Derwent Estuary Program Environmental Management Plan

February 2009

Working together, making a difference

Derwent Estuary Program

The Derwent Estuary Program (DEP) is a regional partnership between local governments, the Tasmanian state government, commercial and industrial enterprises, and community-based groups to restore and promote our estuary. The DEP was established in 1999 and has been nationally recognised for excellence in coordinating initiatives to reduce water pollution, conserve habitats and species, monitor river health and promote greater use and enjoyment of the foreshore. Our major sponsors include: Brighton, Clarence, Derwent Valley, Glenorchy, Hobart and Kingborough councils, the Tasmanian State Government, Hobart Water, Tasmanian Ports Corporation, Norske Skog Boyer and Nyrstar Hobart Smelter.

Kingborough

Brighton Council

Clarence... a brighter place

Hobart City Council

Glenorchy City
Where ideas happen.

Derwent Valley Council

Tasmania
Explore the possibilities

Norske Skog
Boyer

Hobart water

TasPorts

nyrstar

EXECUTIVE SUMMARY

The Derwent: Values, Challenges and Management

The Derwent estuary lies at the heart of the Hobart metropolitan area and is an asset of great natural beauty and diversity. It is an integral part of Tasmania's cultural, economic and natural heritage.

The estuary is an important and productive ecosystem and was once a major breeding ground for the southern right whale. Areas of wetlands, underwater grasses, tidal flats and rocky reefs support a wide range of species, including black swans, wading birds, penguins, dolphins, platypus and seadragons, as well as the endangered spotted handfish.

Nearly 200,000 people – 40% of Tasmania's population – live around the estuary's margins. The Derwent is widely used for recreation, boating, fishing and marine transportation, and is internationally known as the finish-line for the Sydney–Hobart Yacht Race. The Derwent supports several large industries, including paper and zinc production, boat-building and chocolate manufacturing. Upstream, the Derwent supplies most of Hobart's drinking water and is an important source of hydro-electric power.

A number of environmental issues affect the Derwent estuary:

- Heavy metal contamination of water, sediments and seafood
- Loss of estuarine habitat and species
- Introduced marine pests and weeds
- Altered river flow regimes and blocked fish migration routes
- Elevated levels of nutrients and organic matter, and low dissolved oxygen levels

Although there have been significant improvements in the treatment of sewage, industrial wastes and stormwater over the past decade, the Derwent remains a significantly impaired estuary. A strategic and coordinated management approach across all levels of government, industry and the community remains our best prospect for a cleaner and healthier estuary in the future.

The Derwent Estuary Program: Working Together, Making a Difference

Who we are

The Derwent Estuary Program (DEP) is a regional partnership between the Tasmanian Government, local governments, industry, scientists and the community to restore and promote our estuary.

The DEP was established in 1999 and has been nationally recognised for excellence in reducing water pollution, conserving habitats and species, monitoring river health and promoting greater use and enjoyment of the foreshore.

The DEP currently manages monitoring activities, projects and communications valued at over $1 million per year. Our partners and supporters include:

- Tasmanian Government
- Brighton Council
- Clarence City Council
- Derwent Valley Council
- Glenorchy City Council
- Hobart City Council
- Kingborough Council
- Hobart Water
- Norske Skog Boyer
- Nyrstar Hobart
- Tasmanian Ports Corporation
- Australian Government
- Tasmanian Aquaculture and Fisheries Institute/UTas
- CSIRO Marine Research
- NRM South
- Tasmanian Conservation Trust

Achievements: 1999 - 2007

Despite the pressures it faces on a daily basis, The Derwent is showing promising signs of recovery.

Since 1999, heavy metal and organic loads have declined by over 50% in response to management actions undertaken by industries. Improvements have also been made to sewage discharges through advanced treatment and effluent reuse, and a number of stormwater treatment projects have been completed by local councils. Improved management of boat wastes has also been achieved through collection and treatment of slipway wastes at the Domain.

As the condition of the estuary improves, there is growing interest in conserving and enjoying the Derwent's natural features. The DEP has led initiatives to acquire wetlands – increasing the area of protected wetlands by 40% – and to preserve iconic species such as the little penguin. More recently, the DEP has developed strategies to link and extend foreshore tracks and to increase awareness and enjoyment of the Derwent through interpretations.

The DEP is underpinned by a comprehensive monitoring program that documents environmental conditions and trends, and also supports scientific research into key issues such as heavy metals and nutrient processing.

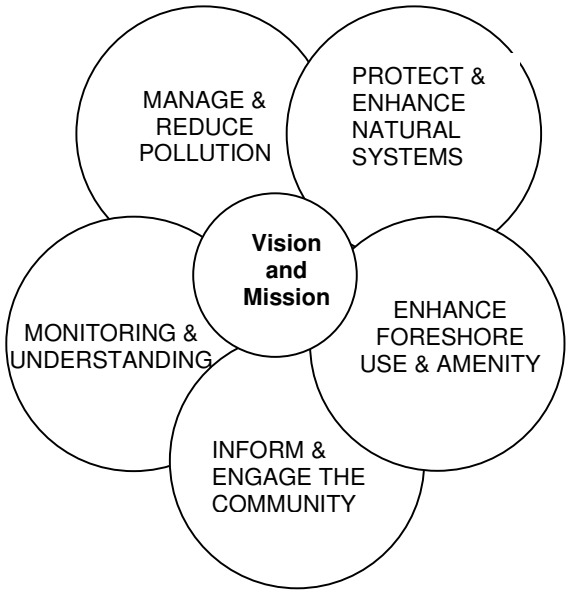
The DEP informs the community about our activities via quarterly eBulletins, annual 'Report Cards' and five-yearly 'State of the Derwent' reports. We also maintain a comprehensive website at www.derwentestuary.org.au.

The 2008 Environmental Management Plan

In 2001 the first management plan was completed for the Derwent and partnership agreements were signed by the Premier, Mayors and heads of industries to support its implementation. This original partnership remains strong and has expanded to include new members. Using resources provided by our regional partners - together with a number of Commonwealth grants - the DEP has tackled several key issues including heavy metal contamination, water sensitive urban design, soil and erosion control, wetlands protection, and conservation of little penguins.

As the first implementation period draws to a close, it is time for a review of the original Management Plan, including a reassessment of priorities and consideration of emerging issues. The 2008 Environmental Management Plan is broadly similar in structure to the original plan, but covers a wider range of issues – including foreshore use and amenities, communications and a more detailed science and monitoring plan. This Plan is based on a ten to twenty year horizon.

The Management Plan is structured around five key management themes as illustrated below. Within this framework, key issues are analysed and strategic actions are proposed. These actions are then distilled into a five-year Action Plan.



Our ***vision*** for the Derwent is an estuary with a healthy and diverse ecosystem that supports a wide range of recreational and commercial uses and is a source of community pride and enjoyment.

Our ***mission*** is to work together to understand the Derwent system, to take action to progressively enhance and protect the estuary's values, and to inform and involve the community in this process.

Key Management Strategies and Aspirations: 2025

Manage & Reduce Pollution

- Water quality at all swimming beaches is rated 'good'
- Heavy metal levels in shellfish in some areas of the lower Derwent meet Food Safety Standards
- Sustainable nutrient limits are established and sewage, industrial and aquaculture loads are being managed to achieve these
- Sustainable catchment flows and loads are established and land/water use activities are being managed to achieve these
- Water Sensitive Urban Design is incorporated within all major new developments
- Stormwater management plans are being implemented in all priority urban catchments
- Slipway wastes from all major slipways are captured and treated

Protect & Enhance Natural Systems

- Wetlands, seagrasses and other critical estuarine habitats are protected and improving in extent and/or condition
- Numbers of penguins, spotted handfish and other iconic or protected species are increasing
- Marine pests and coastal weeds are actively being managed and priority species are controlled or eradicated
- Climate change impacts are monitored and a Derwent estuary response strategy has been developed and is being implemented

Enhance Foreshore Use & Amenities

- Regional foreshore strategy has been developed and is being implemented, with a focus on conserving natural values and enhancing public use/amenities
- 50% of the Derwent foreshore has been maintained as public open space and reserves
- Foreshore tracks network is established, including construction of 50 km new/improved tracks
- Foreshore litter has been reduced by 50%

Monitor & Understand the Derwent

- Monitoring systems are maintained and enhanced to track Derwent estuary conditions and trends
- Science-based management tools have been developed, including indicators, targets, system models and decision support tools

Inform & Engage the Community

- The community is well-informed about the state of the Derwent and how their efforts can contribute to a healthy system
- Interpretation activities are well-developed, including partnerships with the Tasmanian Aboriginal community
- Events and activities are regularly held to celebrate the Derwent

Our Commitments: the Next 5 Years

The Action Plan summarises priority actions to be progressed over the next five years. Some of these actions are currently funded; others will be pursued through new project partnerships and funding applications. Key areas for action over the next five years include:

Manage & Reduce Pollution

- Investigate and mitigate pollution at all C- and D-rated swimming beaches
- Carry out further groundwater remediation at zinc works (reduce zinc loads by another 50 to 100 tonnes/year)
- Complete implementation of full secondary treatment at the Boyer mill (reduce BOD loads by 7000 tonnes/year as compared to pre-secondary treatment levels)
- Complete nutrient Decision Support System and set targets for sustainable loads
- Plan and/or implement extension of effluent reuse schemes, sewage treatment plant upgrades and improved management of industries to meet targets
- Implement Water Sensitive Urban Design projects at ten new sites
- Prepare stormwater management plans for six high priority urban catchments and commence implementation
- Capture and treat wastes from major slipways
- Complete catchment Decision Support System (monitoring, modelling and research) and set targets for sustainable flows and loads

Protect & Enhance Natural Systems

- Complete Derwent Estuary Conservation Action Plan and set priority actions
- Conserve/acquire critical habitats, including wetlands
- Implement management actions to double populations of little penguins and spotted handfish
- Eradicate ricegrass from the Derwent
- Develop Derwent estuary climate change strategy and monitor impacts of sea-level rise in high risk areas

Enhance Foreshore Use & Amenities

- Prepare Derwent open space/access strategy
- Establish Derwent foreshore tracks network and extend/upgrade six major tracks
- Conduct annual foreshore litter survey and extend/enhance Clean Up Australia Day activities

Monitor & Understand the Derwent

- Maintain and enhance monitoring of Derwent estuary water quality, sediment quality and biota
- Support and facilitate integrated studies into heavy metals, nutrients and catchment processes in partnership with the University of Tasmania/Tasmanian Aquaculture and Fisheries Institute and CSIRO

Inform & Engage the Community

- Re-issue the State of the Derwent Report and publish regular Report Cards
- Publish Derwent Estuary Guide and associated interpretations
- Celebrate the DEP's ten year anniversary in 2011

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Acknowledgements
In addition to the three levels of government, many other stakeholders have played an active role in developing the strategies contained within this management plan, including industry and commerce, conservation groups and research institutions. A full listing of participants and contributors is provided in Appendix 1.

1. INTRODUCTION

1.1 The Derwent Estuary – Values and Uses

The Derwent estuary lies at the heart of the Hobart metropolitan area and is an asset of great natural beauty and diversity. For over 40,000 years, this area was the home of two Tasmanian Aboriginal tribes– the Oyster Bay Tribe on the eastern shore and the South East Tribe on the western shore. The estuary had a number of Aboriginal names, (to be included following consultation with Tasmanian Aboriginal community). In 1794, the estuary was named 'Derwent' by the European explorers after the Celtic word for 'clear water'.

Today, approximately 40% of Tasmania's population (200,000 people) live around the estuary's margins. The Derwent is widely used for recreation, boating, fishing and marine transportation, and is internationally known as the finish-line for the Sydney-to Hobart yacht race. The Derwent is also Tasmania's fourth largest port and supports several large industries, including paper and zinc production, boat-building and chocolate manufacturing. The Derwent River, immediately upstream of the estuary, supplies the majority of the region's drinking water and is an important source of hydroelectric power.

The estuary is an important and productive ecosystem and was once a major breeding ground for the southern right whale. Areas of wetlands, underwater grasses, tidal flats and rocky reefs support a wide range of species, including black swans, wading birds, penguins, dolphins, platypus and seadragons. The critically endangered spotted handfish is found only in the Derwent estuary.

1.2 The Derwent Estuary – Issues, Conditions and Trends

The Derwent estuary is the largest estuary in southeastern Tasmania, covering an area of nearly 200 square kilometres. The estuary extends from New Norfolk (maximum extent of salt water) to a line between Tinderbox and the Iron Pot Light. The Derwent is a relatively deep 'salt-wedge' type estuary, which is highly stratified in its narrow upper reaches and well-mixed in its broad, lower reaches. The estuarine circulation is characterised by a relatively short residence time (approximately 2 weeks) and a large and consistent freshwater input from the Derwent River (average 90 cumecs). Freshwater surface flows tend to be diverted towards the eastern shoreline, and saline bottom water travels slowly up-river. This has important implications for pollutants, which tend to be widely distributed throughout the estuary. Tides are generally small, with an average tidal range of one metre. The Derwent is influenced by strong seasonal and annual variations in temperature, rainfall, river flow, winds and coastal currents: these factors can significantly affect water quality.

The following environmental issues affect the Derwent estuary:

Heavy metals

The Derwent has a legacy of heavy metal contamination of water, sediments and biota that is largely the result of past industrial practices. Levels of zinc, mercury, lead and

cadmium in Derwent estuary sediments and shellfish are among the highest in Australia. Although recent monitoring indicates that levels in the environment are also now starting to decline, heavy metals in sediments and shellfish remain well above national environmental and health guidelines. Shellfish should not be consumed from any part of the estuary and limits have been recommended on the consumption of Derwent-caught fish.

Introduced marine pests

The Derwent has been severely impacted by introduced marine pests, harbouring a number of nationally listed priority species, such as the northern Pacific seastar, toxic dinoflagellates and the European green crab. These species pose a serious threat to the overall ecology of the estuary and some also have important human health and economic implications. There are also a number of potential new species (e.g. Gambusia, zebra mussel) that could cause serious damage if introduced to the estuary.

Loss and degradation of estuarine habitats and species

The Derwent has experienced major historical losses of wetlands, tidal flats, seagrasses and macroalgae associated with urban, industrial and catchment development. Species that depend on these habitats have declined in numbers; others such as the spotted handfish are now threatened or endangered.

Catchment flows and water quality

The Derwent River is the second-largest river in Tasmania and is an important resource for water supply, irrigation, hydropower generation and fisheries. The river also plays a major role in the health of the estuary, providing clean water and driving estuarine circulation. While water quality has generally been good, there are a number of changes underway in the catchment that could have significant future consequences. Furthermore, the combination of an extended dry spell, increasing water extractions and hydropower development have significantly altered the Derwent's natural flow patterns and blocked access for migratory fish.

Water pollution

While water quality has generally improved in the Derwent over the past 10 to 20 years, some areas still experience poor water quality, particularly after heavy rains and/or during summer months. Estuarine water quality issues include the following:

- intermittent contamination of recreational waters by faecal bacteria associated with stormwater and sewage discharges;
- elevated nutrient concentrations associated with sewage treatment plant discharges, superimposed on strong natural seasonal variations;
- depressed oxygen levels and organic enrichment of sediments in the upper and middle estuary associated with paper mill and catchment discharges, superimposed on strong natural seasonal variations.

Contaminants enter the Derwent estuary from a variety of sources. Point sources include ten sewage treatment plants and two large industries (the Norske Skog paper mill and Nyrstar Hobart zinc smelter). Diffuse sources include stormwater runoff, tips and contaminated sites, catchment inputs carried by the Derwent and Jordan Rivers, atmospheric contributions, and wastes associated with shipping operations, port facilities and marinas. Some pollutants are also derived from contaminated sediments within the

estuary itself, and recent studies suggest that aquaculture operations in the D'Entrecasteaux Channel may also be a significant source of nutrients to the Derwent. Contaminants associated with these various sources include pathogens, nutrients, organic matter, wood extractives such as resin acids, litter and sediments, and a range of toxicants including heavy metals and hydrocarbons.

At present, sewage treatment plants discharge the majority of nutrients, stormwater accounts for the majority of faecal bacteria, Nyrstar discharges the majority of heavy metals (primarily as diffuse emissions) and, until recently, Norske Skog discharged the majority of organic matter.

Since 1996, there have been several very significant reductions in pollutant loads to the Derwent, particularly with respect to heavy metals discharged by industry (greater than 50% reduction), organic matter discharged by industry (greater than 80% reduction) and pathogens discharged by municipal wastewater treatment plants (greater than 90% reduction). These have resulted to a large degree from site improvements at the Nyrstar Hobart smelter, the new wastewater treatment plant at Norske Skog as well as the upgrading and effluent reuse from several sewage treatment plants (particularly at Sandy Bay/Selfs Point, Brighton/Bridgewater, Rokeby and Rosny).

Although there have been significant improvements in the treatment of sewage and industrial wastes over the past decade, the Derwent remains a significantly impaired estuary. A strategic and coordinated management approach across all levels of government, industry and the community remains our best prospect for a cleaner and healthier estuary in the future.

1.3 The Derwent Foreshore – Issues, Conditions and Trends

The Derwent estuary foreshore covers a distance of 224 km, extending north along the western shore from Tinderbox to New Norfolk and south again along the eastern shore to Ralphs Bay and the South Arm peninsula. The foreshore environment is characterised by great natural diversity of landscapes, flora, fauna and climate, with strong regional differences. The verdant marshes and river landscapes near New Norfolk are a strong contrast to the dramatic seacliffs of Blackmans Bay and the pristine dunes and beaches of South Arm.

The Derwent foreshore is used for a broad spectrum of activities, including, urban and residential development, industry, ports, agriculture, recreation and tourism. There are many foreshore issues and conflicts, and some of these are difficult to resolve due to the jurisdictional and institutional complexities at the interface of land and sea.

Ultimately, management roles and responsibilities are determined to a large degree on ownership. Analysis of foreshore land tenure maps indicates that 49% of the foreshore is in private ownership, 30% is in State reserves or Crown lands, 9% is owned by Councils, 9% is occupied by state or council roadways and 2% is owned by the Commonwealth.

A range of foreshore issues have been identified through the Derwent Estuary Program. These can be broadly categorised as:

Foreshore environment
While diverse and scenic, many foreshore areas have experienced loss and degradation of habitats as a result of clearing and land reclamation, invasion by weeds and feral animals and accumulating litter, resulting in loss of biodiversity and amenity.

Climate change related impacts
Foreshore areas are particularly susceptible to climate change – particularly impacts associated with sea-level rise, flooding and shoreline erosion. These climate change impacts are predicted to have severe consequences for property, infrastructure and biodiversity.

Foreshore use and amenities
The relatively large proportion of public open space along the Derwent foreshore offers excellent opportunities for foreshore access, parks and walking tracks, supporting regional recreational and tourism activities. At the same time, the needs of foreshore-dependent businesses, industries, ports and transport systems must also be accommodated.

Coordinated/sustainable planning and management
Improved coordination and planning would greatly improve the management of the Derwent foreshore, particularly with respect to management of coastal reserves, siting and construction of new developments and foreshore structures, and more generally, implementation of the State Coastal Policy within a regional context.

Foreshore heritage
The Derwent foreshore is richly endowed with Aboriginal, European and maritime heritage sites, however there is a general lack of information and awareness about much of this heritage, a need for coordinated regional management, as well as better preservation and interpretation.

It is difficult to assess conditions and trends along the Derwent foreshore, as there has been little systematic monitoring and reporting at a regional scale. However, there are a number of recently completed surveys that should provide a good basis for future assessment. These include the Southern Tasmanian coastal values mapping project, detailed regional surveys of coastal topography and geomorphology, and inventories of walking tracks and coastal structures.

There is much to be gained from a coordinated and regional approach to foreshore management and strategies are being developed as part of the DEP to enhance foreshore benefits, whilst minimising conflicts and adverse impacts.

