report, and is one of three complementary reporting systems that together constitute the Bay EMP's reporting approach. The two other systems will fall within the already, or soon to be, established environmental reporting mechanisms for the two other key environments that transmit risks to the Bay:

- > A Catchment Actions Report (within the Port Phillip and Westernport Catchment and Land Protection Board's annual report) – for tasks relating to Bay inputs *transmitted to the Bay via the catchment waterways*.
- > The Port Phillip Air Quality Improvement Plan (AQIP) Reporting System (within the AQIP currently being developed by EPA) – for tasks relating to Bay inputs *transmitted to the Bay via the atmosphere*.

However, for completeness, this first Bay Actions Report also overviews progress with tasks relating to waterway and atmospheric Bay inputs – therefore providing an overall performance report on progress to date with the EMP's programs.

Bay Actions Reports will be prepared annually, allowing us to track progress with reducing nutrient and marine pest risks to the Bay. This report is developmental in parts, particularly for marine pests. Tasks in the current pest program, such as development of monitoring approaches, will enhance its future reporting. Inherent background variability means that sensibly interpreting environmental monitoring results from the nutrient program will also require longer data series. Reports will therefore evolve and incorporate more quantitative environmental performance assessments as we build the data series needed for meaningful interpretation.

Reviews of the EMP's nutrient and marine pest programs are scheduled for 2003 (interim) and 2006. As outlined in the EMP, nutrients and marine pests are currently considered the highest priority risks to the Bay's environment. However, the relative importance of other Bay risks will continue to be considered, and where necessary the associated risk mitigation programs reviewed, progressively.

Note: This report was prepared for the 12 months ending 30 June 2002. The names of Government agencies are those applying at that time.

Introduction

The Bay EMP¹ describes our programs to 2003 for mitigating the risks that nutrients and marine pests pose to the Bay's environment, and the environmental management framework surrounding these programs. For each program, the EMP outlines:

- > Current program objectives for mitigating each risk, followed by a series of contributing sub-program objectives
- > Key tasks to address these objectives to 2003, ranging from management planning and implementation to coordination, monitoring and reporting

Each program's monitoring, reporting and review tasks are then consolidated in the EMP as a synthesised framework for reporting performance and reviewing progress. The reporting framework illustrate the relationships between each program's monitoring and reporting tasks, and summarise the tasks' reporting outputs and their timing. This 2002 Bay Actions Report is a key output of both the nutrient and marine pest reporting frameworks.

The EMP's nutrient reporting framework is based broadly on a pressure-state-response approach to monitoring and reporting. Performance assessment for the response element focuses on the extent of implementation of key nutrient program tasks and associated work programs, including monitoring. Performance assessments for pressure and state elements will be based largely on quantitative interpretation of environmental monitoring results, requiring timeframes beyond 2002. The marine pest reporting framework is more developmental and at this stage focuses on progress with implementing the program's tasks, which include development of environmental monitoring approaches.

This Bay Actions report therefore focuses on progress over 2001-2 with implementing the EMP's nutrient and marine pest programs. More specifically, it focuses on those 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*. Future Bay Actions Reports will also include environmental performance assessments providing an indication of the nutrient program's effectiveness². For completeness, this report also overviews progress with tasks relating to waterway and atmospheric Bay inputs – which will also be reported within the already, or soon to be, established environmental reporting mechanisms for these two other key environments that transmit risks to the Bay³.

This report should be read as a companion document to the Bay EMP, reporting directly on progress with EMP programs and tasks. Further background on the Bay environmental management framework, including nutrient and marine pest programs and their reporting approach, is provided in the EMP. More detailed background is available in an EMP Background Document⁴, supported by further technical documents.

¹ Department of Natural Resources and Environment 2002. *Port Phillip Bay Environmental Management Plan: Plan and Critical Programs to 2003*. Department of Natural Resources and Environment, Melbourne, Australia.

² Timing of reporting as outlined in the Bay EMP nutrient reporting framework.

³ The other two reporting outputs are: *A Catchment Actions Report* (within the Port Phillip and Westport Catchment and Land Protection Board's annual report) and *The Port Phillip Air Quality Improvement Plan (AQIP) Reporting System* (within the AQIP currently being developed by EPA). See EMP and particularly EMP reporting frameworks for further detail.

⁴ Department of Natural Resources and Environment 2002. *Port Phillip Bay Environmental Management Plan – Background Document*. Department of Natural Resources and Environment, Melbourne, Australia.

Bay Actions Report 2001–02

This Bay Actions Report summarises the implementation of tasks outlined in the EMP's nutrient and marine pest programs for the 2001–02 year. The approach it takes is to consider:

- > Historical Context;
- > Key Actions for 2001–02; and
- > Future Outlook considerations.

The **Historical Context** section provides background information that helps put the year's progress in perspective. This section describes tasks that have been implemented in the past (response element) and how the risks may have changed through time (pressure element). Broad trends and important events are highlighted to provide a qualitative picture of 'where we have come from'.

The **Key Actions for 2001–02** section lists key tasks that have been implemented, forming the bulk of the response element in reporting. Information provided is quantitative where it is both available and amenable to meaningful interpretation. This section considers 'where we are now' in relation to the EMP's programs.

The **Future Outlook** section outlines actions planned for the future to continue to address these key tasks within the EMP's programs (response element) and discusses how, if known, the pressures that contribute to these risks are likely to change. Tasks that have not been addressed and are not acknowledged in the past (Historical Context) or present (Key Actions for 2001–02) sections will be recognised as opportunities for the responsible agencies to undertake future action. This section is intended to provide brief qualitative insight into 'where we are headed'.

Nutrients

1.1 Direct Bay Inputs – Western Treatment Plant

Key Task – reduce the load from the Western Treatment Plant by 500 tonnes by 2006. As an associated task, continued data collection is required to allow comparison with the nitrogen baseline.

Historical Context

The Western Treatment Plant (WTP) treats approximately 54% of Melbourne's sewage annually.⁵ WTP uses a series of lagoons and either land irrigation or grass filtration to treat the sewage before it is discharged. The effluent contributes approximately 4,000 tonnes of nitrogen annually to the western side of the Bay. The Bay Study recommended that Melbourne Water increase WTP's denitrification efficiency during winter.⁶ This recommendation is addressed in Melbourne Water's Environmental Improvement Plan (EIP) for the WTP.⁵

The WTP EIP aims to improve environmental conditions of the Plant with a focus on reducing nitrogen loads entering the Bay by 2005. The Plan's actions include the installation of advanced lagoon technology that uses an activated sludge process to remove algae and nitrogen. This technology is to be applied in 55 East Lagoon and 25 West Lagoon and will increase nitrogen removal from 55 per cent to 70 per cent.

⁵ Melbourne Water 2000. *Western Treatment Plant Environmental Improvement Plan*. Melbourne Water, Melbourne, Australia.

⁶ See Harris, G., Batley, G., Fox, D., Hall, D., Jernakoff, P., Molloy, R., Murray, A., Newell, B., Parslow, J., Skyring, G. and Walker, S. 1996. *Port Phillip Bay Environmental Study: Final Report*. CSIRO, Canberra, Australia.

Key Actions for 2001–02

Work for the 2001–02 year involved upgrades to the lagoon and pond system, which included:

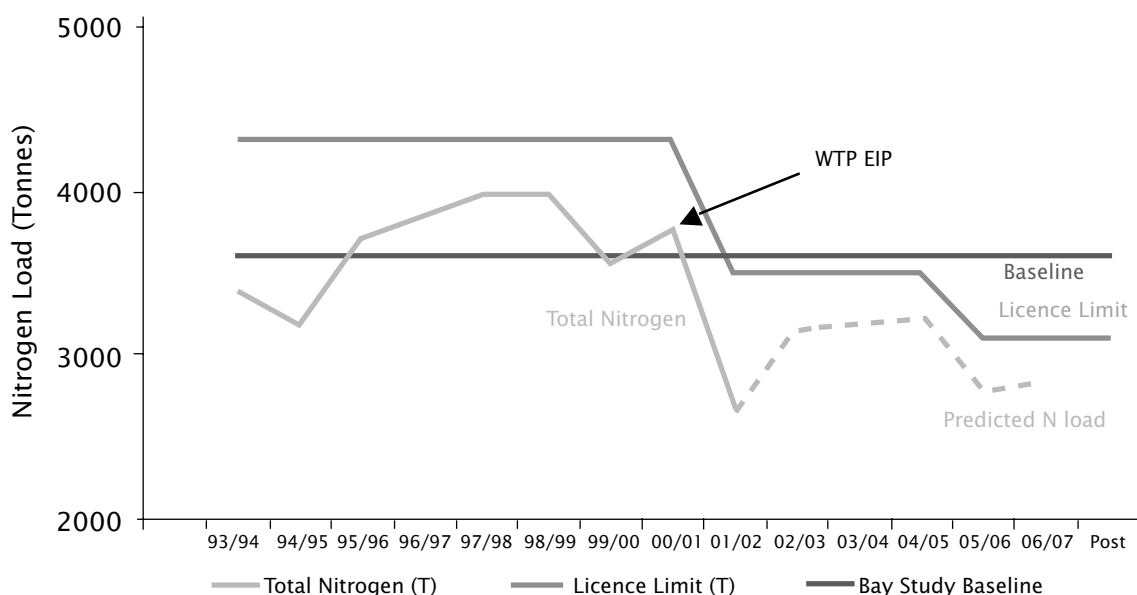
- > Construction and commissioning of the 55 East reuse connection – a pumped connection from the final pond of the 55 East Lagoon into Stage 1 effluent reuse delivery infrastructure.
- > Construction and commissioning of the 55 East Lagoon (Pond 4 to Pond 1) recycling to reduce mechanical aeration requirements for odour control on Pond 1 and to further enhance nitrogen removal and effluent quality.
- > Review of treatment performance of the upgraded 55 East Lagoon.
- > Commencement of the design for the 25 West Lagoon upgrade.
- > Beginning of construction of Stage 2 of the effluent reuse delivery system extending effluent delivery 1.8 kilometres further north and delivering effluent to an additional 1,050 hectares of land previously irrigated with raw sewage. These pipeline extensions were initiated as part of Melbourne Water’s reuse strategy, which targets 20 per cent reuse by 2010.⁷

The nitrogen load from the WTP to the Bay, for 2001–02, was 2,661 tonnes. This figure was derived from the plant’s EPA discharge licence monitoring program. This monitoring program will continue, providing a time series of load estimates that will in future provide for a rigorous quantitative comparison of WTP loads with the nitrogen baseline (see Bay EMP nutrient reporting framework), allowing performance assessment for the WTP reduction target. The monitoring data are stored on a database at Melbourne Water.