1.4 The Derwent Estuary Program

The Derwent Estuary Program (DEP) is a regional partnership between the Tasmanian state government, local governments, industries and the community to restore and promote the estuary. The DEP was established in 1999 and has been nationally recognized for excellence in reducing water pollution, conserving habitats and species, monitoring river health and promoting greater use and enjoyment of the foreshore.

During its first two years, the DEP set up a management framework, including a high-level Steering Committee and Working Groups, prepared the first Environmental Management Plan (EMP) and established a coordinated monitoring and reporting system in partnership with industries. In December 2001, the EMP was endorsed by key stakeholders and a Partnership Agreement was signed by the Premier and Council Mayors to commence implementation of this plan.

Resources to support the program have been provided by the State Government, the six councils that border on the Derwent (Brighton, Clarence, Derwent Valley, Glenorchy, Hobart and Kingborough) and four industry and commercial partners (Norske Skog Boyer, Nyrstar Hobart, Hobart Water and TasPorts). In addition, the Australian Government and NRM South have provided grant funding for a number of important projects.

Our achievements

Since the DEP was established in 1999, the partnership has achieved excellent results in many areas, including on-ground works, conservation of habitats and species, promotion of foreshore tracks, monitoring and scientific investigations, communications and fund-raising – as indicated below. A number of the projects listed below have been supported through Australian Government funding, in particular through Natural Heritage Trust grants.

Pollution control

Despite the pressures it faces on a daily basis, the Derwent is showing promising signs of recovery. Since 1999, our partners have achieved major improvements in pollution control, collectively valued at over 100 million dollars. As a result, heavy metals and organic discharges have been reduced by over 50%. Improvements have also been made to sewage discharges through advanced treatment and effluent reuse, and numerous stormwater treatment projects have been completed by local councils. Improved management of boat wastes has also been achieved through collection and treatment of slipway wastes at the Domain slipway. Key initiatives include the following:

- Major reductions in heavy metal discharges through landfill rehabillitation, capture and treatment of contaminated groundwater and stormwater, covering and reprocessing of stockpiles and improved process controls (Nyrstar Hobart Smelter);
- Major reductions in suspended solids and organic loads though improved process controls and secondary treatment (Norske Skog Paper);
- Improved treatment of sewage through tertiary treatment (Hobart, Clarence) and effluent reuse (Brighton, Clarence);
- Capture and treatment of slipways wastes at the Domain slipways (TasPorts);
- Construction of numerous stormwater treatment systems (all Councils, Royal Tasmanian Botanical Gardens);

- Regional stormwater management initiatives including preparation of a model stormwater management plan, water sensitive urban design guidelines and a regional monitoring program (Derwent Estuary Program)
- Preparation of a Water Quality Improvement Plan for heavy metals (Derwent Estuary Program)

Conserving natural systems

As the condition of the estuary improves, there is growing interest in conserving and enjoying the Derwent's natural features. The DEP has led initiatives to acquire wetlands – increasing the area of protected wetlands by 40% – and to preserve iconic species such as the little penguin. Key initiatives include the following:

- Acquisition and conservation of the 66 ha Murphys Flat wetland (Derwent Estuary Program, DIER, DPIWE, Boyer Mill, Derwent Valley Council);
- Little penguin surveys and management actions to secure key breeding colonies (Derwent Estuary Program, Tasmanian Conservation Trust, DPIW, Kingborough and Hobart councils, Understory Network , Birds Tasmania, Wrest Point);
- Surveys and management actions to sustain/increase populations of the critically endangered spotted handfish (CSIRO Marine Research, DPIW);
- Mapping of foreshore and subtidal habitat and preparation of a Derwent habitat atlas (TAFI, North Barker, Aquenal, Derwent Estuary Program)
- Rice grass surveys and eradication (DPIW and DEP)

Foreshore use and amenity

During the past five years, the DEP has reviewed issues associated with foreshore use and development. Key priorities include linkage and extension of foreshore track, and an increase in awareness and enjoyment of the Derwent through interpretations. Councils have also been very active in constructing and enhancing foreshore tracks. Key initiatives include the following:

- Foreshore issues discussion paper, including analysis of foreshore land tenure (DEP);
- Foreshore tracks discussion paper and visitor survey (DEP);
- Foreshore tracks inventory (DEP);
- Construction and extension of foreshore tracks (Glenorchy, Hobart, Kingborough, Brighton and Clarence councils);
- Derwent estuary interpretation plan (DEP).

Monitoring and scientific understanding

The DEP is underpinned by a comprehensive monitoring program that documents environmental conditions and trends, and also supports targeted research projects addressing key issues such as heavy metal contamination and nutrient enrichment. Key initiatives include the following:

- Regular monitoring of Derwent estuary water and sediment quality (DEP, DEPHA, DHHS, Norske Skog, Nyrstar, Councils);
- Surveys of heavy metal levels in fish and shellfish (Nyrstar, TAFI, DEP)
- Development of system models and decision support tools (DEP, CSIRO);
- Heavy metal and nutrient process studies (DEP, TAFI, CSIRO)

Education and awareness

The DEP informs the community about our activities via quarterly eBulletins, annual 'Report Cards' and five-yearly 'State of the Derwent' reports. We also maintain a comprehensive website (www.derwentestuary.org.au) and issue regular media releases about new developments.

Program development and fund-raising

The DEP partnership has evolved substantially since 1999 in terms of resources, staff, and program outcomes. Cash and in-kind resources have grown from approximately $100,000 to $1,000,000 per annum, and staffing has increased from about 1 to 5 full-time employees. The program has developed effective working relationships with industries, research organisations, conservation groups, and regional/national funding bodies.

1.5 This Management Plan

To prepare for the challenges that lie ahead, the DEP has reviewed and revised our management plan, including a reassessment of priorities and consideration of emerging issues. The revised plan covers a wider range of issues – including foreshore use and amenities, climate change, communications and a more detailed science and monitoring plan. This plan is based on a 10 to 20-year horizon.

The Plan starts with an overview of the strategic elements of the program (Section 2). Sections 3 to 6 present the Program's key management elements, Sections 7 and 8 address science and communications, and Section 9 outlines the implementation framework.

An important objective of this revised Management Plan is to provide greater focus and clarity with respect to setting priorities and recommending short-term actions. These priorities are outlined in Section 10 (Action Plan).

In addition, six priority projects have been identified as areas where additional investment is needed to address key issues. These are:

- Preventing eutrophication
- Catchment flows and water quality
- Water sensitive urban design
- Iconic habitats and species
- Foreshore walking tracks
- Education and interpretation

This management plan is intended as a directional document that will evolve and change with time. Its purpose is to set the context, provide a framework and catalyst for regional coordinated action, and to identify goals and priority actions to achieve these. This management plan will be regularly reviewed and revised as new information, issues and opportunities arise.

The Derwent Estuary Management Plan will be implemented through a number of mechanisms, including coordination of on-going activities, initiation of priority projects, securing and leveraging of funding, monitoring, information and communications, and

regular review and revision of strategies. Implementation of the management plan and associated projects will be formalised through voluntary Partnership Agreements between the stakeholders.

3. STRATEGIC DIRECTIONS

This section sets out the Management Plan's vision, management principles and overall goals, together with an outline of the key strategies. The section also sets out the roles and responsibilities of the Derwent Estuary Program.

3.1 Vision and Mission

Our ***vision*** for the Derwent is an estuary with a healthy and diverse ecosystem that supports a wide range of recreational and commercial uses and is a source of community pride and enjoyment.

Our ***mission*** is to work together to understand the Derwent estuary system, to take action to progressively enhance and protect the estuary's values, and to inform and involve the community in this process.

3.2 Management Principles

The management framework for the Derwent estuary is based on a number of principles. In particular, the management strategy supports an approach that is:

- Cooperative (non-statutory);
- Inclusive of the full range of interests;
- Builds on and integrates current actions and initiatives;
- Pragmatic (based on environmental, social and economic balance);
- Adaptive and evolving;
- Based on 'best available' information, contemporary research and sound scientific studies;
- Linked with environmental indicators and targets and regular reporting;
- Financially sustainable by the stakeholders.

3.3 DEP roles and functions

The Derwent Estuary Program fulfills a variety of non-statutory roles and functions as part of our mission to restore and protect the Derwent.

These include:

- Strategic planning to encourage a whole-of-estuary perspective
- Coordination and facilitation of stakeholder activities
- Initiation of projects to address key regional issues
- Environmental monitoring and reporting
- Scientific investigations to improve our understanding of key issues
- Development of decision support tools and models
- Communications, including media and development of educational materials
- Fund-raising and proposal development

- Provision of scientific and technical advice, as requested by our stakeholders.

3.4 Goals and strategies

The fundamental goals of this management plan are:

- To manage and reduce pollution, resulting in better water and sediment quality and an overall improvement in ecosystem health;
- To protect and enhance estuarine and foreshore ecosystems;
- To enhance human uses and benefits associated with the estuary and foreshore;
- To improve scientific understanding and monitor conditions and trends;
- To inform and engage the community.

These fundamental goals are linked with a series of more specific strategies, as illustrated in Figure 2 and summarised below.

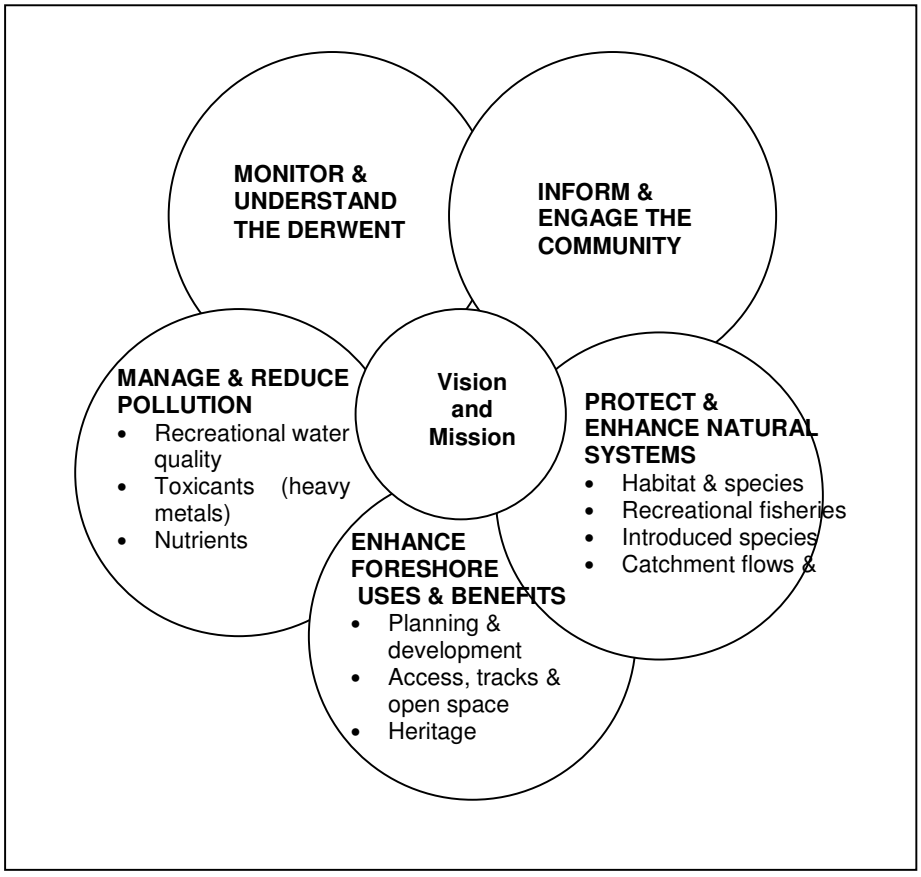

Figure 2 Derwent Environmental Management Plan: management goals and strategies

The key strategies to be used in implementing this management plan are grouped according to the five overall management goals, as indicated below. Summary papers for each strategy are provided in Sections 4 through 7.

Goal #1 Manage and Reduce Pollution

- Strategy 1.1 Improve recreational water quality
- Strategy 1.2 Reduce toxicants
- Strategy 1.3 Prevent eutrophication

These strategies are supported by associated ***source control strategies*** for sewage, industrial wastes, stormwater and boat wastes, i.e.

- Strategy 1.4 Manage sewage discharges
- Strategy 1.5 Manage industrial discharges
- Strategy 1.6 Manage stormwater runoff
- Strategy 1.7 Manage boat wastes

Goal #2 Protect and Enhance Natural Systems

- Strategy 2.1 Conserve and restore critical habitats and species
- Strategy 2.2 Enhance recreational fisheries
- Strategy 2.3 Manage introduced species
- Strategy 2.3 Manage environmental flows and catchment water quality

Goal #3 Enhance Foreshore Uses and Benefits

- Strategy 3.1 Coordinate foreshore use and development
- Strategy 3.2 Improve foreshore access, tracks and open space
- Strategy 3.3 Conserve foreshore and maritime heritage

Goal #4 Monitor and Understand the Derwent

Strategy 4.1 Maintain and enhance collaborative monitoring and research programs
Strategy 4.2 Maintain and enhance science-based management tools

Goal #5 Inform and Engage the Community

Strategy 5.1 Regular reports, bulletins, report cards
Strategy 5.1 Maintain and enhance information and interpretive stations
Strategy 5.3 Celebrate success of DEP

3.5 Indicators and Benchmarks

An important element of the management strategy is the establishment of appropriate long-term environmental objectives for the estuary, together with interim benchmarks. These will assist us in prioritising and implementing those management actions that will achieve these objectives most effectively and cost-efficiently. These objectives and benchmarks will be associated with indicators – for example, nutrient levels in water, heavy metal levels in sediments, area and condition of seagrasses – that can be used to monitor and track progress.

Development of indicators, WQOs and interim benchmarks has been identified as a high priority in this management plan and will be advanced as part of the implementation strategy. To assist in this process, potential indicators have been identified within each of the management strategies.

4. MANAGING AND REDUCING POLLUTION

Overview

The Derwent estuary has been a center for urban and industrial development for over 100 years, and for much of this time, sewage, industrial wastes, stormwater and boat wastes were discharged to the estuary with minimal treatment. The environmental consequences of these combined actions have included pollution of water, sediments and biota. Unlike many river basins, the majority of contaminants entering the Derwent are associated with nearby urban and industrial sources, rather than the catchment above the estuary. However, as land uses within the catchment and the nearby D'Entrecasteaux Channel change over time, it is important that potential impacts of these changes on the estuary be considered and managed.

Over the past few decades, there have been significant reductions in point-source sewage and industrial discharges to the Derwent, with measurable improvements in water quality. More attention is now being focused on remaining point sources and on diffuse sources of pollution, such as urban stormwater, spills and leaks from aging sewerage infrastructure and contaminated groundwater.

Specific pollutants of concern include litter, sediments, organic matter, nutrients, pathogens and toxicants (e.g. heavy metals, hydrocarbons). The estimated relative contributions of these pollutants from the major sources is indicated in the table below (X = minor, XX = moderate, XXX = substantial).

Pollutant	**Measure/indicator**	**Sewage**	**Industry**	**Urban runoff**	**Boats & boatyards**
Litter	Gross solids		X	XXX	X
Sediment	Total Suspended Solids	X	XX	XX	
Organic matter	Biochemical Oxygen Demand	X	XX	X	
Nutrients	Nitrogen and phosphorus	XXX	XX	X	
Pathogens	Enterococci	XX		XXX	X
Toxicants	Heavy metals	X	XXX	X	X
	Hydrocarbons	X	X	XXX	X

This section of the management plan focuses on three major issues that affect human and ecosystem health in the Derwent estuary, specifically:

- Maintaining and improving recreational water quality;
- Reducing and managing toxicants, particularly heavy metals, and;
- Preventing eutrophication (i.e. over-enrichment by nutrients and organic matter).

A variety of management approaches are proposed to address these issues, including source controls, improved scientific understanding and – where there are potential human health risks – providing clear and consistent information to the community.

Sections 4.4 to 4.7 specifically address the pollution sources – sewage, industry, stormwater and boat wastes – that collectively contribute to the management issues.

4.1 Maintaining and improving recreational water quality

Water contaminated by sewage and animal faeces may contain pathogenic micro-organisms (bacteria, viruses, protozoa) that pose a health hazard when the water is used for recreational activities, particularly those involving total immersion. Indicator bacteria are used to assess the health risks associated with pathogens in recreational waters. The recently revised NH&MRC guidelines (2005) and the *Tasmanian Recreational Water Quality Guidelines 2007* recommend the use of enterococci as the preferred indicator for marine waters. The guidelines adopt a risk-based classification of recreational waters that relies on a combination of sanitary surveys and water quality monitoring, and also give greater weight to occasional high bacteria counts (events), rather than median conditions.

The Derwent estuary is widely used for recreation. Primary contact (direct immersion) sports include swimming, scuba diving, water- and jet-skiing, and windsurfing, while secondary contact sports include large and small boat sailing, motor-boating, fishing, paddling and rowing. There are also an increasing number of triathlons and other water-based events being held at sites around the Derwent each year.

The Derwent recreational water quality monitoring program was initiated in 1987 as a joint monitoring effort between Councils, the Environment Division (DEPHA) and the Department of Health and Human Services. Approximately 40 sites around the estuary are monitored weekly from December through March. A review of the long-term data set suggests that faecal bacteria levels have decreased at most sites, probably due to improvements to sewage treatment plants and infrastructure.

Under previous state and national guidelines, most Derwent beaches received passing marks, however, the revised guidelines set a higher standard. Under these new guidelines, several popular swimming beaches have received poor water quality ratings, as have a number of recreational bays. This is generally due to occasional high bacteria counts - particularly after heavy rains - rather than chronic poor water quality

Sources of bacterial contamination to the Derwent may include sewage treatment plants, malfunctioning or overloaded sewerage infrastructure; sewage discharges from boats; illegal sewer connections to rivulets and storm drains; malfunctioning septic systems; urban runoff; and waterfowl or animal wastes. Urban runoff now predominates as the main source of faecal bacteria to the Derwent, contributing an estimated 90% of the total load. The estuary is at greatest risk of contamination during and immediately following heavy rainfalls, when large volumes of urban run-off flow into the Derwent and sewerage systems may become overloaded by stormwater.

A number of actions have been taken to address recreational water quality in recent years, including improved management of sewage and stormwater (see Sections 4.4 and 4.6 for details), enhanced monitoring and investigations, and better public information. However, further work is needed to track and address pollution sources at several key sites and to inform and educate the public about recreation water quality.

The major issues, recent actions and management recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with proposed performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
New guidelines In October 2006, the NH&MRC released new national guidelines for recreational water quality in line with international standards (World Health Organisation). New Tasmanian guidelines were issued in February 2007. These guidelines set a higher water quality standard, and further work is needed at some Derwent sites to achieve the recommended standards.	• Revised NH&MRC guidelines released in October 2006 • Revised State Government guidelines issued in February 2007.	• Work with councils and DHHS to streamline implementation of new guidelines and support development of new reporting systems
Monitoring and investigations The current recreational water quality monitoring program should be continued and refined in accordance with the new national and state guidelines. Standardised methods for sanitary surveys, pollution tracking and predictive models would also be very useful.	• DEP summer monitoring program (on-going) • Sanitary survey software trialled and distributed to councils • Pollution tracking trials using sterols and caffeine	• Continue/enhance monitoring, including event monitoring • Review/test sanitary survey methodologies • Review/test methods to track pollution sources • Investigate use of predictive models to predict water quality based on rainfall
Public information It is important to provide the community with clear and up-to-date information about recreational water quality so that they can make an informed choice about where to swim.	• Media releases • 'Swimming in the Derwent' pamphlet issued (Feb 2006) • Signage installed at Nutgrove, Marieville and Cornelian Bay (HCC) • Derwent Beachwatch feature and weekly columns published in Mercury (2007/8)	• Issue annual 'Swimming in the Derwent' feature and technical recreational water quality summary report • Continue regular 'Beachwatch' reports in the newspaper and DEP website • Develop & install signage at key sites and update as needed
Strategic improvements		
Beaches A few popular beaches (e.g. Nutgrove) have received poor water quality ratings under the new national guidelines, typically due to occasional 'spikes' rather than chronic poor water quality.	• Sanitary surveys completed at Nutgrove, Howrah and Kingston beaches • Follow-up surveys/assessments are on-going at Nutgrove and Howrah	• Continue/ follow-up on source investigations to Improve water quality at D-rated beaches • Investigate/address sources of pollution at C-rated beaches
Bays Water quality adjacent to several popular recreational areas is poor (e.g. at Cornelian Bay, Marieville Esplanade and Elwick Bay). At a minimum, the public should be made aware of this through signage. In the longer-term pollution sources should be addressed so that these areas can be used for water-based recreation.	• Signage installed at Marieville Esplanade and Cornelian Bay	• Investigate/address sources of pollution at D-rated bays, particularly those with foreshore parks/access • Install signage at all D-rated bays with adjacent foreshore parks (e.g. New Town, Elwick, Lowestoft)
Major events The Derwent is being increasingly used for swimming events and triathlons. It is important that event organizers consider water quality monitoring results when planning and holding these events.	• Information and advice provided to event organizers on request; • Meeting held with event organizers (2007, 2008)	• Continue annual meetings with event organisers to plan and manage events so as to limits risks from poor recreational water quality.

Objectives for Maintaining and Improving Recreational Water Quality (2025)

- Water quality at major swimming beaches achieves B rating or better
- Water quality at bays with foreshore parks achieves C rating or better
- Public has good access to water quality information via signage, websites and media
- Swimming and other primary contact events are planned/managed to minimize health risks
- Rigorous monitoring and assessment protocols in place, including predictive models

Strategies and Proposed Actions – next five years

1. Identify and address pollution sources at C and D-rated swimming beaches, specifically:

- Nutgrove, Howrah, Bellerive and Kingston

2. Identify and address pollution sources at D-rated bays, particularly those with foreshore parks, specifically:

- Cornelian Bay, Marieville Esplanade, Watermans Dock, New Town Bay and Elwick Bay

3. Maintain/develop protocols to ensure event planners are aware of water quality issues and can manage risks accordingly

4. Maintain/ enhance existing recreational water quality monitoring program, including:

- Weekly summer monitoring of beaches and bays
- Sanitary surveys
- Methods to identify/track sources
- Predictive tools and models

5. Improve public information and awareness of recreational water quality

- Publish annual 'Derwent Swim Guide' feature
- Install signage at all major beaches and at any bays with poor water quality
- Develop Beachwatch website and associated newspaper report with weekly updates
- Issue regular reports and media releases
- Support education campaigns to improve management of pollution from dogs, waterfowl and gulls

See Sections on managing sewage (4.4), stormwater (4.6) and boat wastes (4.7) for other related actions.

Performance Indicators and Targets

- Enterococci counts (95%)
- Public information and signage (% of beaches/bays with signage)
- %. beaches with target ratings achieved

4.2 Reducing and Managing Toxicants

Toxicants – including heavy metals, hydrocarbons, biocides and other organic contaminants – are known to affect both ecosystem and human health where they occur at elevated levels. Adverse impacts can occur through direct toxicity and/or through bioaccumulation. National guidelines for toxicants in aquatic systems have been set by ANZECC (2001), while human health guidelines for seafood have been set by FSANZ (2007).

The Derwent estuary has a long history of contamination by heavy metals, commencing in 1917 with the establishment of the EZ zinc smelter at Risdon, followed by the Australian Newsprint Mill at Boyer in 1940. Over the years, large amounts of zinc, mercury, lead, cadmium, copper and arsenic were discharged to the Derwent, resulting in high levels of contaminants in water, sediments and seafood. During the 1980s and 1990s, heavy metal discharges were reduced to a small proportion of previous levels, however, the estuary retains a legacy of this historical contamination, particularly in sediments and biota. Other toxicants of potential concern include hydrocarbons, tributyl tin (TBT) organic contaminants and resin acids; these are associated with a variety of sources such as industries, urban run-off, slipways and contaminated landfills.

Heavy metal levels in Derwent estuary water, sediments and some seafood have been monitored for many years. Recent surveys indicate that metal levels in water have decreased significantly over the past 20 years. Metal levels in surface sediments are also starting to decline, but remain very high by national and international standards. Fortunately, the Derwent does not require maintenance dredging. Metal levels in shellfish are several times the FSANZ human health guidelines, while mercury levels in flathead are close to or slightly above the maximum recommended levels. Recent surveys also indicate that mercury levels may be elevated in other recreationally targeted fish, particularly bream. The estuary is closed to commercial and recreational shellfish harvesting, but is an important resource for recreational fishing.

During the period 2003 to 2006, the DEP conducted a major investigation into heavy metal contamination in the Derwent and developed a Water Quality Improvement Plan (WQIP) as a basis for future management. This project – supported by the Australian Government *Coastal Catchments Initiative* – involved monitoring, sediment and biological investigations, development of estuarine models, establishment of targets (Total Maximum Daily Loads) and recommended actions to further reduce metal loads to the estuary. The project also recommended better public information about seafood safety, careful management of dredging activities and additional investigations (DEP, 2006). A number of other studies have recently been initiated to investigate biological effects and pathways, and to monitor metal levels in a wider range of fish species.

During the past 5 to 10 years, a number of actions have been taken at the Risdon zinc works to reduce heavy metal loads, including improved process controls and effluent treatment, construction of a secure landfill at Loogana, and capture and treatment of contaminated groundwater and stormwater. As a result, it is estimated that metal loads have been reduced by at least 50%. Other recent actions to manage toxicants have included an upgrade of the region's largest slipway at the Domain (TasPorts, 2002), the national ban on leaded fuel (Jan, 2002), and improved management of trade wastes and stormwater (see Sections 4.4 and 4.6).

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with proposed performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Monitoring and investigations The recently-completed WQIP has greatly increased our understanding of heavy metal sources and processes in the Derwent. However, a better understanding of biological pathways and impacts is needed. A broader scan of seafood for a wider range of toxicants would also be valuable.	• Monitoring of heavy metals in water, sediments and biota (DEP/Nyrstar) • WQIP heavy metal sediment process and toxicity studies (DEP, TAW, TAFI, CSIRO) • Estuarine models & benthic surveys (CSIRO, TAFI) • Preliminary surveys of PCBs, OCPs and dioxins in sediments and biota (DEP, UQ) • Broader surveys of metals in fish; extension of biological studies (bioaccumulation, toxicity) (DEP, TAFI)	• Continue/enhance ambient monitoring • Enhance/extend estuarine models (e.g. sediment desorption curves, interactions with organics/nutrients) • Improved understanding of mercury sources, sinks and processes, including foodchain pathways • Extend/enhance monitoring of heavy metals in biota, esp in recreationally-targeted fish
Heavy metal indicators, targets & guidelines Interim water quality targets were set as part of the WQIP process. These should be reviewed/refined as new information becomes available. National guidelines for toxicants are also likely to evolve over time, and some recommended guidelines (e.g. zinc levels in oysters) may not be appropriate to Tasmania.	• New FSANZ seafood safety guidelines issued (2001) • Sediment quality guidelines under review (ANZECC) • Interim heavy metal targets and TMDLs set for Derwent as part of WQIP process	• Review/refine Derwent indicators, targets and TMDLs as further information becomes available.
Public information Although most residents in the region are aware of the heavy metal contamination of Derwent estuary shellfish, visitors may not be aware of the situation. Many residents are also uncertain about the suitability of eating fish caught in the Derwent. Given the importance of the Derwent as a recreational fishery, clear and consistent advice and a public information program is needed	• Information provided in DEP publications (Annual Report Card, State of Derwent Report) and occasional media releases. • Seafood safety brochure issued (July 2007) • DHHS precautionary health advice issued to recreational fishers on Derwent-caught fish (March 2008)	• Develop clear and consistent advice on eating seafood from the Derwent, in consultation with DHHS • Develop and implement public information program, including brochures and signage • Identify and target high risk populations as appropriate
Reduction of toxicant loads Although heavy metal loads have been significantly reduced in recent years, there is still more to do – particularly to manage contaminated groundwater at the Risdon zinc works site. In addition, toxicants from other sources (e.g. smaller industries, slipways, stormwater) need better evaluation and management.	Recent actions to reduce heavy metal loads at the Risdon zinc works site include: • Improved process controls & wastewater treatment • Rehabilitation of the Loogana landfill • Capture and treatment of contaminated groundwater and stormwater • Covering and management of stockpiles Other important actions have included improvements to the Domain slipway (TasPorts), tradewastes and stormwater (councils)	• Extend/enhance on-site works at the zinc works site to capture and treat contaminated groundwater • Improve management of slipway wastes, trade wastes and stormwater (see Sections 4.4, 4.5 and 4.6)
Manage contaminated sediments Recent investigations indicate that heavy metals in Derwent estuary sediments tend to be tightly bound and are being gradually diluted by cleaner materials. Thus, it is important to ensure that contaminated sediments are not disturbed and that the current water quality conditions are not altered to favour release of metals (e.g. through low oxygen events).	• Sediment investigations and process studies (WQIP)	• Develop and implement Derwent dredging guidelines • Manage inputs of other pollutants (e.g. nutrients and organic matter) so as to avoid conditions that could release heavy metals from sediments.
Contaminated sites There are about a dozen historical tips and former industrial sites located around the margins of the Derwent estuary. There is currently very little information about the level of contamination at these sites and if there are significant discharges to the Derwent.	• Site investigations at several old tips and contaminated sites (e.g. Wentworth Park, Hobart railyards, etc)	• Identify high priority sites for further investigation and assess high risk sites.

Objectives for Managing and Reducing Toxicants (2025)

- Reduction of zinc from Risdon zincworks site (Nyrstar Hobart) by an additional 50 to 100 tpa
- Zinc concentrations in water meet WQIP target of 15ug/L
- Measurable reduction in heavy metal levels in sediments and shellfish, and shellfish in some areas of Derwent meet National Food Standards
- Public has good access to seafood safety information via pamphlets, signage and other media
- Dredging guidelines completed and being used
- Continue/enhance monitoring, modeling and investigations and review/revise indicators and targets.

Strategies and Proposed Actions– next five years

1. Reduce metal discharges from the Nyrstar Hobart smelter site, particularly from groundwater sources (see Section 4.5)

- Stormwater capture project (2007/8)
- Groundwater extraction project (2008/9) and extension of groundwater recovery system (longer term)
- Manage residual leaks and spills (e.g. cell room)

2. Improve public information and awareness of seafood safety

- Regularly update/distribute seafood safety brochure
- Install signage at main fishing and boating areas
- Regular media releases and reports

3. Develop and implement Derwent dredging guidelines to limit disturbance of contaminated sediments

4. Maintain and enhance toxicant monitoring and investigations, including:

- Biological surveys (monitor heavy metal levels in wider range of seafood; investigate food chain pathways)
- Modeling and implications of nutrient and organic matter enrichment
- Better understanding of mercury sources, sinks and processes

5. Identify and investigate historical contaminated sites

- Review and update information about tips and contaminated sites for the 2008/9 State of the Derwent report;
- Seek opportunities to investigate high priority sites

See also Sections on managing industries (4.5), stormwater (4.6) and boat wastes (4.7) for other related actions.

Performance Indicators and Targets

- Annual zinc loads and % reduction/trends
- Zinc concentrations in water and oysters; lead levels in mussels
- Public information and signage (e.g. % of target sites with signage)

4.3 Preventing Eutrophication

Eutrophication of aquatic systems occurs when inputs of nutrients and organic matter increase over time, resulting in 'blooms' of nuisance and toxic algal species, nuisance weed growth, loss of seagrass beds, low dissolved oxygen levels, fish kills and odours. Estuarine eutrophication is a severe problem affecting many major cities around Australia and is very difficult to manage once established. Prevention is a key management goal for the Derwent.

Nutrients

Nitrogen is considered to be the primary nutrient that drives plant growth in most marine and estuarine system, although phosphorus may be an important influence in the upper/fresher reaches. The effects of current nutrient loads on the estuary are not clearly understood. A detailed study in 1993/94 demonstrated that the Derwent does experience elevated nutrient levels, particularly in the middle reaches of the estuary and at depth, where the majority of sewage outfalls are located (Coughanowr, 1995). This study and subsequent work also showed that the estuary experiences strong natural variations in nutrient levels, with high nutrient levels entering the estuary from both the ocean and upper catchment during winter months (Coughanowr, 2001). The Derwent does not experience recurrent nuisance phytoplankton blooms, and may not be very susceptible to these blooms due to the estuary's rapid flushing rate. Wetlands, seagrasses, macroalgae and microscopic sediment algae probably play a more important role in terms of primary production, and some of these species (particularly seagrasses) are sensitive to nutrient enrichment. Significant losses of seagrasses – particularly in Ralphs Bay – have been indicated in the past (Rees, 1993).

Sewage treatment plants are the major source of nutrients to the Derwent, contributing over 90% of the current load to the estuary, with the remainder sourced from industry and urban runoff. Since 2001 nutrient loads from sewage treatment plants have remained relatively steady – despite regional population growth - as a result of improved treatment and effluent reuse.

Organic Matter

Large inputs of organic matter may stimulate bacterial production, resulting in low dissolved oxygen levels as the carbon is consumed. Organic matter also has a strong affinity for metals, hydrocarbons, pesticides, and many other contaminants, and may scavenge these substances from the water column, transferring them through the food chain or sequestering them in sediments. At higher loading rates, organic matter may accumulate as organic-enriched sediments, characterised by low oxygen levels and impoverished benthic fauna and flora. In extreme cases, organic matter may accumulate as sludge deposits, accompanied by anoxia, death of benthic organisms and production of unpleasant/toxic gases such as methane and hydrogen sulphide.

Historically, the Boyer paper mill has been the major source of organic matter to the Derwent contributing over 90% of the anthropogenic Biochemical Oxygen Demand (BOD) load, with the remainder sourced from sewage treatment plants and urban runoff. In October 2007, Norske Skog commissioned a secondary treatment system at the plant that has reduced the BOD load by over 80% in 2008 and will reduce loads by over 95% in the longer term.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with proposed performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Monitoring and investigations Nutrient and chlorophyll a concentrations have been extensively monitored in Derwent estuary waters for over a decade. However, more work is needed to understand how nutrients are processed within the estuary and the potential effects of increasing loads. With the implementation of the Norske Skog secondary treatment plant in 2007, there will also be an excellent opportunity to monitor how the system responds to a major reduction in organic loads.	• Monitoring of nutrients, organic carbon and chlorophyll a in water (DEP/NSB, on-going) • Boyer mill Ecological Risk Assessment (upper estuary only, 2000) • ARC-Linkage grant funded to investigate nutrient cycling (2007 – 2011, TAFI/DEP/NSB)	• Continue/enhance ambient monitoring • Complete ARC-Linkage investigations of nutrient cycling in the Derwent, including the role of sediments.
Sustainable nutrient loads Derwent-specific nutrient indicators and targets are needed to underpin a Decision Support System, providing a basis for science-based decision-making about major infrastructure projects, such as sewage treatment. Until then, as a precautionary approach, current loads should remain steady or be reduced.	• Calibrated hydrodynamic model completed as part of CCI WQIP (DEP/CSIRO, 2005) • Biogeochemical model for full estuary under development (DEP/CSIRO, 2008) • Reduction in nutrients through effluent reuse at Brighton, Bridgewater and Rosny and tertiary treatment at Selfs Point and Rokeby	• Develop Derwent-specific indicators and targets for nutrients and organic matter • Complete estuarine decision-support models and link these to catchment and channel models • Manage nutrient loads from STPs and industries (maintain/ or reduce)
Nuisance algal blooms and seagrass loss Excessive nutrients have caused severe nuisance algal blooms and loss of seagrass beds in many urban estuaries. Given the recent outbreaks of toxic algal blooms in the Derwent catchment, it is important that we take this issue seriously, with a view towards prevention. The Derwent seagrass beds are also an essential habitat for many species and require careful management.	• Increased monitoring and management of upper catchment blue-green algal blooms; • Baseline survey of seagrass beds (TAFI, 2001) ; resurvey completed in 2007 • Derwent habitat atlas under development (DEP, 2008)	• Continue/enhance seagrass and other habitat monitoring
Low dissolved oxygen Dissolved oxygen (DO) levels in the upper estuary are frequently depressed, particularly at depth and during summer months. This is partially due to natural conditions and partially the result of organic loads from the paper mill at Boyer. Low DO levels are stressful to many aquatic species (particularly bottom dwellers) and may also cause the release of sediment-bound metals and nutrients.	Improved industrial treatment: • > 80% reduction in BOD load from Boyer paper mill (starting in 2007)	• Monitor estuarine changes in response to Stage 1 reduced BOD loads from the Boyer paper mill; • Implement full secondary treatment at the Boyer paper mill
Catchment and Channel sources Although urban sources have contributed the majority of pollutants to the estuary in the past, it is important that we do not overlook the potential role of the catchment and the nearby Channel, particularly as land uses evolve over time.	• Monitoring of Derwent River and tributaries (2001) • Aquafin CRC study of aquaculture in the D'Entrecasteaux Channel (2008) • Various catchment and river management initiatives (Hobart Water, Hydro, Greening Australia and other stakeholders)	• Improved monitoring/understanding of catchment and channel land use activities, river flows/currents and nutrient loads • Develop linked models and DSS to link catchment, estuary and channel • Support/facilitate catchment management activities, particularly below Meadowbank.

Objectives for Preventing Eutrophication (2025)

- Develop Derwent-specific nutrient indicators, targets and decision-support tools
- Continue/enhance monitoring, modeling and investigations
- Reduce organic loads from Boyer mill by 7000 tonnes/yr compared to levels prior to commencement of secondary effluent treatment
- Maintain/reduce cumulative nutrient loads from sewage treatment plants and industries
- Maintain/improve summer DO levels
- Maintain/increase area and health of seagrass beds
- Prevent nuisance algal blooms

Strategies and Proposed Actions– next five years

1. Reduce organic carbon discharges from the Norske Skog paper mill through secondary treatment.

2. Reduce nutrient discharges from regional sewage treatment plants through effluent reuse, tertiary treatment and/or improved process controls.

3. Improve monitoring and investigations, including:

- Quantify and evaluate other nutrient sources, including catchment, Channel and other urban/industrial sources
- Investigate internal cycling/interaction of nutrients and carbon, including role of sediments
- Investigate interactions between nutrients, carbon and heavy metals

4. Develop Derwent-specific indicators, targets and predictive models. Develop linked estuary, catchment and Channel models and decision support tools.

See also Sections on managing sewage (4.4), stormwater (4.6) and boat wastes (4.7) for other related actions.

Performance Indicators and Targets

- Nutrient and organic carbon loads and trends
- Summer dissolved oxygen levels at depth
- Chlorophll a levels
- Seagrass area and condition (max depth?)

4.4 Managing Sewage Discharges

In many urban areas, sewage is a major source of nutrients to aquatic systems, and may also contribute pathogens (as indicated by faecal indicator bacteria) and toxicants. Nutrient enrichment may trigger algal blooms, seagrass die-off and other ecosystem changes, while pathogens represent a risk to human health. Toxicants in sewage are typically related to trade wastes and household chemical wastes. In Tasmania, most sewage treatment plants are currently managed by councils and are regulated by the Environment Protection Agency (EPA), under the provisions of the *Environmental Management and Pollution Control Act 1994*. The *State Policy on Water Quality Management 1997* also includes a number of relevant provisions, including the setting of new Emission Limit Guidelines for sewage treatment plants, minimisation of overflows and adoption of trade waste policies. In July 2009, management of water and sewerage will be taken on by three regional authorities.