Future Outlook

It is estimated that the WTP upgrades will reduce annual effluent nitrogen loads by more than 500 tonnes by 2005. This represents a total net reduction in loads and accounts for potential future increases in WTP loads over time, due to increases in population and the sewerage network. Figure 1 below shows previous trends of nitrogen loads and expected trends as a result of implementing the WTP EIP.

Figure 1: Predicted reductions in nitrogen loads to Port Phillip Bay from WTP upgrades



⁷ Melbourne Water Corporation 2001. *Environmental Review 2000/01*. Melbourne Water, Melbourne

1.2 Direct Bay Inputs – New Proposals

Key Task – ensure that any EPA works approvals, and NRE consents granted under the Fisheries Act 1995 and Coastal Management Act are consistent with the EMP nutrient program. There should also be an investigation into the potential development of an offset system.

Historical Context

In Victoria, discharge of waste to the environment is the lowest preference in the hierarchy of waste management options, to be considered only after waste avoidance and reuse opportunities have been fully explored⁸. Developments involving waste discharge to the Bay may require a consent or licence, and licence or consent holders operate within a context of continual improvement of environmental performance.

The legislative and policy framework within which dischargers operate includes the *Environment Protection Act 1970*, SEPP (Waters of Victoria) – particularly Schedule F6 (Waters of Port Phillip Bay) and the Industrial Waste Management Policy (Waste Minimisation) 1990.⁹ Legislative tools under which consents or licences are granted include the *Environment Protection Act 1970*, *Fisheries Act 1995* and *Coastal Management Act 1995*. Consent or licence applicants must meet approved performance requirements regarding discharge quality and quantity.

There are currently three shore based aquaculture facilities that are licensed to discharge a combined maximum of 30 tonnes of nitrogen annually to the Bay. Other direct Bay discharges include the Altona treatment plant that discharged approximately 82 tonnes of nitrogen to the northern end of the Bay in 2001–02. The remaining direct Bay discharges are relatively small (less than 1 tonne) and consist of large septic tanks or small treatment plants.

The approach to be applied to proposals involving new or increased Bay nitrogen inputs, and its context, is described in Appendix 1 of the Bay EMP.

Key Actions for 2001–02

EPA issued a Works Approval to Australian Sea Urchins in December 2001. This aquaculture development located at Lara on the western side of the Bay will discharge, when the facility is operating at full capacity, 9.5 tonnes of nitrogen annually. EPA approved the application on the grounds that appropriate nitrogen offsets will be required if offset guidelines are developed in the future. There was no discharge during 2001–02 as the facility was under construction.

During 2001–02, EPA discussed the adoption of improved practices with three existing licence holders that have direct Bay impacts – Avalon Airport, Sands Caravan Park and Seabrae Caravan Park – with the intention that they reduce inputs to the Bay by adoption of reuse technology.

NRE did not issue licences or permits under the Fisheries Act with implications for the nutrient program in the 2001–02 year. Relevant licences or permits would mainly relate to aquaculture proposals. There have been no such applications within the Bay as there have been no increases in the Bay area designated for aquaculture. The Environment Conservation Council made recommendations to provide extra aquaculture areas in the Bay.¹⁰ The Government accepted these recommendations in 2001.¹¹

⁸ See *Environment Protection Act 1970*.

⁹ Victoria, Parliament 1990. 'Industrial Waste Management Policy (Waste Minimisation)', *Special Government Gazette*, no S52, 29 October, Victorian Government Printing Office.

¹⁰ Environment Conservation Council 2000. *Marine, Coastal and Estuarine Investigation: Final Report*. Environment Conservation Council, Melbourne.

¹¹ Victorian Government 2002. *Government Response to Environment Conservation Council's Marine, Coastal and Estuarine Investigation Final Recommendations*.

NRE provided 18 consents under the Coastal Management Act during 2001–02 for work that may have implications for nitrogen loads to the Bay. Eight consents related to works on stormwater infrastructure or related discharges, often involving the replacement of older pipes with newer larger pipes, which are often needed to cope with increases in the area of the urban catchment. Stormwater management is one of the key management themes through which reductions in Bay nutrient loads from the catchment are being targeted (See Bay EMP). Section 1.3.2 of this report outlines progress with this aspect of the EMP nutrient program.

The other consents were for maintenance dredging. Although dredging releases nutrients contained within sediment pore water, modelling indicates that the nutrient levels involved are significant only for large dredging projects¹². Dredging and spoil disposal could affect the nitrogen-removal ability of associated sediments, by reducing their denitrification effectiveness, but current scientific understanding does not provide for specific management targets. Given such scientific uncertainties, a Bay monitoring program has been developed to detect, as early as possible with current understanding, detrimental changes to critical elements of Bay nitrogen cycling processes (see Section 1.5). The EMP nutrient program also recognises the need for complementary project-specific monitoring for projects/programs particularly relevant to nitrogen-cycling risk.

Representatives from NRE and EPA are currently investigating the potential for nitrogen offset system. A preliminary investigation project, collating baseline information and facilitating consideration of an offset system, commenced in May 2002.¹³ Based on the project's results, and consultation, the efficiency of a potential offset system will be assessed in 2003–04. Consultation will occur with the aquaculture industry and other key stakeholders that may be affected by an offset system and associated guidelines.

Future Outlook

There may in future be increased pressure for consents, works approvals and licences, particularly for aquaculture developments in and around the Bay. Implementation of government approved ECC recommendations will make available to aquaculture 1,735 hectares within the Bay and approximately 57 hectares of land on the western side of the Bay.¹⁴ Nutrient management may be an important consideration associated with such aquaculture proposals, depending on the type of aquaculture involved.

In granting works approvals and licenses, EPA will continue to incorporate the EMP nutrient program into their decision making process. The current Altona treatment plant licence requires a works approval application in 2002–03 involving a tertiary upgrade to the treatment plant. This upgrade is predicted to halve current nitrogen discharge loads from a licence limit of 116 tonnes to 58 tonnes annually.

1.3 Catchment Waterways

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

¹² EPA 2001. *Guidelines for Best Practice Environmental Management of Dredging*. EPA Publication 691.

¹³ Department of Natural Resources and Environment 2002. *Nitrogen Offsets Project: Port Phillip Bay Environmental Management Plan Implementation*. Department of Natural Resources and Environment, Melbourne, Australia.

¹⁴ Environment Conservation Council 2000. *Marine, Coastal and Estuarine Investigation: Final Report*. Environment Conservation Council, Melbourne.

1.3.1 Rural Land Management

Key Task – contribute to nitrogen load reductions by working with agricultural industries to develop and encourage the implementation of sound environmental practices and procedures that will reduce nitrogen inputs to waterways from land used for cropping, grazing and horticulture.

Historical Context

The Port Phillip catchment contains a diverse range of farming practices that can contribute nutrients loads to waterways and the Bay. Very broadly, farming in the catchment can be divided into two areas. In the east, intensive industries such as flowers, viticulture, orchard fruit, strawberry fruit and poultry production exist. The western region is predominantly used for grazing, broad-based cropping and localised horticulture.¹⁵

In terms of overall area, rural land predominates the Port Phillip catchment. In the next 20 years, it is predicted that over 400 square km of rural land will be developed for urban use; this will result in an eight per cent decrease in rural land and a 20 per cent increase in urban area.¹⁶ In addition to urban growth, the next most significant change in rural land use during recent years has been the conversion of pasture to grape growing in the Yarra Valley and Mornington Peninsula.

Within the Port Phillip Bay catchment there are five catchment action plans derived from the Regional Catchment Strategy: Werribee, Maribyrnong, Yarra, Dandenong and Westernport (that includes the southeastern

side of the Bay).¹⁷ These Plans provide information on the location and type of priority actions that should be taken to address a variety of catchment issues including those that relate to improving water quality. A nutrient reduction plan has been developed for the Werribee River.¹⁸ The area south of Werribee that borders the southwestern side of the Bay is managed under arrangements established by the Corangamite Catchment Management Authority and actions and plans for achieving nutrient reductions are outlined in the Corangamite Region Nutrient Management Plan.¹⁹

In recent years, NRE, in partnership with industry, has focused on development and demonstration of best management practices by the strawberry fruit, strawberry runner, Werribee South Irrigators and the grape and wine industries. These industries have been selected due to:

- > demonstrated cost effectiveness associated with improving fertiliser management practices by intensive horticulture industries;
- > the presence of a captive audience of industry stakeholders;
- > the location of these industries in relation to hot spot catchments; and
- > flow-on benefits to other industries.