There are currently ten sewage treatment plants that discharge treated effluent directly to the Derwent estuary. Eight of these plants operate at secondary treatment level (removal of solids and organic matter) and two operate at tertiary level (removal of solids, organic matter and nutrients). Wastewater from the two plants in Brighton has been reused since 1999 and no longer discharges to the estuary. Three plants treat combined domestic/industrial wastewater; the remaining seven plants treat domestic wastewater only. All effluent is disinfected prior to discharge. Other sources of sewage discharges to the Derwent estuary include septic tanks, boat wastes and cross-connections to stormwater systems.

Sewage treatment plants currently discharge over 90% of the nutrients and over 10% of the faecal bacteria load to the estuary. During periods of heavy rainfall, some areas of the regional sewerage system may be subject to large influxes of stormwater and become overloaded. This may cause pump failures, overflows and poor plant performance, resulting in intermittent discharges of poorly-treated or untreated sewage. Other key issues include management of trade wastes, design and management of septic systems and greater consistency in monitoring. In managing sewage discharges, it is important that a regional approach be taken that integrates water supply and demand with sewage (and stormwater) treatment and disposal. There may also be opportunities to expand effluent reuse schemes, particularly in the Derwent Valley, Brighton and Clarence.

There have been a number of upgrades in infrastructure and treatment technology during the past ten years, together with several effluent reuse schemes. These improvements have reduced sewage-derived contaminants discharged to the estuary. However, sewage loads are likely to grow in parallel with regional population growth, and short-term nutrient increases are also anticipated associated with secondary treatment at Norske Skog.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with proposed performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Regional strategy and science-based management A regional long-term strategy is needed that sets Derwent-specific nutrient targets and a process whereby these targets can be achieved or maintained. Ideally, this sewage management strategy should be part of a broader regional strategy that also addresses water supply and stormwater.	• System-wide nutrient modeling (CSIRO) and investigations (TAFI) underway • State government water and sewerage infrastructure review and new regional management structure (2009) • Regional infrastructure and strategy review (STC/Hobart Water)	• Complete nutrient models and decision support tools, and use these to set targets for sustainable loads (see Section 4.3) • Encourage/support regional 'integrated water management cycle' planning (water supply/demand, sewage treatment, stormwater management)
Monitoring and reporting Existing plant monitoring programs could be better rationalized to ensure they are consistent and appropriate (e.g. all plants monitor the same basic parameters, with additional parameters monitored at larger plants, particularly those that receive industrial wastes). More information is also needed to document flows and effluent quality during extreme rain events.	• Monitoring is carried out by all treatment plans as regulatory requirement • Annual review and reporting of treatment plant data is included in DEP Report Cards	Review current monitoring requirements for all sewage treatment plants (STPs) and propose revisions
No net increase in nutrient loads Until regional nutrient targets are set, cumulative nutrient loads should not be significantly increased. Given the population growth, some improvements in treatment processes may be needed to achieve this (e.g. advanced treatment, effluent reuse or optimization of current treatment processes).	• Tertiary treatment implemented at Selfs Point (1997) and Rokeby (1999) • New treatment plant proposed at Blackmans Bay (next 5 to 10 years) • Effluent reuse schemes completed at Brighton/Bridgewater (1999) and Rosny (2006)	Monitor and manage nutrient loads from STPs to avoid net increases, particularly from larger plants discharging to the middle and upper estuary (e.g. MacQuarie Point, Prince of Wales Bay, Cameron Bay, Turiff Lodge)
Sewage spills and leaks Sewage leaks and spills from aged or overloaded infrastructure cause periodic contamination of rivulets and beaches. Pressure on this infrastructure is increased during heavy rains, when large volumes of stormwater enter the system.	• Various major and minor works have been carried out by individual councils (e.g. new trunk lines and pump stations; smoke/dye testing)	Continue/expand efforts to prevent leaks and spills, with a focus on swimming areas with known water quality issues (e.g. Nutgrove, Howrah, Kingston).
Maintain/enhance effluent reuse Effluent reuse schemes can provide multiple environmental and economic benefits, including reduction of pollutant loads to the estuary. Several councils have implemented reuse schemes, including the Brighton, Clarence and Hobart councils. A regional approach would be particularly effective, due to differences in land use, climate and topography.	• Major reuse schemes implemented at Brighton, Bridgewater and Rosny • Minor reuse projects in Hobart City • Federal funding approved to extend Clarence reuse scheme ($10.5 million)	Seek opportunities to extend regional reuse schemes, particularly on the Eastern Shore and Derwent Valley
Trade waste management Treatment problems can result from poor quality industrial effluent discharged to regional sewage treatment plants. Trade wastes may also contain excessive levels of toxicants that require pretreatment or other management approaches.	See Section 4.5	See Section 4.5
On-site septic systems Although on-site septic systems are not widely used in the Hobart metropolitan area, these are prevalent in some areas, and may cause localized water quality issues.	• Survey of on-site systems in Honeywell catchment (Brighton) • Trial of alternative system designs (Brighton)	Support/facilitate regional system to improve design and performance of on-site systems (e.g. setbacks, design, maintenance)

Objectives for Managing Sewage Discharges (2025)

- Reduce or no net increase in nutrient loads, until sustainable loads/targets have been set
- Reduce number and volume of sewage spills
- Increase volume of sewage effluent reused
- Comprehensive/consistent monitoring of sewage treatment plants
- Develop regional integrated water management strategies to better integrate water supply, wastewater treatment and stormwater management

Strategies and Proposed Actions – next five years

1. Reduce or maintain nutrient discharges from regional sewage treatment plants through improved process controls, effluent reuse and/or tertiary treatment.

Optimise treatment at existing plants to minimise pathogen, nutrient and toxicant loads. Use science-based decision support models to establish sustainable nutrient loads and to set targets for more advanced treatment (including nutrient removal) within a regional context, taking into account naturally high, seasonal levels of nutrients.

2. Reduce sewage overflows to the Derwent by removing stormwater connections and upgrading infrastructure

Prepare regional maps of sewerage infrastructure showing major pipes, pump stations and overflow points. Monitor/analyse flows and rainfall data to identify areas with significant inflow and infiltration problems. Identify highest risk areas and prioritise actions accordingly. Continue to develop and implement regional and council-specific strategies to reduce sewage overflows to the Derwent, e.g.:

- infiltration/inflow and source control programs to reduce stormwater volumes;
- upgrades to problem pump stations and overflow points;
- repair/replacement of substandard infrastructure.

3. Investigate and promote opportunities for regional sewage effluent reuse

Investigate and pursue options to further develop effluent reuse in the region, including through national funding programs (e.g. National Water Initiative).

4. Improve treatment of trade wastes through industry audits, trade waste agreements, education, monitoring and review

Develop a regional system to audit and manage trade wastes more efficiently (e.g. focus on categories such as car repair, restaurants, laundries, hospitals, etc.).

5. Improve monitoring at sewage treatment plants

Review and refine current monitoring of sewage treatment plants and infrastructure to better assess performance and estimate pollutant loads. Incorporate event monitoring.

6. Seek opportunities to develop regional integrated water management strategies

See also Sections on managing industries (4.5), stormwater (4.6) and boat wastes (4.7) for other related actions.

Performance Indicators and Targets

- Annual loads of faecal indicator bacteria, nutrients, toxicants;
- Number of overflow incidents/year or volume of untreated sewage discharged;
- Volume of effluent reused; number of audits or upgrades undertaken.

4.5 Managing Industrial Discharges

There is a long history of industrial development around the Derwent estuary and until the 1980s effluent from most premises was typically discharged with limited treatment. At present, there are approximately 30 EPA-regulated (Level 2) industrial premises situated within the program area, as well as hundreds of smaller (Level 1) commercial and industrial operations that fall within council jurisdiction. These industries are regulated through the provisions of EMPCA.

Most industrial premises discharge their liquid trade wastes (some pre-treated) to sewer, and these wastes are treated in the region's sewage treatment plants. Two major industries – the Nyrstar Hobart smelter and Norske Skog paper mill - discharge treated wastewater directly to the Derwent estuary. In addition to liquid effluent, industrial contaminants enter the Derwent via a number of other pathways, including air emissions, stormwater run-off, groundwater seepage and spills. Industry-derived contaminants of particular concern include toxicants, organic matter and suspended solids.

Norske Skog Paper (at Boyer) is Australia's largest manufacturer of newsprint, and utilises significant amounts of fresh water in processing. Until recently, wastewater was treated to primary level (removal of solids and some resin acids and organic matter) prior to discharge. This effluent contained large amounts of organic matter (approximately 95% of the total anthropogenic biochemical oxygen demand load) and resin acids. In 2006 modifications to the bleach plant resulted in reductions in chemical and water usage, and in late 2007, the mill commissioned a secondary treatment plant that will reduce organic loads by over 80% in the short-term, and by >95% in the longer term.

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Nyrstar Hobart smelter (at Risdon) is Australia's largest zinc smelter. The smelter's liquid effluent – as well as some contaminated groundwater and stormwater – is treated in the wastewater treatment plant prior to discharge to the Derwent. Major improvements recently implemented at the site, include covering of stockpiles, rehabilitation of the Loogana area, and capture and treatment of contaminated stormwater and groundwater. These have reduced heavy metal loads by over 50%, however, the site still accounts for the majority of heavy metals currently discharged to the estuary. Additional site works are planned in 2008 to further reduce groundwater discharges, with a longer-term objective of full capture and treatment.

While considerable progress has been made in reducing impacts from the major industries described above, further work is needed to evaluate and improve site practices at second and third tier industries. Recent reviews of EMPCA have provided some clarifications and some additional information on emissions has been made available as part of the National Pollutant Inventory. The State Government's Living Environment Program's CleanBiz initiative has also provided some new resources to support improvements at smaller-scale industries.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with proposed performance indicators.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Monitoring Mass emissions from industries are difficult to estimate from existing monitoring data, particularly from smaller industries. Monitoring requirements vary considerably between premises, and industries do not typically report cumulative loads discharged via all major pathways (e.g. liquid emissions, air, groundwater, stormwater).	• Most level 2 premises are required to monitor and report on emissions and part of permit conditions • National pollutant inventory requires reporting for some compounds	• Review/rationalise industrial monitoring programs, including reporting of mass emissions/annual loads
Reduction in pollution loads from major industries ***Nyrstar Hobart smelter*** The smelter is the main source of heavy metals and arsenic to the Derwent, discharged primarily by way of groundwater and stormwater emissions. Major reductions have been achieved in recent years and further work is planned. ***Norske Skog Paper*** The paper mill has historically been the main source of organic matter and resin acids to the Derwent. A new secondary treatment plant was commissioned in late 2007 that has reduced these emissions by over 80%.	Nyrstar • Landfill rehabilitation (Loogana) • Stockpiles covered and managed • Capture and treatment of stormwater and groundwater • Improvements to unloading operations Norske Skog • Improved process controls to reduce TSS and resin acids • Bleach plant upgrade (2006) • Secondary treatment plant (2007)	• Nyrstar: further reductions in heavy metals loads through ground-water management • Norske Skog: further reductions in BOD loads as secondary treatment is fully implemented • Investigate opportunities to improve water efficiency and reuse effluent, where practical
Management of second and third tier premises The State government regulates approximately 30 premises in the DEP area. While wastewater from these sites is typically treated at council wastewater treatment plants, other site practices may impact on the Derwent (e.g. stormwater, spills, foreshore fill). Councils are responsible for managing hundreds of small industries and businesses in the region. This has been difficult to achieve – particularly for older premises - due lack of resources, expertise and guidelines for assessing specific industry types. There are several major industries (e.g. Incat), fuel storage facilities (e.g. Selfs Point) and industry categories (e.g. marinas, boatyards, commercial ports) that are currently regulated at the council level or for which regulatory responsibilities are unclear.	• Glenorchy – comprehensive trade waste management system • Hobart – trade waste agreements with larger premises • DEPHA/Environment Division – Clean Biz initiative to support improved management of smaller-scale industries	• Evaluate potential impacts of second and third tier industries, and identify opportunities for improved management • Promote the DEP to key industries, encourage participation and seek funding opportunities to support improved management • Develop system/guidelines to assist councils in managing level 1 industries

Objectives for Managing Industrial Discharges (2025)

- Evaluate existing loads and effects of industrial discharges on the Derwent estuary;
- Reduce industry-derived pollutants (particularly toxicants and organic matter);
- Encourage reduction, recycling and reuse of industrial wastes
- Improve management of second and third tier industries

Strategies and Proposed Actions – next five years

1. Improve existing monitoring and reporting of industrial discharges to better assess pollutant loads, performance and ecosystem effects

Review and refine current monitoring of major industries to better assess performance and estimate pollutant loads. Estimate annual mass emissions from all industrial point and diffuse sources. Report annually on cumulative industrial discharges/pollutant loads to the Derwent.

3. Encourage/facilitate continued environmental improvements at Norske Skog, Nyrstar and other major industries.

Review and provide feedback on major studies, Environmental Management Plans (EMPs) and EMP reviews. Encourage and publicise further reductions in industrial discharges. Investigate/facilitate options for effluent recycling and reuse and funding opportunities to assist industries in reducing contaminant loads. Identify major industries that do not yet have EMPs and encourage/facilitate preparation of these plans.

4. Support/facilitate strategic program to coordinate and improve the overall management of smaller scale industrial and commercial premises

Prepare regional inventory and map smaller scale industrial and commercial premises; identify high priority business types/premises. Investigate regional funding mechanisms that would assist councils to progressively audit and manage Level 1 and other premises. Encourage/facilitate preparation of Codes of Practice (COPs), guidelines and educational information for high priority categories. (See discussion on trade waste management under Sewage (Section 4.4)

Possible Performance Indicators

- Annual loads of heavy metals and organic matter;
- Number of sites with trade waste audits, agreements, monitoring, infrastructure or performance improvements;
- Volume of effluent recycled or reused.

4.6 Managing Stormwater Runoff

Stormwater runoff is the water from rain that flows across the land, carrying with it litter, vegetative debris, loose soil and a range of pollutants that have been deposited on the land surface, including pathogens, nutrients, hydrocarbons, heavy metals and pesticides. These pollutants can significantly degrade water quality and aquatic habitat, and stormwater may also result in downstream flooding and erosion. Tasmania's *State Policy on Water Quality Management 1997* has identified stormwater as a significant management issue and a State Stormwater Strategy is currently being developed. Stormwater is largely managed by councils.

The Derwent estuary receives stormwater from 57 urban and suburban catchments by way of 13 major rivulets and over 270 outlet pipes. The quality of stormwater discharged from these points is strongly linked to catchment land uses and the condition of rivulet banks and riparian strips. Construction sites, roads, industrial sites, commercial areas and eroding stream banks are major contributors to stormwater pollution. In addition, there are some occasional cross-connections between the stormwater and sewerage systems that contribute to pollution levels.

Stormwater-derived pollutants of particular concern to the Derwent estuary include litter, pathogens (as indicated by faecal indicator bacteria) and silt. In localised areas, oils, heavy metals and nutrients are also a concern. It is estimated that urban runoff delivers approximately 90% of the total faecal coliform load to the Derwent and about half of the suspended sediment load. Pathogens associated with faecal matter represent a risk to human health, while high silt loads reduce light availability and smother bottom-dwelling fauna.

A number of stormwater management projects have recently been initiated or completed by the councils that border on the Derwent estuary, many with support from Australian Government grants. These projects make use of a range of technologies, including gross pollutant traps, constructed wetlands and biofiltration systems, stormwater reuse, education programs and catchment management. The DEP completed a model stormwater management plan focusing on New Town Rivulet that provides a template for similar plans in other urban catchments.

Given the large number of catchments and stormwater outfalls that drain to the Derwent and the high cost of stormwater treatment, it is clearly not possible to treat all stormwater discharges. A regional strategy is needed to minimise stormwater run-off from new developments, using the principles of Water Sensitive Urban Design (WSUD). Management of sediment run-off from construction sites is also a high priority. To support this, the DEP has recently completed WSUD guidelines and engineering specifications for Southern Tasmania, and is developing regional sediment and erosion control guidelines (NRM South funded projects).

Management of existing stormwater discharges will require careful prioritization on the basis of land use, rainfall, topography and receiving water sensitivity. In addition, the potential for beneficial reuse of stormwater within urban catchments should to be further explored.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with proposed performance indicators.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Stormwater monitoring and modelling In recent years, the DEP has coordinated a regional rivulet and stormwater monitoring program. This data indicates that water quality in urban streams and stormwater drains is generally poor, however, further work is needed to quantify pollutant loads associated with storm events. Catchment-based stormwater models are needed to estimate stormwater loads from specific catchments, and to prioritise management efforts accordingly.	• Regional rivulet stormwater monitoring program carried out by DEP, councils and Waterwatch groups • Stormwater catchment map prepared by DEP and initial prioritisation completed on the basis of urban land use analysis • Stormwater loads from catchments modeled using MUSIC software	• Recommence reginal stormwater monitoring, including event monitoring and stream gauging to better quantify loads • Review/revise priority stormwater catchments based on latest information and modelling • Carry out stormwater surveys in areas with beaches and recreational use
Regional planning and management tools A number of planning and management tools are being developed through the DEP and associated LEP program to support stormwater management. These include: • Stormwater management plans for priority catchments • WSUD guidelines, promotion and implementation • System to control erosion on construction sites • Financial instruments to fund stormwater management To be successful, these tools will need to be integrated within council and state planning frameworks.	• Stormwater management plan(SWMP) completed for New Town Rivulet (DEP) • Management plans completed for several urban rivulets (HCC, others?) • State Stormwater Strategy under development	• Continue implementation of New Town Rivulet SWMP • Prepare Stormwater management plans for other high priority catchments
Managing runoff from new developments Integration of stormwater runoff management into both construction and finished stages of new subdivisions and other major developments is essential to minimise future problems.	• Technical WSUD guidelines completed for southern Tasmania (2006) • WSUD and new guidelines promoted at forum and workshops • Regional Sediment and Erosion Control guidelines under development (DEP/NRM South) (2008)	• Promote WSUD in Derwent area • Facilitate/implement WSUD demonstration projects • Implement/extend outcomes of Sediment and Erosion Control project, including enforcement and training systems
Retrofitting existing problems A strategic regional approach is needed to address existing stormwater runoff. Considerations should include: • High priority catchments, i.e. those that generate the greatest loads • Sensitivity of receiving waters, i.e. swimming and recreational areas • Land uses/practices that generate significant loads • Treatment train – start at the source Demonstration projects can serve a valuable role in promoting new approaches to the community.	Demonstration projects have been constructed at a number of sites, including: • Stormwater wetlands at Kingston and Lauderdale • Biofiltration systems/rain gardens at Cornelian Bay and Botanical Gardens Councils, schools and community groups have received funding for over 30 projects under the National Water Initiative Community Water Grants program (2006 to 2008)	• Seek opportunities to retrofit stormwater management systems where practical • Facilitate/support funding applications • Focus on swimming beaches and recreational sites • Focus on other key land uses/practices, such as commercial/industrial areas and unsealed roads
Urban streams and riparian zones Urban streams present both risks and opportunities for stormwater management. Eroding banks and beds can deliver enormous sediment loads to receiving waters, however, well-managed riparian zones can provide multiple benefits, such as living filters, green links and community walking tracks.	Many urban rivulets are a focus for community and council activities, including New Town, Hobart, Sandy Bay, Browns and Kangaroo Bay.	• Provide technical advice and training to council and community work crews • Facilitate/support funding applications

Objectives for Managing Stormwater Run-off (2025)

- Monitor and understand effects of urban runoff on the Derwent estuary.
- Reduce existing stormwater volumes and pollutant loads, taking strategic and practical approach
- Design and manage new development to minimise additional stormwater run-off, through Water Sensitive Urban Design

Proposed Strategies and Actions – next five years

1. Improve existing monitoring and prioritise catchments using stormwater models

Fine-tune regional stormwater monitoring program to better estimate stormwater pollutant loads, ecosystem impacts and effectiveness of management practices. Review/refine priority catchments using stormwater modeling software.