Industry groups such as the YV Fruits Group (orchard fruit) and the Vegetable Growers Association have initiated their own environmental best practice programs.

Actions implemented over 2001–02 (see below) have built on these past initiatives, with development and extension of best management practices forming integral themes of programs to reduce nutrient impacts.

¹⁵ Port Phillip and Westernport Catchment and Land Protection Board 2001. *Port Phillip and Westernport Catchment and Land Protection Board: Annual Report 2000/01*. Melbourne, Australia.

¹⁶ 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.

¹⁷ Port Phillip and Westernport Catchment and Land Protection Board 1997. *Port Phillip and Westernport Regional Catchment Strategy*. Port Phillip and Westernport Catchment and Land Protection Board, Frankston, Victoria. (i) Port Phillip and Westernport Catchment and Land Protection Board 1999. *Werribee Catchment Action Program*. Frankston, Victoria. (ii) Port Phillip and Westernport Catchment and Land Protection Board 1999. *Maribyrnong Catchment Action Program*. Frankston, Victoria. (iii) YarraCare & Port Phillip and Westernport Catchment and Land Protection Board 1999. *Yarra Catchment Action Plan*. Frankston, Victoria. (iv) Port Phillip and Westernport Catchment and Land Protection Board 1999. *Dandenong Catchment Action Program*. Frankston, Victoria. (v) Port Phillip and Westernport Catchment and Land Protection Board 1999. *Westernport Catchment Action Program*. Frankston, Victoria.

¹⁸ Department of Natural Resources and Environment 1999. *Werribee River Catchment Nutrient Management Plan*. Department of Natural Resources and Environment, Melbourne, Australia.

¹⁹ Corangamite Catchment Management Authority 2000. *Corangamite Regional Nutrient Management Plan*. Corangamite Catchment Management Authority, Colac, Victoria.

Key Actions for 2001–02

Irrigated Agriculture

The development and implementation of best management practices by intensive horticulture industries has been identified as an action in the Port Phillip and Westernport Regional Catchment Strategy, the Yarra Catchment Action Plan and Werribee River Catchment Nutrient Management Plan.

The implementation of best practice across the Port Phillip region by irrigated horticulture is estimated to achieve a nutrient reduction of approximately 60 tonnes per year of total nitrogen, with 32 tonnes per year being reduced from the Yarra and Maribyrnong catchments.²⁰ Implementation of the irrigated agriculture program in the Werribee catchment is estimated to achieve a nutrient reduction of 1.3 tonnes per year of total nitrogen, based on projected loads in 2030.²¹

Best practice management guidelines have been developed for the strawberry runner industry.²² This work with the Toolangi Certified Strawberry Runner Growers Co-operative commenced in November 1999 and continued throughout 2001–02. In addition to the guidelines, the project provided practical assistance, through demonstration sites, to encourage best practice soil, water and nutrient management. The work involved grants to facilitate the development of on-ground demonstration sites, a three-day water efficiency course, and incentives for the development of property management plans and purchase of soil moisture monitoring equipment. Implementation of actions from this work will be ongoing.

The strawberry runner initiative led to development of a similar project with the Victorian Strawberry (fruit) Growers Association, based largely in the Yarra Valley.

NRE, in partnership with this industry, developed a *Guide to Better Soil, Water and Nutrient Management Practices*. Ongoing work that commenced in June 2001 included development of three demonstration sites that will promote best practice. Promotion of the Guide and sites will be a focus for 2002–03.

The 'Improving Water Quality Treatment in Earthen Drainage Systems in Werribee South' project continued in 2001–02.²³ The project focuses on treatment of irrigation and stormwater runoff from vegetable growing areas in the Werribee South drainage network. It was considered a priority action in the Werribee River Catchment Nutrient Management Plan due largely to the intensive nature of agriculture in this area and its proximity to the Bay.²⁴ Implementation of best management practices in irrigation and fertiliser use is a priority for medium- to long-term nutrient load reductions, with social capability building being another major issue.

The 'Environmental Management Systems–Yarra Valley Case Study' project aims to develop an Environmental Management Systems (EMS) framework for use by the 15 agricultural and horticultural industries in the Yarra Valley. This work commenced in January 2001 and has been funded by the Rural Industries Research and Development Corporation. In partnership with the development of an EMS, the Naturally Victoria initiative has funded a project to develop a code of practice for viticulture which will be included in the EMS. The EMS framework is directly linked to catchment actions that recommend the need to develop and implement best management practices on rural land. For this reason, additional resources to extend the project beyond its scheduled 2003 finish date are being investigated.

²⁰ 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.

²¹ Department of Natural Resources and Environment 1999. *Werribee River Catchment Nutrient Management Plan*. Department of Natural Resources and Environment 1999. *Draft Runner's resource: A guide to sustainable soil, water and nutrient management for the Toolangi Strawberry Runner Industry*. Department of Natural Resources and Environment, Melbourne, Australia.

²³ Department of Natural Resources and Environment. Project management from Catchment and Agricultural Services.

²⁴ Department of Natural Resources and Environment 1999. *Werribee River Catchment Nutrient Management Plan*. Department of Natural Resources and Environment, Melbourne, Australia.

Dryland Agriculture

Implementation of the dryland agriculture program in the Werribee catchment is estimated to achieve a nutrient reduction within the catchment of 0.7 tonnes per year of total nitrogen, based on projected loads in 2030.²⁴

Implementation of best practices across the Port Phillip region by dryland agriculture (grazing and cropping) is estimated to achieve a nutrient reduction of 43.3 tonnes per year in total nitrogen within the catchment. Of this total reduction, 23.2 tonnes per year of nitrogen is expected from the Yarra and Maribyrnong catchments.²⁵

The 'Better Management of Surface Waters in Intensive Grazing' project, which targeted the Westernport catchment, provides the basis for the future promotion of better surface water management to relevant industries in the Port Phillip catchment.²⁶ The project funded by the National Heritage Trust (NHT), commenced in June 1999 and was completed in June 2002. It resulted in design, establishment and monitoring of five demonstration sites within the Westernport catchment, which addressed issues of runoff, nutrients, and sediments and their retention on farms. Extension activities and material, promoting a joint approach to production and environmental practices, were also developed. Many partnerships with new and existing undertakings were developed, helping create a wider audience to spread the project's key messages. Promotion of these messages in the Port Phillip region will focus on hot spot catchments, to be identified during development of the 'Port Phillip and Westernport Regional Water Quality Plan' (see Future Outlook section).²⁷

The 'Fencing of Crown Water Frontages' project followed up the Crown Water Frontages Review in 1999.²⁸ It was completed

in June 2000 and involved two demonstration sites, in the West Maribyrnong and Werribee catchments, illustrating best practice management of land adjoining Crown Land stream frontages. Like other demonstration sites, their purpose was to empower people with the knowledge required to undertake the work on their own properties; as a result, this project's benefits are likely to occur in the medium to longer term with additional promotion.

Erosion mapping was conducted in June 2001 to assist in the identification of priority sites for rehabilitation.²⁹ The project was a recommendation of the Werribee, Maribyrnong and Westernport Catchment Action Plans. Additional work is required to assess parts of the region more thoroughly. Given the investigative nature of this work, it might be some time before results are available, but it is envisaged that nutrient reductions will occur following rehabilitation of priority erosion sites.

Forestry

Development and implementation of the Code of Forest Practice began in 1989 and is an ongoing responsibility of NRE or, in the case of timber harvesting on private land, local government.³⁰ The Code aims to ensure that commercial timber growing and timber harvesting operations on both public and private land are carried out in a way that is compatible with the conservation of environmental values associated with forests.

No audits were conducted of forest harvesting operations in the Port Phillip Bay catchment for the year ending 30 June 2002. However, logging contractors and crews operating in the Yarra State Forest areas completed refresher environmental training in 2002.

²⁴ Department of Natural Resources and Environment 1999. *Werribee River Catchment Nutrient Management Plan*. Department of Natural Resources and Environment, Melbourne, Australia.

²⁵ See Read Sturgess & Associates 2000.

²⁶ This project was managed by Catchment and Agricultural Services of the Department of Natural Resources and Environment.

²⁷ The Port Phillip and Westernport Water Quality Plan is currently being developed and expected to be completed by 2002/3. The Plan will divide the 500 tonne catchment nitrogen reduction target over the three management themes. Licensed waste discharges will target 100 tonnes, stormwater 100 tonnes and rural land management 300 tonnes. The Plan will outline work programs to address these targets.

²⁸ Westernport and Port Phillip Catchment and Land Protection Board 2000. *Fencing of Crown Water Frontages*. Westernport and Port Phillip Catchment and Land Protection Board. Frankston, Victoria. Westernport and Port Phillip Catchment and Land Protection Board 1999. *Crown Water Frontages Review*. Westernport and Port Phillip Catchment and Land Protection Board. Frankston, Victoria.

²⁹ This project was managed by Catchment and Agricultural Services of the Department of Natural Resources and Environment.

³⁰ Department of Natural Resources and Environment 1996. *Code of Practice: Code of forest practices for timber production: revision no. 2*. Department of Natural Resources and Environment Melbourne, Australia.

Mining and Extraction Industries

'Draft Best Practice Environmental Management Guidelines for Extractive Industries' are being developed by NRE and EPA. The draft is under revision, currently being updated by EPA to reflect provisions under the new SEPP for air. A key component of the Guidelines is erosion control, involving minimising the transport of sediment from work sites to waterways. The implication of the guidelines' adoption (when finalised) for nitrogen loads is yet to be determined.

Industry involved in mining or resource extraction must submit Work Plans as part of the approval process by NRE. In consideration of Work Plans, NRE has placed a strong focus on erosion control matters, which will be more clearly outlined in the draft Best Practice Guidelines. Trained NRE engineering and environmental staff conduct regular auditing throughout the year.

Incentives/Grants

The Land Protection Incentive Scheme (LPIS) and other grant programs provide incentives to individual landholders for onground works that target stream bank, tunnel and gully erosion on dryland and irrigated agricultural properties. The 2001/02 grant budget available amounted to \$50,000 (from NRE) and \$104,000 (from NHT). The provision of incentives for the implementation of best practice was a recommendation in both the Werribee River Catchment Nutrient Management Plan and Yarra Catchment Action Plan. In 2001–02 the LPIS funded works on 10 properties within the Port Phillip catchment.

Capacity Building

The CALP Board has been funded to employ one Landcare facilitator in a strategic role for the Region, who will work towards improving the effectiveness, and expanding the existing network, of Landcare groups in the region. Landcare groups undertake a range of projects that broadly address land degradation issues. Work is often undertaken on land adjacent to waterways, which may lead to nutrient reductions.

Melbourne Water supports the work of six Waterwatch coordinators within the Port Phillip and Westernport region. These coordinators assist schools and community groups to use water monitoring equipment and standard testing procedures to assess the water quality of their local waterways and to raise awareness about the importance of water quality. The program will extend to horticultural groups in the Yarra Valley this year.

Future Outlook

Future priorities for nitrogen reduction activities in the Port Phillip catchment will be better coordinated through the process of developing a *Port Phillip and Westernport Regional Water Quality Plan*.²⁷ Priorities for action from this plan are likely to include:

- > continued education and awareness raising activities, coupled with appropriate incentives, which are fundamental to the ongoing adoption of best management practices by rural land managers;
- > establishment of a baseline of data relevant to the current use of best management practices, so that implementation can be measured over time;
- > continued development and promotion of best soil, water and nutrient management practices by intensive horticultural industries, particularly given that the many pressures facing farmers on the urban fringe may lead to further intensification of operations;
- > linking on-farm management with environmental accreditation and accountability processes, such as EMS, to ensure long-term implementation of improved environmental management practices; and
- > ongoing implementation of the Code of Forest Practice and Best Practice Environmental Management Guidelines for Extractive Industries.

The *Melbourne 2030: Planning for Sustainable Growth* will be an important document that will influence the amount of rural land that is subject to urban expansion in the future, particularly through the protection of 'green wedges'.³¹

³¹ The *Melbourne 2030: Planning for Sustainable Growth* will create a vision of Melbourne's future for the next 30 years. The Strategy will look at how we can better incorporate the social, environmental and economic demands placed on Melbourne. The document was released in October 2002.

1.3.2 Stormwater Management

Key Task – reduce the waterway nitrogen load through targeted stormwater action and encouraging water sensitive urban design. As an associated task, maintain a monitoring system, including storm-event sampling, to allow comparison between Yarra/Maribyrnong and Patterson/Mordialloc waterway loads and the nitrogen baseline.

Historical Context

Melbourne Water is responsible for waterway management, urban drainage of stormwater, and for encouraging Water Sensitive Urban Design (WSUD) across a large area of the catchment. Across these three broad categories, Melbourne Water has undertaken much work in the past to address stormwater nutrient levels and their impacts on the Bay. The Healthy Bay Initiative was launched in 1999; it was a key program that received \$25 million from the Government to implement works to reduce the impacts of stormwater.³²

Melbourne Water has used constructed wetlands to assist with stormwater management. These wetlands, through biological and physical processes, slow the flow of stormwater from the catchment to Bay and reduce the concentration of nitrogen in water that flows through them. Melbourne Water has also worked with EPA, local government and other stakeholders to establish a more effective partnership to improve the environmental management of urban stormwater. A Victorian Stormwater Advisory Committee, which includes representatives from Melbourne Water, local government, EPA, Department of Infrastructure, and the community, was established in 2000. This committee advises the Minister on the allocation of grants from the Government's \$22.5 million Victorian Stormwater Action Program administered by EPA. The funding is available for the development and implementation of council stormwater plans.

Melbourne Water has also worked with EPA and other stakeholders to prepare Best Practice Environmental Management Guidelines for Urban Stormwater³³, to assist those involved in planning, design or operation of urban stormwater systems. The guidelines focus in five key areas:

1. *Environmental performance objectives*: defining environmental performance objectives for managing urban stormwater
2. *Tools review*: describing a range of tools (eg litter traps, wetlands) that can reduce sources of stormwater pollution or remove pollutants from stormwater
3. *Tools selection*: guiding the selection and application of tools to suit particular situations
4. *Best practices*: raising awareness of best practices for environmental management of stormwater
5. *Stormwater management plans*: providing guidance for developing stormwater management plans

To achieve best practice in stormwater management, it is important for local government to develop strategies and plans to guide their activities. Melbourne Water provides funding to assist councils with the development of Stormwater Management Plans.³⁴

The principles of Water Sensitive Urban Design (WSUD) have also been adopted and encouraged in recent years by Melbourne Water working with municipalities and developers. WSUD seeks to minimise the extent of impervious surfaces and to mitigate adverse changes to the natural water balance through onsite treatment and water reuse, as well as temporary storage and infiltration within the source catchment.

³² Melbourne Water Corporation 1999. *The Healthy Bay Initiative*. Melbourne Water, Victoria, Australia.

³³ CSIRO 1999. *Best Practice Environmental Management Guidelines for Urban Stormwater*. Victorian Stormwater Committee, Victoria, Australia.

³⁴ Web site at <http://stormwater.melbournewater.com.au/>, accessed on 27/8/02

As the regional waterway manager, Melbourne Water is responsible for facilitating improvements in stream condition. A high priority task, addressed through the Stream Frontage Management Program, is rehabilitation of stream verges. This is being achieved in partnership with landowners, Landcare groups and other community organisations. The program addresses rural waterway degradation in targeted catchments across the Western Port and Port Phillip Drainage Basins, where Melbourne Water operates. It commenced in 1996-97 and assists landowners to rehabilitate private freehold and leased stream frontage by providing grant subsidies for fencing, revegetation, weed control, offstream stock watering and minor stabilisation. This work has potential to reduce sediment and nutrient loads to waterways.

Key Actions for 2001-02

Construction of seven new wetlands began in 2001-02. Work also continued on two existing wetlands started in 2000-01. A total of nine wetlands will be established in Melbourne's southeast growth corridor as part of the Healthy Bay Initiative. The wetlands, scheduled to be completed by 2003, will cover more than 80 hectares and treat stormwater runoff in the municipalities of Casey, Kingston, Knox and Greater Dandenong. By 2004-05, a better indication of the effects of wetland construction on nitrogen loads should be available.

Stormwater management plans have been implemented by 20 of the 32 councils within Melbourne Water's jurisdiction. Plans for 11 councils commenced during the 2001-02 and are expected to be completed in 2002-03. In the regions outside Melbourne Water's area, but within the Bay catchment, only one municipality is yet to finalise a plan.

Water Sensitive Urban Design (WSUD) was also promoted to municipalities and developers throughout 2001-02. Lynbrook Estate is a greenfield residential development approximately 35 km south east of Melbourne in the city's major growth corridor. The estate is an 800-lot development, of 55 hectares, that incorporates WSUD principles adopted at both streetscape and sub-catchment levels. The estate developer, the Urban and Regional Land Corporation (URLC), has been an active party in the design and implementation of this project. Several early stages of the estate were designed with a conventional stormwater system. Lynbrook was subsequently chosen by the URLC for a WSUD trial after an approach by Melbourne Water to set up a demonstration project. The City of Casey initially approved three stages of the development as part of the demonstration project. The Cooperative Research Centre for Catchment Hydrology is conducting a three-year monitoring program to compare the performance of two drainage systems – water sensitive and conventional – at Lynbrook. The study will look at the quantity and quality of runoff, as well as costs of construction, ongoing issues of maintenance, and community acceptance of WSUD.

The Stream Frontage Management Program was expanded during 2001-02. The number of participants increased from 120 to 339. More than 100 km of fencing was constructed and 111,225 plants were planted.

Monitoring commenced on a program to supplement Melbourne Water's existing water quality monitoring program. At seven locations water quality will be monitored during storm event periods. These data will allow more accurate estimates of nitrogen loads entering the Bay. The data are currently being stored on a Melbourne Water database, and are expected to be made available on the Victorian Water Resources Data Warehouse in early 2003.

Victorian Stormwater Action Program

In 2001–02 the program, administered by EPA, provided \$1.89 million to local councils whose stormwater systems drain to Port Phillip Bay.