2. Promote and implement Water Sensitive Urban Design in new developments

Promote regional WSUD guidelines to councils and developers and provide technical assistance/review as needed. Seek opportunities to implement ten high profile WSUD demonstration projects.

3. Prepare and implement stormwater management plans for high priority catchments, including those discharging to swimming beaches

Implement the New Town Rivulet stormwater management plan and prepare additional plans for other high priority catchments such as those associated with major swimming beaches. Seek to remove/redirect stormwater discharges at major beaches.

4. Target land uses and land use practices that generate significant stormwater flows and pollutant loads and develop/implement source control strategies. These may include:

- construction sites (adopt/implement regional sediment and erosion control guidelines);
- stormwater management guidelines for major sealed roads and for unsealed roads;
- stormwater assessments/audits of industrial and commercial sites;
- fertiliser management at golf courses and other recreational areas;

5. Manage urban streams and riparian zones to prevent bed and bank erosion, improve filtration and enhance community access

6. Educate and inform businesses, contractors and the community about how their actions can reduce stormwater impacts and about the potential risks of stormwater pollution

Possible Performance Indicators

- Number of stormwater catchment management plans and/or area actively managed;
- Proportion of new developments that use WSUD
- Stormwater pollutant loads discharged to Derwent (e.g. tons/yr of litter, silt, nutrients, etc.);
- Volume of stormwater reused

4.7 Managing Boat Wastes

Wastes associated with shipping and boating activities include sewage, bilge water, ballast water, slipway generated wastes, oil leaks and spills, solid wastes and litter, and leaching of anti-fouling paints containing tributyl tin (TBT) and other biocides. Currently there are limited bilge water, ballast water or sewage reception facilities in Tasmanian ports and many of the other facilities that exist in boat harbours and marinas are in need of upgrading. The absence of adequate waste management facilities contributes to discharges of untreated or poorly treated wastes containing a range of contaminants and further potential introductions of marine pests (see Section 5.3 Introduced Species).

The Port of Hobart is the fourth busiest port in Tasmania. In 2006/7, the Port was visited by about 250 large ships, including 54 cruise ships. (TasPorts, 2007) The Derwent is also the home port for an estimated 50 fishing vessels, and supports many visiting fishing vessels as well. The Derwent estuary and nearby coastal waters are an important centre for recreational boating, with over 20,000 recreational vessels registered in southern Tasmania. The Sydney-to-Hobart Yacht Race routinely brings about 100 racing yachts to the waterfront each summer. The Derwent also has approximately 7 marinas, 10 boatyards and 1400 moorings. (Note: issues associated with ship-building industries are covered in Section 4.6 Managing Industries)

Management roles and responsibilities for boat wastes tend to be fragmented between a range of organisations at the Local, State and Commonwealth levels. Roles and responsibilities can be unclear, and resources are often lacking for planning and implementation. In some cases, adequate legislation, regulations and/or guidelines are also lacking. In March 2008, the Environment Division released draft guidelines for boat repair and maintenance facilities. The timeline for implementation of these guidelines has not yet been finalized, in part due to difficulties encountered in the disposal of slipway wastes.

Several operators have made good progress in managing boat wastes. In 2002, the TasPorts Domain slipways were upgraded to capture and treat slipway wastes – this is one of the largest slipways in Tasmania, and the first to implement Best Practice Environmental Management. TasPorts also installed the Derwent's only sewage pump-out facility at Kings Pier in 2003.The Cleanlift facility at Prince of Wales Bay also captures and treats slipway wastes.

The major issues, recent actions and recommendations identified during the review process are presented in the following table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with possible performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Sewage and bilgewater discharges Untreated sewage discharged from boats may result in health risks and nutrient enrichment, particularly in heavily used areas. Although current legislation discourages sewage discharges from boats, it is not prohibited outright. There is one sewage pump-out facility in the Derwent (Kings Pier Marina), however this has rarely been used. Bilgewater is the liquid that accumulates in a ship's bilges and often contains spilled oil, diesel, detergents and other contaminants. Discharges of oily bilgewater from large vessels is regulated; ships must have oil/water separators and the treated liquid cannot be discharged near the coast. However, regulations for discharges from smaller boats are unclear. Current sewage and bilgewater management practices are not documented nor have water quality impacts been monitored.	• Sewage pumpout facility installed at Kings Pier Marina by TasPorts (NHT funding, 2003). • Oily wastewater from commercial vessels is collected on an as needs basis by contractors (e.g. Collex)	• Investigate current practices for disposal of sewage and bilgewater • Review current practices for greywater discharges from large vessels (e.g. cruise ships) • Review /amend legislation regarding discharges from boats as part of State Water Quality Policy review process • Focus on larger/heavily used vessels first
Oil leaks and spills Oil leaks and spills from boats are often reported within the Derwent. Responsibility for the management and clean-up of larger spills is shared by the Commonwealth Government (AMSA), State Government and oil/shipping industries. An oil spill contingency plan has been developed for the Port of Hobart and emergency response exercises are regularly carried out.	• Oil spill response plans were updated in 2003 (State) and 2005 (Port of Hobart); pollution response plan prepared by TasPorts in 2007 • In Oct 2004 Tier 1 oil spill exercise was held in Hobart to practice equipment deployment • Tasmania hosted the biennial National Oil Spill Response Exercise in Sept 2006 (Devonport)	• Review oil spill response plans and reported oil spills and identify opportunities to reduce risks
Slipway wastes During maintenance, most boats are hauled out of the water at boatyards and slipways and hulls are cleaned, sanded and painted on land; some vessels are also worked on (above the waterline) in the water. Resulting wastes contain pollutants, including toxic antifouling paints and exotic marine organisms. Derwent slipway operations include Incat, the Domain slipway, and a number of boatyards, marinas and yacht clubs. Only a few of these premises have interception trenches or other facilities to collect slipway generated wastes. While draft slipway guidelines have been prepared by the State government, there is currently no regulatory framework in place to enforce these.	• Domain Slipway improvements completed by TasPorts (NHT funding, 2002) • CleanLift slipway also collects /manages wastes • Draft slipway management guidelines issued in 2003 (Environment Division); revised and reissued in 2008 • Assessment of slipway waste disposal options completed, including stablisation trials (Environment Division) • Survey of sediment contamination near slipways carried out (Env Division, 2006/7)	• Encourage/facilitate finalisation and implementation of slipway management guidelines; seek funding for high priority projects • Review current slipway management practices, particularly at larger slipways and marinas (e.g. Incat, DSS, Bellerive YC). • Review current practices and guidlines for in-water maintenance
Lack of information and awareness In managing boat wastes, industry and community attitudes and actions are particularly important, as poor practices tend to be very difficult to monitor and enforce.	• TasPorts environmental review completed in 2007 • TasPorts environmental management system to be prepared/implemented in 2008/9	• Develop Derwent recreational boating guide/map with practical information about facilities, environmental practices and contacts for further information. (combine with recreational fishing guide)

Objectives for Managing Boat Wastes (2025)

- Understand current practices and environmental effects of boat wastes on the Derwent estuary;
- Reduce discharges of boat wastes to the Derwent;
- Improve community awareness and practices.

Proposed Strategies and Actions – next five years

1. Encourage/facilitate coordinated approach to management of boat wastes

Participate in state/regional initiatives to develop coordinated strategies for boat waste management.

2. Investigate current practices and impacts of boat wastes on Derwent and identify action priorities

Monitoring

Monitor effects of boats wastes at key sites in the Derwent (e.g. sewage indicators, TBTs, hydrocarbons).

Survey recreational and commercial vessels

Survey boat owners (e.g. through MAST registration mailout) to document characteristics of Derwent fleet, current practices, waste reception needs and preferences. Identify and progress action priorities.

Survey shore-based facilities

Consult with shipbuilders, boatyards, marinas and slipways to document existing facilities/services provided and current practices. Identify and progress action priorities.

3. Encourage/facilitate development and adoption of best management practices and provision of facilities for vessels and shore-based premises

- Support preparation of guidelines/COPs for slipway generated wastes, sewage, ballast water and other high priority management issues;
- Support implementation of guidelines, audits and Environmental Management Plans for high priority premises (e.g. ports, major slipways, boatyards and marinas);
- Support construction of marine waste reception facilities at key locations (e.g. improvements to major slipways, provision of sewage holding tanks and pump-out facilities).

4. Raise awareness among boaters and marina/boatyard operators about potential impacts, responsibilities and waste management options and facilities

Provide information to raise awareness about marine waste issues and facilities through preparation of Derwent Estuary Recreational Boaters map.

Performance Indicators/Benchmarks

- Volume sewage/wastes collected/treated;
- Number/percentage of slipways/marinas with Best Practice management (e.g. interception trenches) installed.

5. ENHANCING AND CONSERVING NATURAL SYSTEMS

The natural character and human values of the Derwent are ultimately underpinned by the condition of estuarine habitats and their associated species. A major consideration in restoring the Derwent is the management of introduced species, including marine pests, riparian weeds and feral animals. Another key issue with long-term implications for the estuary is how changes in catchment land and water uses may ultimately affect river flows and water quality.

5.1 Conserving and restoring critical habitats and species

The Derwent estuary supports a wide variety of habitats – wetlands, salt marshes, tidal flats, rocky reefs, seagrasses and other submerged aquatic plants, as well as riparian vegetation along its foreshores, streams and tributaries. This mosaic of habitats supports a wide diversity of fish, birds, invertebrates and other animal life that are interconnected through an intricate food web. Species of particular note include: whitebait, eel, and other migratory fish; resident estuarine fish; ducks, swans and wading birds; marine mammals such as dolphins, seals and whales; and aquatic mammals such as platypus and water rats. Management of recreational fish species are addressed in Section 5.2.

There are also a number of protected species in the Derwent estuary, including over 10 species of migratory birds, marine mammals, pipefishes, seahorses and seadragons. Threatened species include the spotted handfish (critically endangered), the Australian grayling (vulnerable) and the endemic southeast seastar (*Marginaster littoralis*).

The estuary has experienced pressures from urban and industrial development resulting in a deterioration of water and sediment quality, changes in freshwater flows from the upper catchment, and the introduction of invasive marine species and foreshore weeds. In addition there have been extensive losses of wetlands and other foreshore habitat due to foreshore reclamation, particularly in the most heavily populated middle reaches. There also appear to have been losses of kelp forests and seagrass beds from the estuary.

Nonetheless, there are significant areas of habitat remaining in the estuary that appear to be healthily functioning ecosystems, supporting abundant and diverse populations of native species. These include the extensive wetlands and submerged aquatic vegetation of the upper estuary, the mudflats and salt marshes of Ralphs Bay, and the rocky reef habitat along the Taroona to Tinderbox Bay coastline. These areas provide a significant nursery and rearing area for a number of freshwater, estuarine and marine fish and invertebrate species and support extensive bird populations. The following table indicates the key habitat types found in or around the Derwent estuary, associated ‘iconic’ species, and an indication of some of the threats affecting these resources.

Critical habitat	**Iconic/ typical species**	**Threats**							
		Development & reclamation	River flows & barriers	Water quality	Weeds terr/aq	Marine pests	People & pets	Boating & fishing	Fire regime
Brackish/tidal wetlands	Whitebait & platypus	XXX	XX	X	XX	XX	X		X
Seagrasses	Swans & ducks		XX	XXX	X	X		XX	
Tidal flats	Wading birds	XXX		X	XX	X	XX		
Rocky reefs & kelp	Sea dragons			X		XX		X	
Soft sediments	Spotted handfish			X		XXX		X	
Foreshore & riparian	Penguins & platypus	XXX		X X	XX		XXX	X	

The current management of Derwent estuary habitat and species tends to be fragmented, with numerous state agencies, councils and community groups working on a range of initiatives. A number of conservation mechanisms exist through the *State Coastal Policy 1996, Threatened Species Protection Act 1995, Living Marine Resources Management Act 1995, National Parks and Wildlife Act 1970*, etc. but these generally do not address the need to manage habitat and species within a regional context.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with possible performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Information gaps and systematic approach A considerable amount of information has recently been collected about habitats and species within the region. It is important that this information be integrated and compiled into a user-friendly format. There are also a number of information gaps that should be addressed, e.g. mapping the extent and condition of upper Derwent wetlands. Using this information, a systematic approach is needed to better target management actions.	• Subtidal habitat surveys (TAFI, 2001, 2007) • Comparative survey of Derwent/Huon soft sediment fauna (TAFI /NRM-S, 2005) • Murphys Flat flora, fauna and water quality surveys (DEP/NHT, 2006) • Foreshore surveys (North Barker /NRM-S, 2006); intertidal surveys (Aquenal/NRM-S, 2007-8) and rocky reef surveys (TAFI/NRM-S) • HCC rivulet surveys and maps • DEP/NHT habitat surveys (upper Derwent wetlands, Clarence foreshore, 2008)	• Develop a regional GIS and atlas of key habitats and species as a basis for education, awareness-raising and guiding management actions • Survey Derwent rocky reef habitats and enhance/extend seagrass surveys • Prepare Derwent Conservation Action Plan (Nature Conservancy system) to better target management actions.
Conservation and management of critical habitats There are several habitats within the Derwent that play an important role in maintaining the health of the estuary as a whole – in particular the wetlands and seagrass beds of the upper estuary and the tidal flats of Ralphs Bay. These habitats provide critical services such as nutrient processing, fish nurseries and foraging grounds for aquatic birds.	• Management plans have been developed for several areas (e.g. Goulds Lagoon) • Review/updating of River Derwent Conservation Area plan (underway) • Murphys Flat wetland acquired through Naional Reserve System (DEP/NHT, 2003) • Ralphs Bay Conservation Area amendments (outcome unclear – depends on Walker Corp POSS decision)	• Develop and implement management plans for upper Derwent wetlands, seagrass beds and Ralphs Bay tidal flats • Support/ management plans for other/local conservation areas • Identify/acquire other critical conservation areas
Management of keystone species The Derwent is home to a wide variety of invertebrates, fish, birds and aquatic/marine mammals. Some of these species (e.g. whitebait) occur in large numbers and underpin the estuarine foodchain; others (e.g. penguins) are iconic species that are close to the hearts of the community. The Derwent is also home to a number of threatened species (e.g. spotted handfish) that require careful management to survive. While habitat conservation is an important management tool to protect these species, in some cases, other threats need to be addressed as well (e.g. marine pests, human activities, etc.)	• Spotted handfish recovery plan and implementation (CSIRO) • Derwent community penguin projects (DEP/TCT/NHT) • Whitebait fishery management plan (IFC) • Bird surveys (PWS, Birds Tas) • Platypus fungal disease study (UTas)	• Develop a regional GIS and atlas of keystone species as a basis for education, awareness-raising and guiding management actions • Collect/compile bird survey data • Follow-up on Derwent penguin project • Support/facilitate implementation of Spotted Handfish recovery plan priorities

Objectives for Conserving and Enhancing Estuarine Habitats and Species (2025)

- Understand the Derwent Estuary ecosystem – the interconnection between habitat and species and the essential elements of environmental quality needed to underpin healthy and diverse systems;
- Preserve, protect and restore those habitats that underpin estuarine health and the survival, abundance and diversity of the Derwent's fauna and flora;
- Protect and enhance populations of fish, birds, marine mammals and other living resources.

Strategies and Proposed Actions– next five years

1. Survey, monitor and investigate

- develop, refine and report on ecological indicators and objectives for habitat and species;
- follow-up monitoring on area and condition of estuarine habitat and keystone species;
- conduct more in-depth surveys of wetland, seagrass, rocky reef and tidal flat communities.

2. Improve environmental conditions to support healthy ecosystems

Manage water and sediment quality, marine pests and weeds, river flows and barriers to support estuarine habitat and species. See relevant sections for details.

3. Protect, preserve and restore critical habitat

Improve management of wetlands, saltmarshes, seagrasses, tidal flats, rocky reefs and foreshore/riparian zones. Specific actions may include:

- to develop a Derwent Estuary Conservation Action Plan (Nature Conservancy system) to evaluate values and threats associated with key habitats and to prioritise actions accordingly
- develop/facilitate site specific management plans and implement actions for key areas (e.g. upper Derwent wetlands, seagrass beds, Ralphs Bay tidal flats and salt marshes, Taroona/Blackmans Bay reefs);
- identify and acquire potentially threatened habitats (e.g. wetlands);
- evaluate feasibility of habitat restoration and support restoration trials where appropriate

4. Protect, preserve and manage estuarine species

- Improve management of keystone estuary species (e.g. resident and migratory fish, waterfowl, wading birds) as well as threatened and protected species (e.g. marine mammals, migratory birds, seadragons, handfish, platypus).
- support implementation of spotted handfish recovery plan;
- review the status of other threatened species (e.g. southeast seastar) and the need for targeted recovery plans.

5. Develop interpretation and educational programs to highlight habitat and species values

Prepare Derwent habitat and species atlas to use as the basis for interpretation and educational programs.

Possible indicators/benchmarks

- Area/condition of wetlands, saltmarsh, seagrasses, rocky reefs, tidal flats and riparian zones;
- Diversity and numbers of bird populations (including little penguins);
- Numbers of whales and dolphins sighted annually;
- Spotted handfish (numbers & communities)
- Platypus (numbers and condition)

5.2 Enhancing recreational fisheries

Approximately 150 species of finfish have been documented in the middle and lower parts of the Derwent Estuary. Common resident species include flathead, blue warehou and, bastard trumpeter, while whiting, sea trout, black bream and yellow eye mullet migrate through the estuary in significant numbers. The status of fish populations in the estuary is difficult to determine due to the sporadic nature of scientific studies, differences in sampling technique between studies and a lack of data on the recreational catch specific to the estuary. Furthermore, fish populations are highly mobile and factors affecting populations may occur beyond the boundaries of the estuary.

Several fisheries in the Derwent are under stress, particularly the whitebait fishery, which has declined over the past few decades. Whitebait are particularly vulnerable to environmental conditions, as they have only a one year life cycle. Eels, lamprey and other species that migrate between salt and freshwater have also been affected by dams and other barriers to their migration. Threatened and protected fish species are addressed in Section 5.1.

Recreational fishing is popular in the Derwent and is regulated via licensing, area restrictions, gear restrictions, bag and size limits. Commercial fishing operations in the Derwent estuary were historically quite significant (e.g. arrow squid fishery in the 1970's), however at present only one operator fishes the lower reaches of the estuary primarily for whiting and flathead.

Legislation relevant to fish and fisheries in the Derwent includes the *Living Marine Resources Management Act 1995* (LMRMA) and the *Inland Fisheries Act 1995*. The LMRMA has the objectives of promoting sustainable fishery development, maintaining ecological processes and genetic diversity, facilitating economic development, and sharing the responsibility for resource management among Government, community and industry. The primary management document is the Scalefish Fishery Management Plan.