Actions included:

- > development of Stormwater Management Plans for the City of Greater Geelong and Borough of Queenscliffe;
- > installation of 10 gross pollutant traps to trap litter and sediment before it reached catchment waterways;
- > 5 litter traps in waterways;
- > an environmental management plan for the Queen Victoria Market;
- > preparation of a guide to reducing stormwater pollution from building and construction sites;
- > development of standard contract specifications which councils can use to ensure their contractors lead by example and adopt best practice stormwater management practices; and
- > ten education programs to help retailers, industry and local residents prevent stormwater pollution by changing their behaviour.

Future Outlook

Melbourne Water, with NRE and EPA, are developing a *Port Phillip and Westernport Regional Water Quality Plan*²⁷, which is to be finalised by 2002–03. The Plan will outline each agency's work program to address the contribution of its management theme to the nitrogen reduction target. Melbourne Water's plan will highlight work that aims to achieve a 100-tonne reduction in annual catchment stormwater nitrogen loads to the Bay. This Plan will link across Melbourne Water's current stormwater management programs including wetland development and WSUD promotion.

The main future pressures for the stormwater management theme will come from an increased urbanisation of the catchment. Longer term strategic planning in *Melbourne 2030: Planning for Sustainable Growth* will be instrumental in shaping the extent of urban expansion whilst minimising environmental impacts from stormwater.³⁵

1.3.3 Licensed Waste Discharges

Key Task – reduce waterway nitrogen load through regulation of licensed waste discharges including sewage treatment plants that discharge to catchment waterways.

Historical Context

The *Environment Protection Act 1970*, which establishes licensing arrangements, embraces principles of the Intergovernmental Agreement on the Environment (IGAE) which include:

- > integration of economic, social and environmental considerations;
- > the precautionary principle;
- > intergenerational equity, biological diversity and ecological integrity; and
- > improved valuation, pricing and incentive mechanisms.

The Act also adopts the principles of shared responsibility, product stewardship, application of the waste hierarchy, integrated environmental management, enforcement and accountability. The Industrial Waste Management Policy (Waste Minimisation) 1990 has driven the adoption of waste minimisation and continuous improvement, both of which EPA has promoted since the mid 1980s and through subordinate legislation since 1990.

EPA licenses 18 wastewater facilities that discharge to waterways leading to the Bay. Most discharges within the catchment are from small sewage treatment plants. Licence reviews have occurred in past years following reviews of relevant SEPPs, particularly during 1997 (Waters of Port Phillip Bay) and 1999 (Waters of the Yarra Catchment). These reviews have led to licence holders developing work programs that are being implemented over a number of years.

³⁵ The *Melbourne 2030: Planning for Sustainable Growth* will create a vision of Melbourne's Future for the next 30 years. The Strategy will look at how we can better incorporate the social, environmental and economic demands placed on Melbourne. The Strategy was released in October 2002.

Key Actions for 2001–02

No treatment plant upgrades were initiated during the year. Any future plant upgrades or continuous improvement programs are planned to be consistent with the SEPP (Waters of Victoria), Schedule F7, Waters of Yarra Catchment.

Future Outlook

EPA is working with NRE and Melbourne Water to develop a *Port Phillip and Westernport Regional Water Quality Plan*²⁷, which is to be finalised by 2002–03. This plan will outline how, through licence requirements and cleaner production programs, EPA will assist industry to achieve up to a 100-tonne reduction in annual nitrogen loads to the Bay.

Gisborne Sewage Treatment Plant (STP) and Sunbury STP have both developed strategies to achieve 100 per cent effluent reuse by 2005–06, consistent with their licence requirements. Gisborne STP has already implemented a project with a local golf course that uses 40 per cent of the plants' effluent. The Government launched the Sunbury Melton Recycled Water Scheme with initial work that involved laying of pipes to transport effluent to available markets.³⁶

The Mornington Racing Club currently has a small nitrogen discharge. Options are being considered to reduce its wastewater discharge; an Options Report has been submitted to EPA and is under consideration. Current preference is for total reuse.

Eight treatment plants operated by Yarra Valley Water hold EPA licenses for discharges to the Yarra River. Future upgrades, and consequent reductions in nitrogen loads, will be required to comply with their licence conditions. As stated in the SEPP (Waters of Victoria) Schedule F7 (Waters of the Yarra Catchment) 1999: 'facilities and operating practices of sewage treatment plants with capacity exceeding 0.1 ML/Day must be

upgraded such that, by 1 July 2004, discharges cause no detrimental changes in the environmental quality of the receiving waters as determined by an instream monitoring and assessment program approved by the Authority'.³⁷

An upgrade to tertiary treatment of two small treatment plants in unsewered areas of Williamstown, discharging to Kororoit Creek, will be required by 2004 as part of licence conditions; this will reduce the nutrient load of these small discharges.

During 2002–03, the licence for discharges from the Newport Power station is being reviewed to ensure that potential nutrient discharges as well as current thermal loads to the Bay are addressed.

1.4 Atmosphere

Key Task – refine the estimate of Bay atmospheric nitrogen load; oversee implementation of the Port Phillip Region Air Quality Improvement Plan and annually collate significant works approvals.

Historical Context

During the Bay study, the 1990 annual load of nitrogen entering the Bay was estimated to lie between 800 and 1,300 tonnes, and was nominally cited by CSIRO as 1,000 tonnes.³⁸ This estimate was considered conservative, as it was calculated using concentrations in the Melbourne Metropolitan area and NO_x concentrations over the Port Phillip airshed would be significantly lower than these levels. Estimates have now been revised, as discussed below in 'Key Actions for 2001–02'.

³⁶ McLean, L., Guthrie, C. & Bruhn, K. 2001. *Sunbury Melton Recycled Water Project: Adding life to the region*. Western Water, Shire of Melton & Hume City Council. Victoria, Australia.

³⁷ Victoria, Parliament 1999, 'State Environment Protection Policy (Waters of Victoria). Schedule F7. Waters of Yarra Catchment'. *Government Gazette*, no 589, 22 June 1999. Victorian Government Printing Office.

³⁸ See Carnovale, F., Carvalho, C. & Cope, M.E. 1992. Literature review of the aeolian and atmospheric inputs of nutrient flows to Port Phillip Bay. In *Literature review of the physical and chemical atmospheric inputs to Port Phillip Bay*, Technical report no. 5, CSIRO Port Phillip Bay Environmental Study.

Key Actions for 2001–02

An Air Quality Improvement Plan – Port Phillip Region (AQIP), covering much of the Bay and its catchment area, is being developed. Implementation of the Plan's actions is expected to reduce atmospheric nitrogen loads over the longer term, and short- to medium-term reductions are unlikely. The draft AQIP was released in June 2000, describing its role as 'to promote improvements in air quality, consistent with aspirations of Victorians – both now and in the future – for a safe and ecologically sustainable air environment'.³⁹ A key focus of the Plan will be reducing motor vehicle emissions through increased regulation and influencing travel demand and driver behaviour. The final AQIP is scheduled for release in late 2002.

In 2001–02, EPA revised atmospheric nitrogen loads to the Bay using modelling to estimate the dispersion and deposition of NO_x emissions from all sources within the airshed.⁴⁰ The revised estimate, while subject to some uncertainties, provides a much more accurate estimate of the atmospheric nitrogen load than earlier work due to the inclusion of monitoring data from across the entire catchment rather than basing estimates on loads from central Melbourne. Further refining this estimate is not, however, considered a high priority at this stage in terms of the relevance of a more accurate estimate to guiding future management strategies.

A Works Approval was issued in January 2002 to Singapore Power in the West Metropolitan Region for a maximum discharge of 54.6 kg/hour of NO_x for another two power stations proposed for the catchment. These plants are not yet operational but will be required to adopt high quality treatment technology if a licence is issued.

A licence held by Geelong Cement is no longer active as the plant closed during mid 2001. The plant contributed about 1,900 tonnes of nitrogen per annum, which is approximately half of Geelong's industrial NO_x discharged to the airshed.

Future Outlook

The AQIP⁴¹ will be an important tool in addressing future sources of atmospheric pollution including those components that relate to nutrients. Successful implementation of the AQIP will be important to help achieve the attainment program of the SEPP (Air Quality Management). Given that NO_x is one of the primary sources of atmospheric nutrients to the Bay, a reduction in emissions will be important to help to achieve the atmospheric element of the Bay EMP's nutrient program. An important part of AQIP will be facilitating the adoption of higher standards for the car manufacturing industry. Figure 2 illustrates a business-as-usual scenario if current standards are maintained for the production of cars and Figure 3 the adoption of European standards. The adoption of European standards for production of new cars builds on the Government commitment of having European standards adopted for all new cars by 2007.

³⁹ EPA 2000. *Draft Air Quality Improvement Plan: Port Phillip Region*. EPA Publication 707.

⁴⁰ Dennis Hearn 2002. Nutrient Loads to Port Phillip Bay due to Emissions into the Port Phillip Airshed. *Proceedings 16th International Clean Air and Environment Conference: 19-22 August, 2002, Christchurch, New Zealand*.

⁴¹ EPA 2000. *Draft Air Quality Improvement Plan: Port Phillip Region*. EPA Publication 707.

Figure 2: BAU Annual emissions of NOx for Port Phillip Region

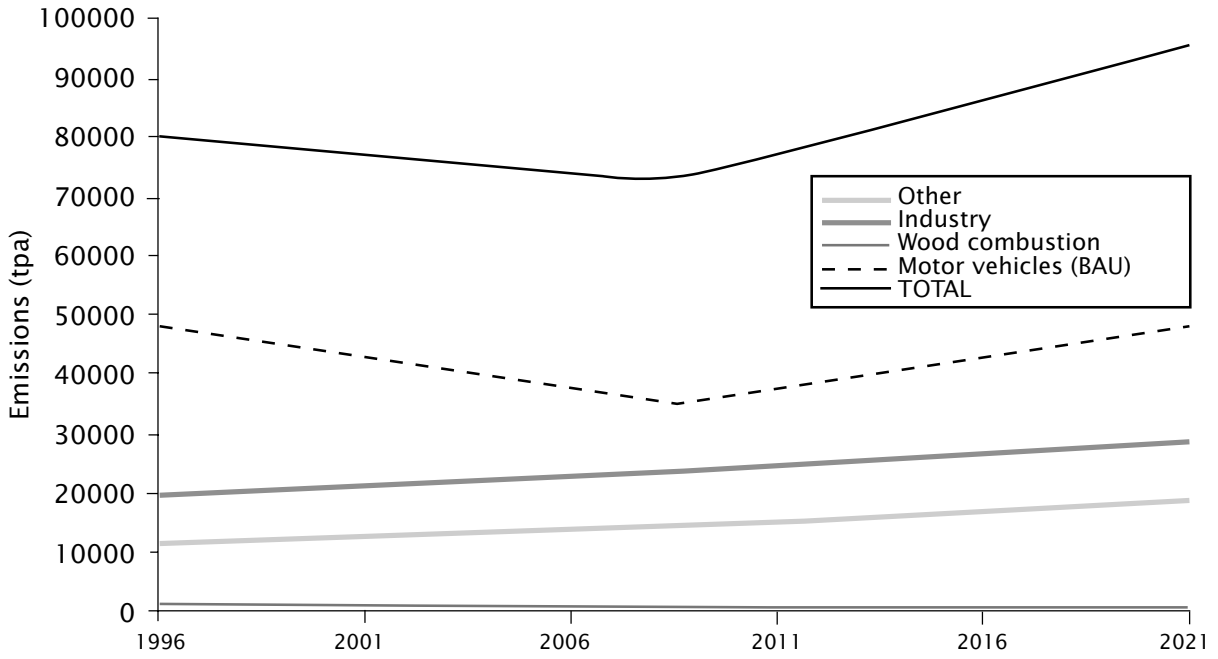
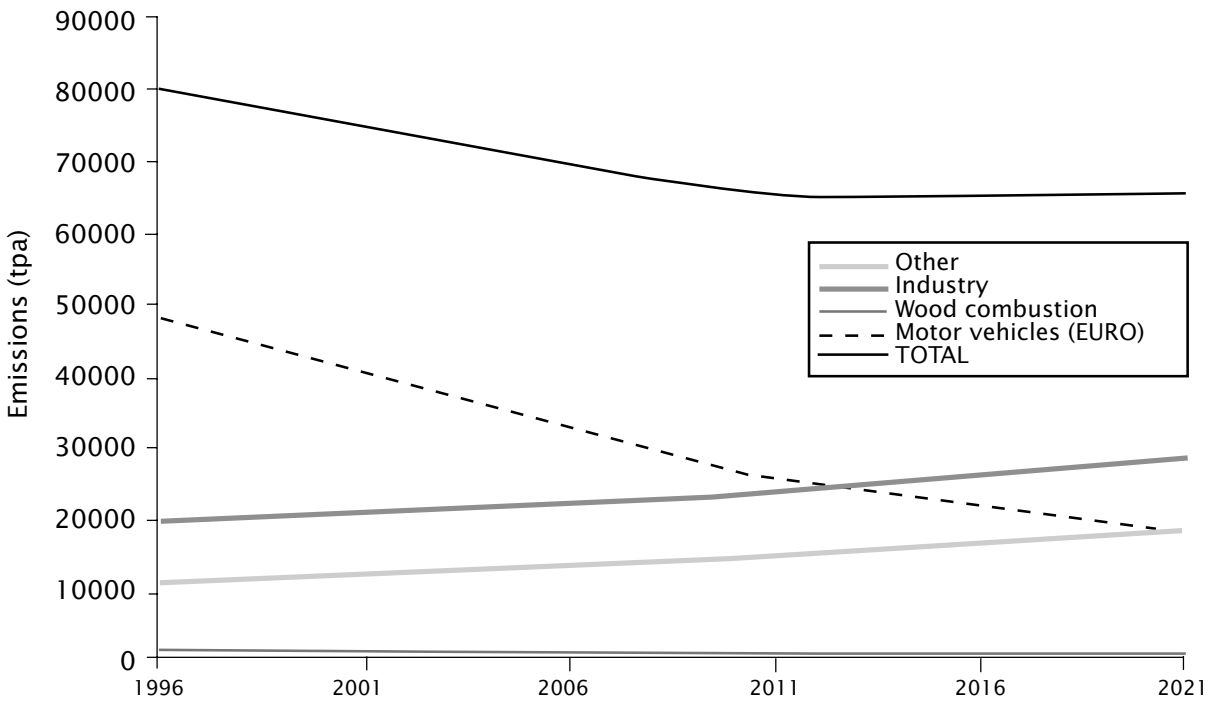


Figure 3: EURO Annual emissions of NOx for Port Phillip Region



1.5 Other Risks to Cycling

Key Tasks – develop and implement a program to monitor the state of Bay nitrogen cycling; continue to collect information from the existing fixed sites monitoring program. Data for both monitoring programs will be stored on the electronic data warehouse. Establish an inter-agency Bay nutrient monitoring technical coordinating committee. Through targeted research resolve key uncertainties – investigate the impacts of marine pests on Bay nutrient cycling processes.

Historical Context

The Bay Study⁴² substantially improved our understanding of Bay nutrient cycling processes, but knowledge of these complex systems is far from complete. The EMP Background Document⁴³ includes a summary of current understanding and also highlights the potential for Bay activities other than input nitrogen loads to disrupt cycling via mechanisms that are not yet understood scientifically. The EMP's nutrient program therefore emphasises the importance of both continued research to progressively reduce scientific uncertainty and of establishment of a Bay monitoring program addressing the following objective: *'To detect, as early as possible with current scientific understanding, detrimental changes to critical elements of Bay nitrogen cycling processes that indicate an increased risk of eutrophication at Bay-wide and regional scales.'*

Key Actions for 2001–02

NRE in collaboration with Melbourne Water and EPA have established the monitoring program described above. Development of the program was based on recommended 'high-priority' approaches and indicators from a workshop of scientists with expertise in nutrient cycling⁴⁴, and subsequent statistical data analysis and consideration of practical logistic issues.⁴⁵

The monitoring is occurring at three sites within the Bay and includes measurements of physical parameters near the seafloor such as salinity, temperature and dissolved oxygen. Towards the end of 2002, it will also include extra readings near the water surface, and use of benthic chambers to provide insight into denitrification efficiency by measuring benthic fluxes of nutrients. Arrangements for data to be transferred to the Victorian Water Resources Data Warehouse are expected to be finalised by 2002–3. The program is receiving considerable funding from NRE and Melbourne Water.

EPA has continued its fixed site monitoring in the Bay in 2001–02. This monitoring has been running since 1984 and collects information on nutrients, chlorophyll concentrations and water clarity at six locations around the Bay. It complements the NRE–Melbourne Water funded program, providing an integrated approach to monitoring the state of Bay nutrient cycling processes. A summary report of fixed site monitoring results over 1984–1999 was published in January 2002.⁴⁶ This report highlighted the close relationship between nutrient loads entering the Bay and climatic conditions. During the reported period, there was no measured increase in nitrogen concentrations in Bay waters, with some indication of a decrease. The additional monitoring now implemented will provide a more comprehensive picture of Bay nutrient cycling processes. EPA is currently adding Bay water quality data to the Victorian Water Resources Data Warehouse, and this will be publicly available late in 2002.

⁴² See Harris, G., Batley, G., Fox, D., Hall, D., Jernakoff, P., Molloy, R., Murray, A., Newell, B., Parslow, J., Skyring, G. and Walker, S. 1996. *Port Phillip Bay Environmental Study Final Report*. CSIRO Canberra, Australia.

⁴³ Department of Natural Resources and Environment 2002. *Port Phillip Bay Environmental Management Plan – Background Document*. Department of Natural Resources and Environment, Melbourne, Australia.

⁴⁴ See 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

⁴⁵ 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.

⁴⁶ EPA 2002. *Port Phillip Bay Water Quality: Long-term trends in nutrient status and clarity, 1984-1999*. Publication 806.

In May 2002, an inter-agency Bay nutrient monitoring technical coordinating committee was convened with representatives from NRE, Melbourne Water and EPA. The committee's role is to discuss the management and future direction of Bay monitoring programs.

With funding support of the Australian Research Council, a three-year research project began in June 2002 to investigate the impacts of marine pests on nutrient cycling processes in the Bay's sediments. The *Building Effects of Marine Pests into Nutrient Management Strategies* project involves collaborative research between the University of Melbourne, the Marine and Freshwater Resources Institute (MAFRI) and NRE. The project aims to determine:

- > the changes to the fauna of soft-sediment habitats that occur at a local scale when individual species of marine pests are present;
- > whether these changes affect denitrification in the sediments; and
- > if more than one pest species is implicated, whether they act independently or synergistically.