Management of and research into fish and fisheries in the region is undertaken by DPIW's Marine Resources (e.g. Fishery Management Plans, Fishcare), the Tasmanian Aquaculture and Fisheries Institute (e.g. habitat mapping, scalefish stock assessments) and the CSIRO.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with possible performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Lack of information to support management There is little consistent and long-term information about the condition and trends of Derwent fish populations or about the recreational and commercial pressures on these populations. It is therefore difficult to assess sustainability. Factors that may influence the sustainability of local fisheries include: • water pollution • habitat change or destruction • introduced marine pests • fish passage & environmental flows • over-fishing	• National recreational fishing survey (TAFI) • Tasmanian recreational fishing survey (TAFI Fishwise grant) • Upper estuary fish surveys (ERA, Murphys Flat)	• Use/extend recreational fishing and habitat surveys to assess sustainability of Derwent fisheries • Survey/assess migratory fish passage blockages • Evaluate extent of gill netting in the Derwent and impacts on penguins and other species
Effectiveness of management methods The new scalefish management plan sets out a range of regulations on recreational fishing, including size and bag limits, gear restrictions, etc. There are also several marine reserves and restricted areas within the Derwent Estuary (e.g. Tinderbox, Crayfish Point). IFC has recently completed a fisheries management plan for whitebait. Are these measures effective? Are plans needed for any other species (e.g. eel and lamprey)?	• Scalefish management plan DPIW/(Marine Resources, under review 2008/09) • RPDC review/recommendation on marine reserves in southern region (RPDC, 2008) • Whitebait management plan (IFC, 2006) • Fish pass & biobaffle projects (TCT/Davies, status?) • Upgrades to Meadowbank eel trap (Hydro)	• Support RPDC recommendations for new reserves to protect sensitive areas and species (e.g. handfish, penguins, seadragons) • Support/facilitate high priority actions from whitebait and other management plan • Support/facilitate improvements to fish passage
Adequate and safe infrastructure to support recreational fishing While there are a number of boat ramps, jetties and other fishing infrastructure at sites around the Derwent, the use of these facilities is not well known, or whether there is demand for additional facilities.	• Various boat ramps and jetties have been upgraded through MAST recreational fishing grants • Inventories and surveys of foreshore structures (MAST and Crown Lands)	• Prepare map showing location of existing infrastructure in the Derwent • Support/facilitate development of recreational fishing infrastructure, including maintenance
Fisheries education and promotion There is an on-going need to raise awareness and provide information to the recreational fishing community about issues affecting fisheries, current rules and regulations, seafood safety, etc.	• Various Fishcare projects and Fishwise grants, including recreational fishing signage • Seafood safety brochure (DEP, 2007)	• Produce a recreational fishing guide/map with information about fishing zones, access points, reserves, regulations, fish types, seafood health hazards (combine with recreational boating map/guide Section 4.7). • Update seafood safety brochure & develop signage • Education/interpretation focusing on icon species (e.g. whitebait, eel, flathead, black bream)

Objectives for Enhancing Recreational Fishing (2025)

- Understand existing status of and pressures on fish/fisheries in the Derwent;
- Preserve, protect and restore important fish habitats and restore migration pathways and triggers;
- Manage fishing pressures to ensure sustainable stocks;
- Protect and manage vulnerable fisheries;
- Inform/educate the community about sustainable practices and seafood safety risks.

Strategies and Proposed Actions – next five years

1. Survey, monitor and investigate

- Conduct baseline surveys of fish habitat and species in the Derwent and develop consistent methodology for on-going monitoring (major commercial and recreation species as well as protected species);
- Survey and assess recreational and commercial fishing practices in the Derwent (effort, catch, impacts, sustainability);
- Assess impacts of barriers and flow modifications on migratory fish populations;

2. Improve environmental conditions to support healthy fisheries

Manage water and sediment quality, marine pests and river flows to maintain/enhance recreational fisheries. See relevant sections for details

3. Protect, preserve and restore critical fish habitat

Particularly wetlands, seagrasses, tidal flats and rocky reefs (see Section 5.1)

5. Assess and mitigate barriers to fish migration

In coordination with work on environmental flows, evaluate existing barriers to fish migration (both physical barriers and flow patterns) and develop/implement mitigation strategies.

6. Inform and educate the community

- Work with existing organisations and programs (e.g. Fishcare) to inform and educate the community.
- Prepare Derwent-specific fishing and boating map with information on fish and fisheries, sustainable fishing practices, current regulations and restricted areas/practices, seafood safety, fishing facilities and services, etc.

Possible performance indicators/benchmarks

- Area and condition of critical fisheries habitat (e.g. wetlands, seagrasses, rocky reef/kelp beds);
- Populations of important recreational and commercial species;
- Whitebait recruitment;
- Number of barriers removed/ river length made accessible to migratory species.

5.3 Managing Introduced Species

Marine pests

Introduced marine species are a particularly insidious form of ecological pollution in that, once established, they can be extremely difficult or impossible to eradicate, and can result in severe consequences to the marine environment, aquaculture and public health. These species typically reproduce rapidly and tend to prey on or out-compete the native flora and fauna. Temperate southern hemisphere estuaries such as the Derwent are susceptible to marine pest invasions from other temperate areas (e.g. high latitudes in northern hemisphere, New Zealand) as they provide comparable conditions for these species to thrive, but may lack the natural controls, such as predators, to limit their populations. Once marine pests are established in Australia, they can be further translocated through domestic shipping traffic, natural dispersion and other vectors.

Many marine pests are translocated in ship's ballast water. It has been estimated that between 3000 and 7000 marine species are moved globally in ship's ballast water every day. Additionally, marine pests can be transported through hull fouling on vessels, through aquaculture operations and via other vectors. The National System to manage marine pests incorporates three main components: prevention, emergency response and on-going control/management. The system also supports research, monitoring and communications.

Introduced marine species pose a serious threat to the overall ecology and native species of the Derwent estuary and are believed to be partly responsible for the decline of the spotted handfish, and native seastars. Marine pests can also affect human health and recreational opportunities (e.g. toxic algae blooms, Pacific oysters). About 70 introduced marine species were identified in the Derwent in a baseline survey carried out in 2001 (Aquenal). Many of these species appear to flourish in the Derwent, taking advantage of the disturbed or altered environment. The Derwent is also considered to be a problem area in terms of potential transfers of marine pests to other ports – for example, the northern Pacific seastar has been transferred from the Derwent to Port Phillip Bay, where it has become a serious pest. This concern about the pest status has important potential economic implications for domestic and international shipping. For example, New Zealand will not permit the discharge of ballast water originating in Tasmania to New Zealand coastal waters.

Introduced flora & fauna in foreshore and intertidal habitats

Invasion of introduced flora and fauna in foreshore and intertidal habitats can reduce the diversity of native flora and fauna, reduce human amenity and cultural heritage values and create fire and health hazards. The Hobart metropolitan area contains a particularly rich weed flora. Weeds are generally more diverse and abundant along the urban/bushland interface, along roads, tracks and urban waterways and on sites that have been disturbed. The extent and distribution of weeds along most of the Derwent foreshore have recently been mapped (North Barker), with more detailed site studies undertaken by councils and community groups. Weeds of particular concern include boneseed, blackberry, willow, gorse, serrated tussock and African boxthorn. The intertidal weed rice grass has also been extensively mapped and managed by DPIW and the DEP, and has nearly been eradicated from the Derwent. Introduced fauna associated with foreshore areas typically include rabbits, cats, dogs, foxes and non-native ducks and geese.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with possible performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Monitoring and reporting An extensive baseline survey of marine pests was carried out in 2001, and follow-up surveys of the Hobart Ports area is currently being planned by DPIW. In 2007, weeds along most of the Derwent were mapped as part of a regional coastal values mapping project, however the results have not been analysed and some gaps remain (Clarence)	• Pacific Oyster Survey 1999/2000 (TAFI) • Baseline IMP survey carried out in 2001 (Aquenal) • IMPs in soft sediments surveyed in 2005 (TAFI) • IMP monitoring protocols developed through National System (DPIW participation–Tasmania) • Foreshore vegetation surveys (North Barker) • Local surveys of foreshore areas and urban rivulets (councils, community groups)	• Prepare Derwent foreshore weed map and strategic approach to monitoring (current infestations & management success) • Support/facilitate regular Hobart Port IMP
Research Considerable research has been carried out on marine pests and their ecological impacts by CSIRO and the University of Tasmania. Further work is needed in this area, however funding has been limited in recent years.	• CSIRO research (e.g. Geneprobe, sterile ferals) • UTas research (NPSS, Undaria, NZ screw shell) • UTas research (toxic dinoflagellates, ballast water treatment) • TAFI research (Pacific oysters)	• Support/facilitate research on IMPs, • Support/facilitate research on weeds and management methods.
Education A number of educational brochures, pamphlets and websites have been produced. These require on-going distribution/maintenance and ideally a more targeted communications plan.	• DPIW IMP brochure, cards and website • CSIRO NIMPIS community education kits • Various coastal weed brochures	• Identify education objectives, audience, and appropriate medium. • Support/facilitate education about IMPs and weeds (needs to be carefully targeted) • Cat and dog control/desexing • Raise awareness of fox presence & impacts
Management		
Prevention To date, marine pest prevention has been mainly focused at a national/international level (e.g. ballast water management, National Plan). Further focus is needed on the Derwent in terms of identifying and managing potential risks and species we are trying to prevent. Similarly, weed management strategies are focused largely on a national, state or council level rather than at the system level	• International ballast water convention signed in 2005; National System (to be ratified) • Australian Emergency Marine Pest Plan (2005) • AQIS implement voluntary prevention of biofouling pests international vessels (< 25 m length) in 2005 • National Control Plans prepared in 2008, includes four Derwent pest species (Aquenal) • National Ballast Water Management Arrangements being developed • AQIS developing options to prevent biofouling pests on large international vessels • Slipway management guidelines released (2007)	• Assess ballast water discharges to Derwent • Support/implement existing ballast water management initiatives, including testing /treatment for high risk vessels • Promote awareness of DPIW emergency response contact & ID of CCIMPE species of particular concern. • Prevent translocation of IMP from northern Tasmania e.g. European fan worm, Gambusia, and Asian bag mussel. • Facilitate implementation of slipway guidelines
Control A strategic and long-term approach is needed for appropriate IMP control in the Dewent. Terrestrial weed/feral pest management strategies on a national, state, NRM South or council level need to be connected to strategic objectives at a Derwent estuary (and adjacent catchment) level.	• NPSS diver removal & trapping trials • Undaria control trials • Oyster removal projects (locally successful) • Weed management projects at foreshore & rivulets • Trapping/removal of feral cats, ducks/geese at key sites	• Based on results of weed survey develop regional control strategies • Control weeds at high value habitats • Support/implement recommended actions in pest-specific national plans, where practical • Develop/support strategies to manage feral cats, fox, ducks/geese and rabbits.
Eradication The rice grass program has been successful in nearly eradicating rice grass from the Derwent	• Derwent Ricegrass control 2006, 2007 & 2008 (DEP & DPIW)	• Support/facilitate eradication of rice grass from Derwent

Objectives for Managing Introduced Marine Species (2025)

- Prevent the introduction of new pests and weeds into the Derwent and avoid exporting marine pests to other areas;
- Control, reduce or eradicate existing infestations;
- Improve information and understanding about pests/weeds and their impacts on the Derwent.

Strategies and Proposed Actions – next five years

1. Support surveys, monitoring and targeted research

There is a need for more marine pest monitoring and ecological impact studies in the Derwent estuary.

- Support/facilitate follow-up monitoring of marine pests in the Derwent (currently under development by DPIW) through community, council and/or industry participation.
- Support/facilitate baseline survey of Derwent foreshore weeds.
- Support/facilitate continuing research on marine pest biology, transportation vectors and control strategies.

2. Facilitate emergency response strategies for early detection and elimination of new marine pests, foxes and weeds

- In collaboration with DPIW, support early detection/elimination of marine pests for example by promoting marine pest identification information and contact details.
- In collaboration with the Fox Taskforce, support early detection/elimination of foxes, for example through sign identification and contact details.

4. Develop introduced flora and fauna management 'master plans' for the i) Derwent estuary and ii) high priority foreshore areas.

- Clear achievable and appropriate management objectives will be identified through data review, consultative workshops, and expert advice.
- Management plans should then be developed to direct strategic actions and investments in order to achieve the objectives.
- Follow-up monitoring is required in order to support adaptive management.

6. Support on-going monitoring and eradication of rice grass in the Derwent.

With ongoing management, eradication of rice grass is an achievable outcome.

7. Inform and educate the community and key stakeholder groups

Create and disseminate educational materials about marine pests and weeds, potential health risks, and what actions they can take to assist in prevention and management.

Possible performance indicators/benchmarks

- Reduction in numbers and/or densities of target pests and weeds (e.g. rice grass);
- No new pests or a reduced rate of introduction into the Derwent
- Distribution of information on pests and weeds.

5.4 Managing Environmental Flows and Catchment Water Quality

The Derwent River is one of the largest rivers in Tasmania, both in terms of its catchment area (about 9000 square kilometres) and its flow (about 90 cubic metres per second). Over the past 70 years, the volume and seasonality of flows in the Derwent have been strongly affected by the diversion, impoundment and removal of water from the catchment, as well as by a climatic dry period. Development of hydro-electric power has been the primary cause, with 10 power stations and over 20 storages constructed within the catchment. However, other users also play an important role, particularly irrigators, municipal and industrial water suppliers, and fish farms. There have been several recent initiatives/proposals to transfer additional flows out of the catchment and to increase irrigation extractions.

The cumulative effect of the aforementioned impacts has been an estimated 30% reduction in flows from an annual average flow of 130 cumecs in the 1920s to 90 cumecs in the 1990s. Furthermore, seasonal flow patterns have changed dramatically, with higher base flows in summer and a reduction in the number and frequency of moderate and low level flood events. These flow modifications have affected dynamics in the Derwent estuary including water circulation patterns, dilution and flushing of wastewater discharges, oxygen replenishment, displacement of saline water, delivery of silt, impacts on primary production, and the seasonal cycles of migratory fish. The numerous dams and weirs throughout the catchment also block the passage of migratory fish and eels (see section 5.2).

Although water quality from the catchment to the estuary has been historically good, this situation may change over time in response to changing land uses. It is difficult to assess or predict long-term trends in catchment water quality without a comprehensive monitoring program and catchment models. Recently, toxic algal blooms have been reported in upstream storages and tributaries (e.g. Ouse River). Potential threats to water quality include run-off from agriculture and forestry, loss or degradation of riparian vegetation, riverbed and bank erosion, etc.

Current responsibilities for water management in the Derwent catchment lie primarily with the State (DPIW) for the administration of the *Water Management Act 1999*, including the preparation of Water Management Plans to assist in maintaining the health of the river system. The Environment Division is responsible for managing water quality, including the setting of Protected Environmental Values and Water Quality Objectives. Some of the primary users of the water (HEC and Hobart Water) have recently completed catchment reviews and management plans that address environmental flow and water quality issues, while other groups have prepared management plans for specific areas and/or tributaries. A key issue is the lack of a coordinating plan/vision between the various land and water managers.

The major issues, recent actions and recommendations identified during the review process are presented in the following Table. Proposed objectives, strategies and actions are summarised on the subsequent page, together with possible performance indicators/benchmarks.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Monitoring, investigations and reporting There have been several whole-of-catchment monitoring programs in the past, and a number of more recent surveys of key rivers and lakes. A number of sites are monitored continually for flows and/or water quality, however, there is no comprehensive, on-going monitoring system for the entire catchment. Furthermore, previous studies have focused on baseline conditions, with very little event monitoring	• On-going monitoring of key sites by the Hydro, DPIW and Hobart Water. • Annual Waterways Reports by DPIW • Derwent catchment nutrient study (DPIWE, 2000) • Monitoring river health (DPIW, 2001) • Jordan River State of River study (DPIW, 2003), and EFlows study (Davies et al, 2005) • Hydro catchment review studies (status?) • Various CFEV projects and reports (DPIW, 2008) • Develop/implement a River Condition Index Framework for Tasmania (Earth Tech/NRM South)	• Develop/implement integrated catchment water quality monitoring system, including event monitoring and toxic algae • Carry out baseline surveys of habitat (e.g. riparian zones, wetlands) and fauna (e.g. fish, platypus), including threatened and introduced species • Prepare/enhance regular State of the River reports and report cards
Environmental flows The Derwent's present flow regime is largely artificial and is largely influenced by releases from hydro storages, which have been operating for decades. While there may be opportunities to adjust flows to improve ecological values, this needs to be managed carefully. There is a good flow monitoring network upstream of Meadowbank, however flow monitoring in the lower river and upper estuary is limited. Data about the total amount of water extracted from the Derwent is not readily available.	• Derwent environmental flows studies (Davies et al, 2002;2007) • Clyde, Sorell and Crescent water management plans (DPIW, 2005) • Flow gauges installed below Meadowbank (Hydro), below Bryn Estyn (DPIW) and at RR bridge (BOM) • Hydrologic surface water model of Derwent catchment (DPIW, 2008) • Jordan River Water Management Plan to be developed (DPIW – status?)	• Maintain/install flow/height gauges on key tributaries, main river and in upper estuary (including wetlands) • Quantify current extractions • Define flow-related values, indicators and targets • Investigate and recommend flow regimes to maintain/restore these values • Prepare Derwent water management plan (DPIW)
Catchment water quality While water quality from the catchment to the estuary has been historically good, this may change over time with changing land uses. Recently, toxic algal blooms have been reported in upstream storages and tributaries. In addition to on-going monitoring, a detailed analysis of land use is needed, coupled with catchment models to enable prediction of water quality changes.	• Assessment of surface water quality monitoring in the NRM South region (Hydro/NRM South, 2008) • Partnership agreement between DPIW and Central Highlands Council for monitoring and data sharing • Riparian and land management projects (Derwent Catchment, Landcare, Greening Australia, NRM South, etc.) • Fish farms - wastewater treatment/recirculation	• Document current catchment land uses using aerial photography/remote sensing and projected land use changes • Develop models to assess impacts of current and changing land uses on water quality and quantity • Maintain/restore riparian zones and improve land use practices
Fragmented management Several management plans have been prepared or are currently under development within the Derwent catchment. However, these tend to focus on specific issues (e.g. drinking water, hydroelectricity) or specific areas (e.g. Clyde River). Furthermore water flow and water quality are managed through separate processes and by different state agencies.	• Water Quality PEVs set (Environment, 2001) • Derwent catchment NRM plan (CH Council, 2002) • Derwent catchment review + studies (Hydro, 2001/6) • Derwent Catchment Drinking Water Plan (Hobart Water, 2006) • Derwent River Recovery (Greening Australia, in progress)	• Support/facilitate a catchment management process that integrates water quality, quantity and ecosystem health across the whole of the catchment

Objectives for Managing Environmental Flows and Catchment Water Quality (2025)

- Understand how Derwent River flows and inputs affect estuarine circulation, water quality and ecosystem processes;
- Manage freshwater flows and extractions so as to maintain/enhance estuarine values;
- Maintain/improve catchment water quality;
- Support/facilitate establishment of a coordinated catchment management partnership similar to the DEP

Strategies and Proposed Actions – next five years

1. Support investigations, monitoring and reporting

Support and facilitate investigations and monitoring of current flow regime, water extractions and diversions, water quality and land use; support/facilitate catchment-to-coast reporting process.

- Maintain/enhance flow monitoring sites on Derwent River, major tributaries and upper estuary sites;
- Improve quantification of current extractions and diversions for the Derwent and tributaries;
- Analyse recent aerial photos/remote sensing to document current land uses;
- Develop and implement a coordinated water quality monitoring program for the Derwent River and major tributaries, including event monitoring;
- Prepare/augment annual State of the River report, to include data from all major stakeholders

2. Identify optimal flow regimes to maintain/improve estuarine health and commence implementation

- Identify key estuarine values that are impacted by catchment flows (e.g. wetlands, seagrasses, fisheries), investigate how current flow regime could be modified to maintain/enhance these values.
- Develop flow-related indicators and targets and fine-tune monitoring arrangements
- Develop environmental flows decision support models building on previous work, and incorporate operational models and cost-benefit analyses;
- Modify and monitor flow regime accordingly.
- Support/facilitate initiatives to conserve and/or reuse water within the catchment

3. Maintain/improve catchment water quality

- Develop catchment models to estimate inputs of nutrients, sediments and organic matter and integrate these with estuarine DSS system (see Section 4.3);
- Evaluate projected and alternative land use changes and their potential effects of estuarine health;
- Support/facilitate initiatives to improve water quality within the catchment, including riparian protection/restoration.