This will help fill a significant gap in our understanding of the threat that marine pests pose to nutrient cycling, therefore helping to reduce the risk that remaining scientific uncertainties could pose to the effectiveness of our nutrient management program.

Future Outlook

The Fisheries Habitat Assessment Group is proposing to assess the current state of knowledge on issues relating to Bay fisheries. This assessment will be led by Fisheries Victoria and MAFRI and will build on a 1995 assessment, which identified nutrients and marine pests as significant threats to the Bay's ecology.⁴⁷ The assessment group brings together NRE divisions, EPA, the CALP Board, local councils, professional and recreational fishing groups and conservation groups. The assessment will determine the current state of information on threats to fisheries and recommend directions for future research.

Reviews of the Bay EMP's nutrient and marine pest programs are scheduled for 2003 (interim) and 2006. As outlined in the EMP, nutrients and marine pests are currently considered the highest priority risks to the Bay's environment. However, the relative importance of other Bay risks will continue to be considered, and where necessary the associated risk mitigation programs reviewed, progressively.

⁴⁷ Gunthorpe, L., Garnham, J., and Vlassopoulos, A., editors. 1997. *Port Phillip Bay fish habitats – 1995*. Compiled by the Fish Habitat Assessment Group. Fisheries Victoria Assessment Report No. 8. (Fisheries Victoria: East Melbourne.)

Marine Pests

2.1 Vector Management – Ballast Water

Key Tasks – establish a ballast water management regime that reduces risks from internationally and domestically sourced ballast water proposed for discharge to the Bay. 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 and develop a management plan that addresses the risks of marine pests in operating the Port of Geelong. Develop an environmental management plan for the Port of Melbourne. Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of ballast water.

Historical Context

The role of ballast water in introducing exotic species has increased substantially over the last decades. In the 1990s, it became the dominant vector for newly reported introductions, accounting for eight of the 18 introductions to the Bay with another four equally likely to have been introduced by either ballast water or hull fouling.⁴⁸ In 1999, the Victorian Government introduced a package of measures to help systematically deal with marine pest threats that included:

- > the *Flora and Fauna Guarantee Act 1988* Action Statement for the potentially threatening process 'Introduction of exotic marine organisms into Victorian marine waters';⁴⁹
- > the Draft Industrial Waste Management Policy for Ships' Ballast Water and Hull Cleaning;⁵⁰ and

- > the Interim Victorian Protocol for Managing Exotic Marine Organism Incursions, which establishes the administrative arrangements for the management of marine pests in Victoria.⁵¹

These Victorian measures were supported by a national commitment to address marine pests through implementing the recommendations of the National Taskforce on the Prevention and Management of Marine Pest Incursions.⁵²

Key Actions for 2001–02

During 2001–02, the ports of Melbourne and Geelong received 3,019 and 498 visits respectively by merchant vessels.

Since 1 July 2001, all international vessels have been required to manage their ballast water in accordance with Australian Quarantine Inspection Service requirements and not discharge high-risk ballast water into Australian ports or waters.⁵³ In terms of the current risk assessment procedures that are based on the risks associated with a list of 'target species' (see Appendix 1), only those vessels whose ballast water was considered likely to contain *Gymnodinium catenatum*, *Crassostrea gigas* (feral) and *Mytilopsis sallei* were not able to discharge this ballast water in Port Phillip Bay.

In October 2001, the Melbourne Port Corporation released a Whole of Port Environmental Management Plan that outlines arrangements to both reduce the risk of marine pest introductions and to deal with pests in the event that they are introduced.⁵⁴ The Corporation also released the Port of Melbourne Environmental Monitoring Program Inception Report⁵⁵ to assist with the Plan's implementation.

⁴⁸ Thresher, R.E., Hewitt, C.L., Campbell, M.L. 1999. Synthesis: Introduced and Cryptogenic Species in Port Phillip Bay. pp 283–295. In Hewitt, C.L., Campbell, M.L., Thresher, R.E., and Martin, R.B. (eds.). *Marine Biological Invasions of Port Phillip Bay, Victoria*. Centre for Research on Introduced Marine Pests. Technical Report No. 20. CSIRO Marine Research, Hobart. 344pp.

⁴⁹ Victorian Government 1988. *Flora and Fauna Guarantee Act 1988 Action Statement for the potentially threatening process 'Introduction of exotic marine organisms into Victorian marine waters'*. Department of Natural Resources and Environment, Melbourne, Australia.

⁵⁰ Environment Protection Authority 1999. *Protecting the Victorian Marine Environment from Marine Pests: Draft Industrial Waste Management Policy (Ships Ballast Water and Hull Cleaning) and Draft Policy Impact assessment*. EPA Publication 673.

⁵¹ Department of Natural Resources and the Environment 1999. *Interim protocol for managing exotic marine organism incursions*. Department of Natural Resources and the Environment: 17pp

⁵² Joint SCC/SCFA National Taskforce on the Prevention and Management of Marine Pest Incursions 2000. *Report of the Taskforce*. Environment Australia, Canberra, Australia.

⁵³ Australian Quarantine and Inspection Service 2001. *Australian Ballast Water Requirements*. Australian Quarantine and Inspection Service, Canberra, Australia.

⁵⁴ Melbourne Port Corporation 2001. *Whole of Port Environmental Management Plan*. Melbourne Port Corporation, Melbourne Australia.

⁵⁵ Melbourne Port Corporation 2002. *Environmental Monitoring Program Inception Report*. Melbourne Port Corporation, Australia.

Future Outlook

The 'National System for the Prevention and Management of Marine Pest Incursions: Australian Strategic Plan 2002–2006'⁵⁶ requires development of a single national management system that deals with internationally and domestically sourced ballast water. A trial of this system commenced in January 2000 at the Port of Hastings and is scheduled to conclude in December 2002. Based on this experience it is proposed, in 2003, to implement arrangements to manage the risks from both internationally and domestically sourced ballast water discharges associated with ship visits to the Ports of Geelong and Melbourne. These arrangements will be supported by EPA's finalisation of Waste Management Policy for Ships' Ballast Water.

The identification of effective risk indicators will be assisted by the National System, which, in the coming year, will address monitoring arrangements for marine pests in Australian ports.

Bay-specific arrangements include development of an environmental management plan for the Port of Geelong, which is scheduled to commence following completion of a Strategic Land Use Plan for the Port in 2003. This plan will provide the opportunity to outline specific management arrangements with respect to the marine pest risk to the port.

2.2 Vector Management – Fouling of Large Ships

Key Tasks – assess the feasibility of establishing a hull fouling management regime. Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of hull fouling.

Historical Context

Historically, fouling has been a significant vector in the introduction of marine pests to the Bay, although ballast water has been of increasing importance in the last decade.⁵⁷ The package of measures that was introduced by the Victorian Government in 1999 to help systematically address marine pest threats is summarised in Section 2.1.

The risk associated with fouling of large ships is currently managed through the application of antifoulants and by the ban on in-water hull cleaning under the *Marine Act 1988*.

Key Actions for 2001–02

Existing arrangements for antifoulants and prohibition of in-water hull cleaning continued to be applied in 2001–02.

Future Outlook

The plan for future development of national arrangements is outlined in the 'National System for the Prevention and Management of Marine Pest Incursions: Australian Strategic Plan 2002–2006'.⁵⁸

⁵⁶ 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.

⁵⁷ Thresher, R.E., Hewitt, C.L., Campbell, M.L. 1999. Synthesis: Introduced and Cryptogenic Species in Port Phillip Bay. pp 283–295. In Hewitt, C.L., Campbell, M.L., Thresher, R.E., and Martin, R.B. (eds.). *Marine Biological Invasions of Port Phillip Bay, Victoria*. Centre for Research on Introduced Marine Pests. Technical Report No. 20. CSIRO Marine Research, Hobart. 344pp.

⁵⁸ 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.

2.3 Vector Management – Fouling of Small Vessels

Key Tasks – establish a management regime to reduce the risk that small vessels and their associated gear introduce marine pests to, and transfer them within, the Bay. Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of ballast water.

Historical Context

Internationally, small vessels are often implicated in the movement of exotic species. This has also been the case within Australia with, for example, the Black Striped Mussel introduction to Darwin Harbour in 1999. Fouling on small vessels was also suspected to be the cause of the jump in the distribution of the pest kelp *Undaria pinnifida* in the Bay from an area to the south of Point Cook to St Kilda.

Key Actions for 2001–02

During 2001–02, draft guidelines were developed to help skippers of small vessels to keep their vessels and gear free of marine pests, and to aid managers of marinas and local ports to assist with this process. The draft guidelines are based on the identification and ranking of hazards associated with small vessels and their gear being infected with marine pests. The ranking was undertaken by the CSIRO - Centre for Research on Introduced Marine Pests (CRIMP), vessel skippers, and local port managers in Victoria and southern New South Wales.⁵⁹

In May 2002, a project identifying the patterns of small vessel movements in southeastern Australia commenced. This information will help us understand how the risk associated with small vessel movement might vary from one area to another, and also how marine pests could be introduced to a new area through the repeated localised movements of small vessels. NRE is working collaboratively with the Bureau of Rural Sciences (BRS), the lead agency on the project, to complete it by July 2003.

Future Outlook

In 2002-03, the guidelines referred to above will be finalised following further input from peak organisations with responsibilities for small vessels and local ports. An extension program will also encourage skippers to keep their boats and gear free of marine pests.