4. Support/encourage integrated management of water quality and water quantity within the catchment

A coordinating framework is needed to better integrate the various planning and development activities within the catchment.

Proposed indicators

- Derwent River flows at New Norfolk (e.g. water level, volume, seasonality);
- Recruitment/population of whitebait and other migratory fish;
- Annual loads of nutrients, sediments and organic carbon to the estuary.

6. FORESHORE PLANNING, USE AND AMENITY

6.1 Coordinated Foreshore Planning and Development

At the national and international level, there is a growing trend towards increasing use and redevelopment of urban foreshores that is resulting in major social and economic benefits as well as more liveable cities. This trend is now becoming apparent along the Derwent foreshore, with increasing interest and investment in new restaurants, marinas, residential and commercial facilities.

The Derwent foreshore is remarkable for its scenery, diversity and ease of public access. Approximately 50% of the foreshore is still in the public domain, providing enormous scope and opportunities for enhanced public use and recreation, together with associated economic and tourism benefits. As interest and momentum grows for new development, it is essential that we develop a regional strategy that optimises development opportunities without sacrificing public amenity or environmental values. Careful planning will also be needed to retain the 'working waterfront' character of the Derwent.

The Derwent foreshore is used for a wide range of purposes and is managed by multiple land and infrastructure managers, each with their own management frameworks and codes; these include six Council planning schemes as well as the management systems used by Parks & Wildlife, Crown Lands, Department of Infrastructure, Energy & Roads, Marine and Safety Tasmania and the Sullivans Cove Waterfront Authority. The foreshore is a particularly critical area, as development here has greater potential to affect estuarine water quality, coastal ecosystems, public use, views and heritage values. The sensitivity of foreshore land to development varies, depending on slopes, soils, vegetation type, fauna, threatened species and susceptibility to sea level rise.

At present there is no estuary-wide vision or planning framework for the Derwent foreshore. The State Coastal Policy should provide some guidance, but has been under review for a number of years. The Sullivans Cove Waterfront Authority was established in 2005 to plan and manage development along Hobart's historic waterfront. A number of local plans have also been developed by councils for areas such as Kingston Beach, Blackmans Bay and Kangaroo Bay, and numerous site specific plans have been developed for specific foreshore parks and reserves by councils, Parks & Wildlife and community groups.

It is important to improve links and coordination between existing council and state government planning processes to better address foreshore issues and opportunities, and to provide a more consistent and streamlined assessment process. Comprehensive and user-friendly information about foreshore values and constraints would greatly assist in planning and assessment. In addition, much could be done to develop (and implement) guidelines that address both design and construction aspects of foreshore development.

Finally, it is important to emphasise the critical role played by the community, as a private land manager, as a user of public lands and - increasingly – as a hand-on manager of public lands through Coastcare, Landcare and other programs.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Regional vision and planning The Derwent foreshore is in need of 'big-picture', regional vision and planning, and would also benefit from better coordination and implementation of local plans.	• Sullivans Cove Waterfront Authority established • Numerous local area plans prepared or under development (e.g. Kingston, Blackmans Bay, Kangaroo Bay). • Numerous site specific plans prepared or under development (e.g. foreshore reserves and parks)	• Support/provide feedback on site specific and regional plans • Support/facilitate implementation of approved foreshore management plans • Initiate a pilot project to develop a municipal foreshore management plan as a case study • Support/facilitate preparation of a comprehensive Derwent estuary foreshore plan
Planning and assessment tools At present, there are few regional policies, guidelines or design specifications to guide foreshore development. In particular, it would be beneficial to have a consistent regional approach to issues such as: • Clearance/management of foreshore vegetation • Setbacks from waterways, wetlands and dunes • Soil erosion and landslip controls • Coastal erosion, flooding and sea level rise • Coastal views • Public access • Foreshore structures • Reclamation and dredging	• Regional WSUD guidelines completed (DEP, 2006) • Regional soil & erosion control and reclamation guidelines (DEP, in progress) • Survey/inventory of foreshore structures completed by MAST and Crown Lands • Package of planning and assessment tools developed through Coastal Policy review process	Prepare/promote regional guidelines and design specs for issues including: • Coastal erosion and sea level rise • Foreshore structures • Coastal vegetation management
Comprehensive and user friendly information systems While a large body of information has recently been developed about coastal and foreshore values, it is not clear that this information is being fully utilised by decision-makers.	• Shoreline vulnerability assessment completed (Sharples, 2005) • Foreshore vegetation and geomorphology surveys completed (North Barker/Sharples, 2007/8) • Threatened species GIS compiled (PWS) • Derwent habitat atlas under development (DEP, 2008) • LIDAR data (high resolution topography) collected for Derwent region (SES, 2008)	• Extend and enhance Derwent habitat atlas to include foreshore values • Compile regional foreshore GIS • identify and address information gaps
Community education and engagement The Derwent foreshore is popular with the community and tourists alike and offers excellent opportunities for education and engagement.	Various brochures on coastal weeds, foreshore habitats, species, walking tracks, etc. have been prepared by councils, state government and community groups	Expand current State of Derwent reporting to address foreshore issues

Objectives for Coordinated Foreshore Planning and Development (2025)

- Develop good information base and practical planning and assessment tools
- Develop regional vision and long-term planning framework for the Derwent estuary foreshore
- Support development and implementation of local and sub-regional plans in key areas
- Inform and engage the community

Strategies and Proposed Actions – next five years

1. Compile and enhance foreshore information systems

- Compile regional GIS database on foreshore land tenure, vegetation, weeds, fauna, endangered species, geomorphology, coastal/erosion and sea level rise
- Identify high priority sites for acquisition/conservation and sites more suitable to development

2. Develop, promote and support practical planning and assessment tools

- Support the development and implementation of policies, guidelines and design specifications addressing issues such as foreshore vegetation management, foreshore reclamation; foreshore structures; coastal erosion/sea level rise, etc
- Provide technical support and advice on planning applications as requested by DEP stakeholders

3. Support/facilitate development of a regional vision and long-term planning framework for the Derwent foreshore

- Review existing council and state strategic plans relevant to the Derwent forshore and conduct gap analysis
- Develop regional foreshore vision and strategic plan
- Support development of foreshore policies, models and planning scheme provisions

4 Raise community awareness of foreshore issues and values

- Enhance current State of Derwent reporting to provide more information on foreshore issues

Possible performance indicators/benchmarks

- Length/proportion of foreshore in public ownership

6.2 Enhancing Foreshore Access, Open Space and Tracks

Nearly half of Tasmania's population lives around the margins of the Derwent, and the estuary is widely used for recreation both on and off the water. Popular water-based sports include swimming, water-skiing, windsurfing, sailing, motor-boating, paddling and rowing. Sea-kayaking has recently experienced a surge in popularity and recreational fishing is common – both from small boats and from the shoreline. The Derwent is also an important focus for foreshore recreation, with numerous parks, picnic areas and sports grounds. An estimated 50% of the foreshore is owned or managed by state and local governments, largely as parks and reserve areas. These contain a significant network of foreshore tracks and trails that are being increasingly used by walkers and cyclists.

The Derwent estuary is an important tourism resource: the greater Hobart area combines a rich history, galleries, markets, restaurants and waterside pubs with a working port, providing a rich experience for visitors. Hobart is the most visited area in Tasmania, and the Derwent is central to the to the image of the city. Many visitors participate in tourism and recreational activities on or near the water including ferry tours, scenic flights, kayaking and jetboat tours. Major sporting and cultural events such as the Sydney-to-Hobart, Taste of Tasmania and Australian Wooden Boat Festival are also a major drawcard for the region. Other growing sectors include cruse ship visits, Antarctic tourism and convention-based tourism.

Recent developments on or near the Derwent foreshore include major new projects (e.g. waterfront re-development), extension of walking and cycling tracks, water-based tourism and an increasing scale and number of events. Over the past few years, there has been accelerating interest in use and development of foreshore, and there are a large number of other initiatives being planned or considered.

A wide range of organisations play a role in managing the various uses and activities described above, including the six local councils, state agencies (particularly DEPHA, MAST and DSD). The private sector (e.g. TasPorts, commercial, industrial and tourism operators) also play a key role both in terms of management and economic development of the waterfront.

There are a number of issues and opportunities associated with the use and development of public open space on the foreshore, as summarised in the following Table. Considerable benefits could result through better linkages and enhancement of existing assets. A regional coordinating framework would facilitate these linkages and also help plan for new development and attractions, while minimising potential conflicts and duplication of effort. Opportunities include extension of tracks and trails, better maintenance of parks and reserves, improvements of jetties and other facilities, and regional interpretation of natural and cultural features. There is also scope for development of new foreshore attractions, such as a high-quality interpretation centre.

ISSUES	ACTIONS (1999 TO PRESENT)	MANAGEMENT OPTIONS
Foreshore access and open space While about 50% of the Derwent foreshore is publicly owned, it is important that the community has and retains good access to this space. Foreshore open space and access should be integrated within new developments, and 'missing links' should be identified and acquired where possible. In addition, there is a need for improved management of many foreshore parks and reserves, with a consistent approach taken across different tenures.	• Analysis of Derwent foreshore land tenure (DEP 2003) • Various local area/reserve plans • Numerous community plans and maintenance of reserve areas	• Update foreshore tenure maps, including identification of access points • Regional foreshore open space inventory • Regional foreshore open space strategy, including priorities for maintenance and acquisition
Foreshore tracks A recent inventory of Derwent foreshore walking tracks mapped 64 individual tracks, extending for a distance of 111 km. Although many of these tracks are currently in poor condition, there are excellent opportunities to upgrade, extend and link these tracks to provide a world class network.	• Extension of Intercity Cycleway (GCC, HCC) • Extension/maintenance of foreshore tracks in all council areas • Derwent regional tracks strategy drafted (DEP, 2006) • Tasmania Walking Tracks Strategy completed (2007) • Derwent foreshore tracks inventory completed (DEP/Track & Trail Management Services, 2007)	• Prepare regional foreshore tracks guide • Develop signage strategy, including branding and interpretations • Refine/implement DEP regional tracks strategy (staged) • Upgrade and extend high priority walking tracks
Foreshore activities and amenities There are many opportunities to enhance foreshore activities and amenities to encourage community and visitor engagement with the Derwent.	See Section 9 (Communications)	See Section 9 (Communications)

Objectives for Enhancing Foreshore Open Space, Access and Tracks (2025)

- Maintain and enhance public foreshore open space
- Upgrade, link and develop regional foreshore tracks network
- Promote foreshore activities and amenities that enhance community enjoyment and awareness of the Derwent

Strategies and Proposed Actions – next five years

1. Refine and implement DEP foreshore tracks strategy

Commence staged implementation of DEP draft foreshore tracks strategy in partnership with land managers, as follows:

- Stage 1 community priority tracks
- Stage 2 tourism priority tracks
- Stage 3 links to water-based transport
- Stage 4 links to regional tracks (e.g. rivulet and Mt Wellington tracks, Tasmanian Trail, Tangara Trail)

2. Develop/facilitate a regional plan to maintain/enhance foreshore open space and access

- Prepare a regional inventory and management strategy for open space, focusing on foreshore parks and reserves, including extent and condition, maintenance, and options to acquire and link public land.
- Support/facilitate foreshore open space management and maintenance initiatives by land managers and community groups

3. Support foreshore activities and amenities

See Section 9 (Communications)

Possible performance indicators/benchmarks

- Linear extent (and condition) of foreshore parks and reserves
- Linear extent (and condition) of foreshore tracks

6.3 Conserving Foreshore and Maritime Heritage

Throughout history, the Derwent estuary has been central to human survival, transportation and economic development. The Derwent was widely used by the Tasmanian Aborigines, and later became the focus for early European settlement and subsequent regional economic growth. Remains linked to the region's early inhabitants can be found along the entire Derwent foreshore from the Iron Pot lighthouse, to the historic village of New Norfolk and back down to Tinderbox. This heritage is extraordinarily diverse and includes Aboriginal middens and quarries, ports, boatyards and shipwrecks, whaling sites, military forts, as well as hundreds of historic homes and public buildings. The estuary offers unprecedented opportunities for examining the human relationship with the environment across history and how this has varied between cultures and over time.

Heritage sites can range in size from extensive cultural landscapes, townscapes and streetscapes to individual houses, middens or boats. Individual artifacts are also part of heritage, as are records of our past – maps, books, photographs, etc. Some heritage places are hidden below the ground as archaeological deposits. Finally, our intangible heritage includes memories, songs, stories, trades, crafts and customs, many of which are passed on in living form to the next generation. (SOE, 1996)

There is an increasing awareness of the value and significance of preserving historic and cultural heritage. In recent years, a number of studies have been carried out by Councils in order to identify places of heritage for restoration and/or public benefit to further define a "sense of place" in their areas. As yet, however, there is no consistent regional strategy for identifying, defining, preserving or restoring places or icons of cultural or heritage value associated with the Derwent foreshore.

Tasmanian Aboriginal cultural heritage has been defined as the physical evidence of over 40,000 years of occupation of the island by Tasmanian Aborigines. This evidence may include stone artifacts, shell middens, rockshelters and spiritual places, as well as the land, landscapes, plants, animals and the cultural practices and rights which define the Tasmanian Aboriginal community today. Over 600 Aboriginal sites were identified along the Derwent estuary foreshore during a systematic survey in the 1970s and it is believed that Aboriginal occupation of the area dates back as far as 14,000 years ago. The oldest known sites are at Kingston (8000 years BP), followed by Bedlam Walls.

The Derwent also has a rich and varied European maritime heritage. The history of recreational and commercial use of the estuary and its foreshore includes whaling, shipbuilding, regattas, recreational boating, and the built environment (wharves, jetties, warehouses). Whale boats, transportation ships, cargo vessels, ferries, barges, cruise boats and military vessels have all frequented our shores and helped shape the history and culture of the region.

There are a number of issues associated with the conservation of the region's cultural and historical resources, including lack of information, the need for an integrated and proactive regional management strategy, as well as issues associated with restoration and protection of specific sites. In addition, there are opportunities to considerably enhance the interpretation of foreshore heritage.

Objectives for Conserving Foreshore and Maritime Heritage (2025)

- Improve information base on foreshore and maritime heritage sites and their condition
- Support heritage initiatives of the Tasmanian Aboriginal community
- Protect and enhance foreshore and maritime heritage sites
- Develop regional approach towards interpretation

Strategies and Proposed Actions – next five years

1. Collect/compile information on foreshore and maritime heritage sites

2. Support initiatives to protect and enhance heritage sites

- Support initiatives of Tasmanian Aboriginal community to protect and interpret their heritage
- Support implementation of existing heritage plans
- Develop partnerships with museums and heritage organizations
- Promote regional approach and consistency

3. Develop and implement regional interpretations plan that include heritage sites

See Section 9 (Communications)

Possible performance indicators/benchmarks

7. CLIMATE CHANGE

The most recent report from the Intergovernmental Panel on Climate Change (IPCC, 2007), confirms the seriousness of climate change. Potential negative impacts associated with rising temperatures are likely to affect ecosystems and biodiversity, water resources, agriculture and forestry, fisheries, human health as well as coastal settlements and infrastructure.

Recent modeling for southeastern Tasmania (CSIRO, 2007) suggests that longer-term impacts of climate change could be severe, particularly in low-lying coastal areas. Recent studies (Sharples, 2006) have highlighted the vulnerability of Tasmanian coastal communities and infrastructure to flooding and erosion due to sea level rise and storm tides. Other concerns include effects of changing rainfall patterns on water supply and stormwater run-off, changes in estuarine fisheries and habitats, and increased vulnerability to marine pests and weeds.

A number of climate change initiatives have recently been completed or are currently underway, including the *Tasmanian Climate Change Projections 2008*, coastal vulnerability mapping, Tasmanian climate change review and a national pilot project focusing on the Clarence City Council area.

Potential management responses include direct action to reduce/absorb emissions, as well as planning and adaptation to minimise adverse impacts.

The DEP's approach to addressing climate change issues will commence with preparation of an issues and options paper to identify key risks and management options relevant to the Derwent estuary. This work will be undertaken within the context of other regional initiatives, particularly the *Scientific Assessment and Response to Climate Change Impacts on Clarence Foreshores*.

7. SCIENCE AND MONITORING

Effective environmental management requires a good understanding of how a system functions, how it may respond to alternative management actions, and a rigorous monitoring system to document environmental conditions and trends. In recent years, many estuary programs have established water quality indicators and targets in an effort to better quantify what defines a healthy ecosystem. Some programs have linked these indicators and targets to predictive models so as to better assess alternative management actions and their projected consequences.

The DEP's monitoring program was established in 2000, through a formal agreement between state government, council and industry partners. The objective of the agreement was to coordinate and improve existing monitoring activities to provide better information about the estuary as a whole. The agreement also set out annual data review and reporting requirements – specifically, the preparation of an annual Derwent Report Card and a five-yearly State of the Derwent report. This monitoring system is an important on-going mechanism to evaluate the Program's performance over time and to revise management approaches accordingly.

This coordinated monitoring program has been very successful, with standardisation of field and lab methods, a unified database and routine data analysis and reporting systems. The DEP now has several years of ambient water quality monitoring data, and good baseline information on sediment quality, marine pests, subtidal and foreshore habitat and benthic invertebrate communities. During the past five years, several additional monitoring projects have been established (e.g. stormwater) and the program has received a number of externally funded grants, allowing a better understanding of baseline conditions and processes. Recently, heavy metals have been a major focus, with support from the Australian Government Coastal Catchments Initiative (see Section 4.2 for details). This grant has supported the development of detailed hydrodynamic, sediment transport and toxicant models that will provide a good basis for further modeling work.

The initial five-year span of the Monitoring Agreement has now been concluded and it has been agreed to integrate science and monitoring within this revised management plan, based around a comprehensive science plan that addresses key issues and uncertainties in a systematic way. An adaptive management framework is proposed, incorporating indicators and targets, decision support models, targeted investigations (e.g. process studies, event monitoring), feasibility studies and performance monitoring.

The science plan is organised around key issues – specifically recreational water quality, nutrient enrichment, heavy metals, habitat and species and catchment flows and inputs. This is an ambitious proposal, given the relatively modest resources of the DEP, and it is therefore essential that we work closely with research partners at the University of Tasmania, CSIRO Marine Research and other research organisations to progress key projects through research collaborations, grants and student projects.

Priorities over the next five years include nutrients, estuarine habitats and catchment flows/inputs. Further discussion about the five main components of the Science Plan are provided below.

Recreational water quality

As discussed in Section 4.1, recreational water quality has been monitored in the Derwent for over 15 years. However, there has recently been a major shift in the national guidelines (NH&MRC, 2005), whereby occasional poor water quality conditions can significantly affect beach classification. As a consequence, several popular swimming beaches that previously received 'pass' ratings, have received poor water quality classifications.

The DEP's recreational water quality monitoring program is therefore shifting focus from routine weekly monitoring to a greater focus on event monitoring, predictive methods and tools to identify and track pollution sources. Another important priority is the provision of public information in a clear and timely fashion.

Nutrients and organic matter

As discussed in Section 4.3, nutrients and organic matter have been monitored extensively in the Derwent. The estuary experiences a high degree of natural variability with respect to nutrient and organic matter loads, due to strong seasonal variations in catchment and oceanic inputs. Added to this are the loads associated with ten sewage treatment plants, the Boyer paper mill and aquaculture activities in the D'Entrecasteaux Channel. Although the Derwent is not prone to nuisance algal blooms and fish kills are rare, dissolved oxygen levels in the upper Derwent are very low during summer and there is little understanding of existing and potential effects of nutrient enrichment.