2.4 Vector Management – Aquaculture

Key Tasks – ensure that aquaculture of translocated aquatic biota within the Bay conforms to Victoria's translocation policy and that marine farming equipment introduced to the Bay from other marine areas is treated to ensure that it is free of marine pests. Investigate and trial appropriate and cost-effective indicators and approaches for monitoring the effectiveness of tasks aimed at improving the management of ballast water.

Historical Context

Aquaculture equipment has been implicated in the movement of marine pests.⁶⁰ In 1999, the 'National Policy for the Translocation of Live Aquatic Organisms – Issues, Principle and Guidelines for Implementation' was finalised to help deal with this risk by establishing a consistent risk assessment approach and framework.⁶¹

⁵⁹ 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).

⁶⁰ Thresher, R.E., Hewitt, C.L., Campbell, M.L. 1999. Synthesis: Introduced and Cryptogenic Species in Port Phillip Bay. pp 283-295. In Hewitt, C.L., Campbell, M.L., Thresher, R.E., and Martin, R.B. (eds.). *Marine Biological Invasions of Port Phillip Bay, Victoria*. Centre for Research on Introduced Marine Pests. Technical Report No. 20. CSIRO Marine Research, Hobart. 344pp.

⁶¹ Ministerial Council on Forestry, Fisheries and Aquaculture 1999. *National Policy for the Translocation of Live Aquatic Organisms - Issues, Principles and Guidelines for Implementation*. Bureau of Rural Sciences, Canberra, Australia.

⁶² Gunthorpe, L., Mercer, J., Rees, C. and Theodoropoulos, 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, Queenscliffe

Key Actions for 2001–02

A project finalised in 2001 determined practical ways to sterilise mussel ropes and remove the following marine pests: the Northern Pacific Seastar *Asterias amurensis*, the fanworm *Sabella spallanzanii*, the kelp *Undaria pinnatifida* and the crab *Carcinus maenas*.⁶²

Future Outlook

The National Policy for the Translocation of Live Aquatic Organisms requires Australian States and Territories to develop specific arrangements for their jurisdiction. The Victorian policy is scheduled for completion in 2002–03. 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 Pests Incursions: Australian Strategic Plan 2002–2006.⁶³

2.5 Early Detection

Key Tasks – design and trial a monitoring system that maintains the currency of information on the status of ‘target species’

Historical Context

Baseline surveys were reported on for the Port of Geelong in 1998 and for the Port of Melbourne in 2001.⁶⁴ In addition, a Bay wide assessment was completed by CSIRO in 1999.⁶⁵ Of the 12 species that were nationally identified in 2001 as ‘target species’, 9 have been recorded in the Bay (see Appendix 1).

Key Actions for 2001–02

As aid to systematically identifying species that should be targeted for management effort, CSIRO – CRIMP formalised criteria for the assessment of risks to Australia from exotic marine species. The criteria and species that meet them have been published and are expected to be considered by Australian Governments in 2002–03.⁶⁶

Future Outlook

Species considered as target species are currently subject to review by the National Introduced Marine Pest Coordination Group and the agreed list will form the basis of a national approach to the early detection of new introductions of target species.⁶⁷ Early detection provides the best opportunity for eradication or control of a newly established species. With NHT funding, NRE is reviewing the passive and active surveillance methods currently in use for the early detection of pest plants and animals. This information, together with port surveys data, will be used to determine the optimal system for early detection of marine pests. The project is due to be completed in 2003.

⁶³ 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.

⁶⁴ Currie, D.R., McArthur, M.A. and Cohen, B.F. 1998. Exotic Marine Pests in the Port of Geelong, Victoria. *Marine and Freshwater Resources Institute, Report No. 8*: 1-57; Cohen, B.F., McArthur, M.A. and Parry, G.D. 2001. Exotic Marine Pests in the Port of Melbourne, Victoria. *Marine and Freshwater Resources Institute, Report No. 25*: 1-68

⁶⁵ Hewitt, C.L., Campbell, M.L., Thresher, R.E., and Martin, R.B. (eds.). *Marine Biological Invasions of Port Phillip Bay, Victoria*. Centre for Research on Introduced Marine Pests. Technical Report No. 20. CSIRO Marine Research, Hobart. 344pp.

⁶⁶ Hayes, K. R. and Sliwa, C. 2002. Identifying potential marine pests - a deductive approach applied to Australia. *Bioinvasions*.

⁶⁷ 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.

2.6 Mitigate Effects of Introductions

Key Tasks – mount rapid response to the introduction of new pest species to the Bay where feasible technically and beneficial environmentally, economically and socially. Implement and support targeted research (with a particular emphasis on pests and their relationship to Bay nutrient cycling) to better understand existing pest populations, with the aim of mitigating their impacts in the longer term where feasible technically and beneficial environmentally, economically and socially. Continue to mitigate the impact of established pests species to the Bay where feasible technically and beneficial environmentally, economically and socially.

Historical Context

Arrangements to deal with emergency responses to new marine pest introductions are outlined in the report of the National Taskforce on the Prevention and Management of Marine Pest Incursions, which is supported by the Interim Victorian Protocol for Managing Exotic Marine Organism Incursions.⁶⁸ The Taskforce provides a list of species and conditions that trigger national emergency response arrangements. The introduction and spread of marine pests are among the Bay “activities” that have recognised potential to disrupt Bay nitrogen cycling through mechanisms not yet understood scientifically (see Section 1.5). The Bay Study outlined the potentially adverse implications that marine pests may have for nutrient cycling, and the gap in our knowledge about establishing the risks involved.⁶⁹ The success of EMP’s marine pest program therefore also has potential implications to the nutrient program.

Key Actions for 2001–02

No new marine pest introductions were reported for the 2001–02 year. (Note that during this year reporting of new pest introduction was reliant on general observations by the public rather than a 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 (further detail provided in Section 1.5).

Control efforts continue to focus on the Northern Pacific Seastar in accordance with the National Control Plan for this pest. In the absence of readily available technology to reduce its numbers, priority continues to be given to reducing the risk of its introduction to new areas of Victoria and elsewhere in Australia. With the support of NHT funds, three collaborative projects commenced during the year that will help address this issue including:

- > The mapping of human-mediated vectors and activities that could lead to dispersal of marine pests in southeastern Australian marine waters. This is managed by BRS.
- > The identification of vectors that have transported the Seastar with the aim of reducing the movements of Seastars by these vectors. Also, a review of existing techniques for the early detection of marine pests and the possible use of a ‘ballast window’ to avoid uptake of the Northern Pacific Seastar. This is managed by NRE.
- > The use of the information from the BRS and NRE projects in a project managed by the CSIRO – CRIMP. CRIMP will use a Management Strategy Evaluation (MSE) model to determine which management responses would be most effective, or most robust, in dealing with this pest.

⁶⁸ Joint SCC/SCFA National Taskforce on the Prevention and Management of Marine Pest Incursions 2000. *Report of the Taskforce*. Environment Australia, Canberra, Australia; Department of Natural Resources and the Environment 1999. *Interim protocol for managing exotic marine organism incursions*. Report to the Department of Natural Resources and the Environment: 17pp

⁶⁹ Harris, G., Batley, G., Fox, D., Hall, D., Jernakoff, P., Molloy, R., Murray, A., Newell, B., Parslow, J., Skyring, G. and Walker, S. 1996. *Port Phillip Bay Environmental Study: Final Report*. CSIRO, Canberra, Australia.

⁷⁰ 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.

To aid these projects, in May 2002 a workshop was held in Adelaide that aimed to improve the targeting of current efforts to implement the National Control Plan. Workshop invitees included representatives of key marine industries, State and Commonwealth agencies and representatives from New Zealand. To assist development of the MSE model, participants identified and ranked vectors of the seastar and then identified key actions that would prevent its spread from infected Australian sites. This preliminary hazard analysis identified 19 vector groups, with ballast water the most prominent vector for North Pacific Seastar larvae, and commercial fishing gear an important vector for seastar adults. Workshop participants agreed that ballast water taken up from sites of Seastar infection should be considered hazardous and treated accordingly if it is proposed to be discharge to other Australian temperate ports. For the commercial fishing sectors, it was agreed that industry adoption of improved practices is likely to lead to significant reductions in the risk of spreading the Seastar. Risk reduction strategies include extension programs, to improve the application of existing knowledge, and improved understanding of the character of risks associated with particular fishing activities and vessel movements.

Future Outlook

The 'National System for the Prevention and Management of Marine Pest Incursions: Australian Strategic Plan 2002–2006' outlines arrangements for the long-term control of marine pests.⁷⁰

⁷⁰ 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.

Abbreviations

AQIP	Port Phillip Air Quality Improvement Plan
BRS	Bureau of Rural Sciences
CALP	Port Phillip and Westernport Catchment and Land Protection Board
CRIMP	Centre for Research on Introduced Marine Pests
CSIRO	Commonwealth Science and Industrial Research Organisation
ECC	Environment Conservation Council
EIP	Environmental Improvement Plan
EMP	Environmental Management Plan
EPA	Environment Protection Authority
MAFRI	Marine and Freshwater Resources Institute
NHT	National Heritage Trust
NHT2	National Heritage Trust 2
NRE	Department of Natural Resources and Environment
SEPP	State Environment Protection Policy
WTP	Western Treatment Plant

Appendix 1

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 (feral)</i>	<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>