Is the Derwent nutrient stressed? How would it respond to higher or lower nutrient loads? During the next five years, further treatment upgrades are planned at the Boyer mill and several sewage treatment plants that will significantly alter both the current loads and the relative proportions of nutrients and organic matter discharged to the Derwent. The issue of whether further sewage treatment plant upgrades are required should also be addressed within this timeframe.

The DEP's nutrient monitoring program has therefore broadened its scope from ambient monthly monitoring to incorporate processes studies (particularly the role of sediments), predictive models and development of indicators and targets to support management decisions. This work will be greatly enhanced by a large ARC-Linkage research grant awarded to the University of Tasmania, in partnership with the DEP and Norske Skog. A second stage Water Quality Improvement Plan has also been funded by the Australian Government to extend system modeling in cooperation with CSIRO. The ambient monitoring program will also be maintained to document any water quality changes associated with the changes in organic matter and nutrients loads.

Heavy metals

During the past five years, the DEP has had a strong focus on heavy metal contamination, with support from the Australian Government's Coastal Catchments Initiative program (see Section 4.2). We now have a much clearer understanding of heavy metal sources, processes and effects, and management actions to further reduce inputs are underway. Detailed hydrodynamic, sediment transport and toxicant models have been developed for the Derwent by CSIRO Marine Research, and an initial set of indicators and targets have been established (DEP, 2007).

Future priorities include monitoring the system's response to continued reductions in heavy metals (water, sediments and seafood) and further investigation of biological pathways and impacts. In particular, a broader survey of heavy metals in biota is underway (including a wider variety of recreational species), as is further work to develop biological indicators (e.g. caged oyster experiments). Some additional work on sediment processes (e.g. fluxes) is also planned, in conjunction with the nutrient investigations described above.

Estuarine habitat and species

Investigations and monitoring of Derwent estuarine habitat and species, while improving, have been somewhat piecemeal. In recent years, several important baseline surveys have been completed – including mapping of subtidal habitats, foreshore vegetation, surveys of benthic invertebrates and marine pests. Monitoring of several threatened/protected species (e.g. spotted handfish, little penguins, seahorses) has also been carried out.

During the next five years, a more comprehensive approach is proposed to address the full range of habitats and species. A habitat atlas will be prepared – documenting the area and condition of key habitat types – and an initial set of biological indicators and targets will be developed. These indicators can then be used as the basis for future monitoring programs. The DEP will also seek to maintain/extend monitoring of key species such as penguins and spotted handfish. Resources will also be sought to re-survey marine pests and for a baseline survey of coastal weeds. Annual surveys/eradication of rice grass will be maintained.

Catchment flows and inputs

While there have been several water quality surveys and investigations of environmental flow requirements within the catchment, we do not have a good understanding of the Derwent system as a whole, and particularly how land and water use changes in the catchment may ultimately affect the estuary. This is a major undertaking, but is essential if we are to protect the estuary in the longer term. The DEP's goal over the next five years is to establish a systematic program of catchment-related research, including development of indicators and targets, catchment models and monitoring of flow and water quality.

Objectives for Science and Monitoring (2025)

- Understand how the Derwent works through surveys, investigations and research
- Set indicators and targets to achieve/maintain environmental health and revise these as new information becomes available
- Develop system models and use these to predict and manage change
- Monitor environmental conditions and trends
- Analyse data and report regularly

Strategies and Proposed Actions – next five years

1. Support research and investigations into key issues, working in partnership with scientific organisations

- Recreational water quality – predictive tools and source tracking
- Nutrients and organic matter – water column/sediment processes ; quantify diffuse sources
- Heavy metals – biological pathways and impacts; metal/organic matter interactions
- Catchment flows and inputs

2. Develop indicators and targets

- 'First pass' indicators and targets will be developed for recreational water quality, nutrients, heavy metals, habitat/species and catchment flows/loads.

3. Develop system models to address nutrients and organic matter

4. Carry out/support routine surveys and monitoring for water quality, sediments and biota

- Recreational water quality monitoring (weekly in summer)
- Seafood safety (flathead, oysters, mussels; other recreational species)
- Ambient water quality monitoring (monthly)
- Repeat surveys of subtidal habitat, sediment quality and benthic communities
- Baseline survey of coastal and riparian habitats
- Population surveys for iconic species (e.g. penguins, spotted handfish, platypus)
- Repeat survey for introduced marine pests; baseline survey for coastal weeds

5. Prepare Derwent habitat atlas

6. Compile/analyse data and prepare scientific reports

- Annual report cards
- State of the Derwent Report (2009)

Possible performance indicators/benchmarks

- Reports issued
- Scientific collaborations
- Research grants funded
- Scientific papers published

9. COMMUNICATIONS

Effective communications are essential to ensure that DEP partners and the wider community are regularly updated on program activities and outcomes and maintain commitment to the program. During the first few years of the DEP, communications were primarily achieved through periodic newsletters, the website, annual report cards and occasional media features. In 2005, the DEP partners agreed that a more proactive and comprehensive approach was needed and a three-year Communications Agreement was signed to implement this. A draft Communications and Marketing Strategy was prepared and a Communications Advisory Group was established to guide this work. As with the Monitoring Agreement, communications will now be integrated within the overall management plan.

The objectives of the communications and marketing strategy are multiple; first, to maintain and enhance stakeholder support for the DEP and to develop new partnerships and funding as needed to implement priority projects. Second, the communications strategy should increase awareness of the DEP as a broad-based and effective partnership with strong scientific credibility. And finally, the communications strategy should increase community understanding, awareness and enjoyment of the estuary and its foreshore, building greater ownership and pride. This will ultimately underpin the day-to-day behavioural changes and informed decision-making that will restore the Derwent in the longer term. Target audiences for communications include: current DEP stakeholders; community leaders, politicians and funding agencies; scientists and environmental managers; Derwent estuary user and community groups, and the wider community.

Communications activities carried out in the past few years have included annual ‘roadshows’ and presentations to DEP partners, a new website, quarterly electronic bulletins and publication of scientific reports including the annual Report Cards and five-yearly State of the Derwent report. In addition, the DEP issues regular media releases to keep the public up-to-date on key issues and projects and has achieved good television, radio and newspaper coverage.

Ultimately, however, if the long-term objective is to inspire ownership, pride and behavioural change, we need to get people out to experience and enjoy the estuary on a regular basis. This is one of the goals of the regional tracks strategy (see Section 6.2) and the Derwent interpretation plan. The interpretation plan was drafted in 2006 with input from community, government and industry stakeholders and sets out a series of themes to be used as a basis for regional interpretation activities and products. Priorities for implementation include innovative signage, self-guided brochures and a regional interpretation centre.

Further information on proposed communications and marketing objectives and actions is provided on the following page and in the 2009-2014 Action Plan.

Objectives for Communications (2025)

- Maintain / increase DEP stakeholder support, both in terms of funding and management actions
- Develop new partnerships to support priority projects
- Increase community awareness of the DEP partnership
- Maintain and enhance scientific credibility
- Increase community awareness and enjoyment of the Derwent estuary and foreshore
- Influence community behaviour and encourage informed decision-making

Strategies and Proposed Actions – next five years

1. Maintain and increase stakeholder support and develop partnerships with other organisations

- Continue annual roadshows
- Increase presentations and briefings to other organizations and individuals
- Develop and market major projects to prospective partners, including development of business plans where appropriate
- Hold a biennial cruise for DEP partners, community leaders, elected representatives, etc to showcase the Derwent and DEP initiatives.

2. Increase awareness of the DEP partnership

- Maintain consistent DEP brand via style guide, branding and communications protocols
- Maintain media campaign to ensure regular and proactive reporting on DEP issues and activities (television, radio and newspaper)
- Maintain DEP website and quarterly eBulletins and include DEP features in relevant professional and commercial newsletters
- Promote the DEP at relevant events, forums and workshops

3. Maintain/enhance scientific credibility

- Develop research partnerships with University of Tasmania/TAFI, CSIRO Marine Research and other scientific/educational institutions
- Participate in scientific conferences and workshops
- Publish scientific papers in peer-reviewed publications
- Continue publishing annual report cards and five-yearly State of Derwent scientific reports

4. Increase community awareness, use and enjoyment of the Derwent

- Implement key elements of the Derwent interpretation plan, including signage and self-guided brochures
- Scope out opportunities for a Derwent interpretations centre.
- Commence implementation of Foreshore Tracks Strategy (see Section 6.2)
- Support/sponsor activities to get people out on the Derwent

5 Focus on key issues and relevant user groups to motivate behavioural change

- Survey community to better understand concerns, understanding and behaviour.
- Develop targeted communications strategies to inform user groups and motivate change (e.g. target seafood safety messages at recreational fishers).

Possible performance indicators/benchmarks

- Number of annual roadshows and presentation
- eBulletin circulation
- community survey results

10. IMPLEMENTATION

One of the most difficult challenges in managing natural resources is to ensure that proposed management plans are in fact implemented. Publication of this management plan is merely a first step along the way. A review of estuary management programs, both in Australia and overseas, indicates that successful programs share a number of a number of common elements, in particular:

- broad ownership and support at the political, management and community levels;
- effective institutional arrangements to coordinate and focus stakeholder actions;
- committed individuals, including political and community 'champions' and dedicated staff;
- secure and adequate funding;
- a sound information base and a comprehensive monitoring system;
- regular review and reporting on actions and outcomes;
- some 'runs on the board' – building on a record of successes;
- commitment to sustained effort over an extended period of time (10 to 20 years);
- a flexible and adaptive approach.

The DEP seeks to integrate these elements with our program while recognising that – as with the proposed management strategies and actions – implementation arrangements may also evolve over time. Our overall implementation strategy is to adopt the DEP Management Plan as a dynamic and evolving document, and to implement it through a series of annual action plans. Funding for the action plans will be secured annually and leveraged to the degree possible through grant applications. Other funding opportunities will also be explored. Equally important is a structured process of review, revision and reporting, as well as the development of associated indicators and benchmarks.

10.1 Partnership agreements

Several high level partnership Agreements have been signed since the DEP was initiated, including the Implementation Agreement for the inaugural management plan (5 years), the Monitoring Agreement (5 years) and the Communications Agreement (3 years). The intent of this revised EMP is to consolidate the issues addressed by these agreements and to seek signature of a new 5-year Implementation Agreement.

The DEP Partnership Agreement is essentially a high-level statement of political will, signed by the Premier, Mayors and directors of major industries/utilities. The Agreement endorses the EMP and signifies a commitment to the management framework and resources required for its implementation. While non-statutory, the Agreement nonetheless highlights the importance of the Derwent and represents a public commitment to its long-term management and restoration.

10.2 Institutional arrangements

The institutional arrangements set out in the original EMP have generally proved to be effective and will be retained with minor modifications. As illustrated in the following figure, the DEP management structure consists of a high level Steering Committee (Secretary DEPHA, council General Managers and industry CEOs) and a Technical Working Committee (senior technical, planning and environmental staff). These committees meet quarterly to review the full range of issues and projects. Issue-specific Working Groups focus on key activities such as monitoring, communications, stormwater and tracks. This three-tiered structure provides both good vertical integration and flexibility, as additional participants can be included in the various groups as required to address and resolve specific issues.

The respective roles and responsibilities of the major stakeholder groups – State Government, Local Government, Private Sector, Voluntary Sector and Community - are outlined in Figure __. Each has their role to play in managing the Derwent and it will be their collective efforts that ultimately improve the environmental quality of the estuary.

The staff of the DEP secretariat manage the day-to-day activities of the program, including committee support, project management, grant-writing, monitoring and communications.

10.3 Links and integration with other plans and strategies

An essential element of implementation is the development of links with policy- and decision-makers to ensure that DEP objectives and strategies are widely communicated and incorporated within the various State and Local Government agencies and departments ('horizontal integration'). It is also important that DEP objectives and strategies are progressively integrated into State, Regional and Local Government statutory policies, plans and work programs and that links are also developed with site-specific Environmental Management Plans for major industries, sewage treatment plants and other large-scale facilities.

An important objective for the DEP is to ensure that our plan and strategies link clearly with the regional Natural Resource Management Strategy for Southern Tasmania (NRM South 2004) as well as with strategic plans currently being developed for the Derwent catchment (e.g. Hobart Water, Hydro, Derwent Catchment NRM and Greening Australia River Recovery). In addition, the Derwent estuary plan and strategies need to be integrated with regional coastal plans and strategies (e.g. Northwest Bay, D'Entrecasteaux Channel and regional marine planning initiatives).This may be best achieved by ensuring DEP representation on relevant committees and participation in strategic planning processes.

10.4 Resources and financing

Improved management and restoration of the Derwent estuary will require a long-term and sustained commitment. Some of our environmental problems are severe and difficult to remedy, and the resources available for the task are limited. It is therefore essential that existing resources are used efficiently and effectively, and leveraged to the maximum degree possible.

In many ways, the program's 'core business' of coordination, fund-raising, monitoring, and communications will ultimately drive implementation, and for the long-term success of the program, it is essential that this 'core business' be financially sustainable by the stakeholders within the region. With this secure base, additional funds can then be raised to implement specific projects, as agreed by the stakeholders. There are also many funding opportunities at the Commonwealth, State and regional levels that can be effectively targeted, such as the Natural Heritage Trust, regional NRM and other programs.

Resourcing requirements will be addressed annually through the development and adoption of annual action plans and associated budgets. Action plan budgets will include funding to maintain DEP core business as well as to implement specific priority projects. Opportunities to raise external funding will also be identified within the action plan and actively pursued.

Figure __ DEP Management Structure

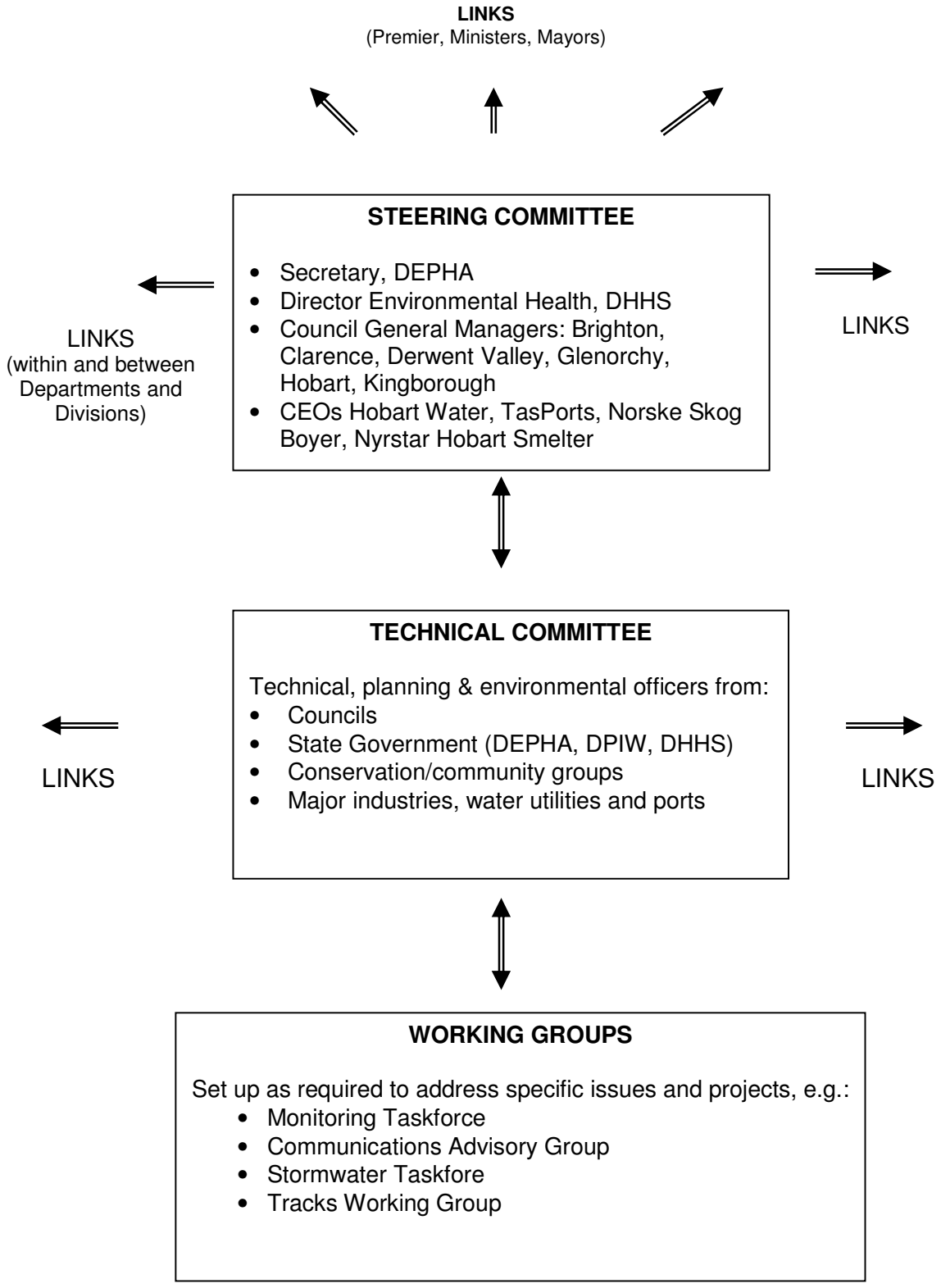


Figure 4: Roles and Responsibilities of Derwent Estuary Program Stakeholders

State government
A number of DEP objectives, strategies and projects overlap with state government policies and actions, particularly within DEPHA, DPIW, DHHS, DIER, MAST and DSD. State Government agencies should:

- Ensure that the issues concerning the Derwent estuary are considered in the development of policy;
- Work together to encourage coordinated and integrated delivery of state and regional policies;
- Incorporate DEP objectives, strategies and actions into state, regional and local programs and business plans;
- Adopt a consistent approach to the estuary across departments;
- Provide funding and in-kind support for core DEP business and implementation of priority projects;
- Provide advice, guidance and data on issues concerning the estuary;
- Actively participate in DEP committees.

Environment Protection Authority
The EPA regulates Level 2 activities, including industries and wastewater treatment plants that fringe the Derwent Estuary. Permit conditions relate to monitoring requirements, effluent quality and the management of emissions. The EPA can support the objectives of the DEP by:

- ensuring that, through the enforcement of permit conditions, industries operate at environmentally sustainable levels;
- ensuring that environmental harm through emissions to the Derwent is prevented.

Local Government
The six councils that border on the Derwent play a vital role the management of the estuary through their planning, management and operational roles, Councils should:

- Ensure that the issues concerning the Derwent estuary are considered in the development of planning schemes and development control practices;
- Incorporate DEP objectives, strategies and actions into council strategic plans and operational plans;
- Adopt a consistent approach to the estuary across departments and within regional authorities;
- Provide funding and in-kind support for core DEP business and implementation of priority projects;
- Provide advice, guidance and data on issues concerning the estuary;
- Actively participate in DEP committees.

Private Sector
The private sector – including industry, shipping, water utilities and commerce - has a major role to play within the estuary and can enhance the DEP in a number of ways. The private sector should:

- Incorporate DEP objectives, strategies and actions into EMPs, work programs and business plans;
- Minimise adverse impacts by implementing best practice environmental management practices;
- Provide funding and/or in-kind support for core DEP business and implementation of priority projects;
- Provide advice, guidance and data on issues concerning the estuary;
- Actively participate in relevant DEP committees.

Voluntary Sector
Voluntary groups, including nature conservation groups, heritage groups, sports clubs and others collectively have a substantial stake in the management of the estuary. There are over 35 Landcare, Coastcare, Bushcare, Waterwatch and other environmental community groups working in the area. Voluntary groups can support the objectives and strategies of the DEP by:

- Helping to conserve and manage the estuary through practical action;
- Seeking outside funding for specific projects;
- Incorporating DEP objectives, strategies and actions into their work programs;
- Actively participating in relevant DEP committees.

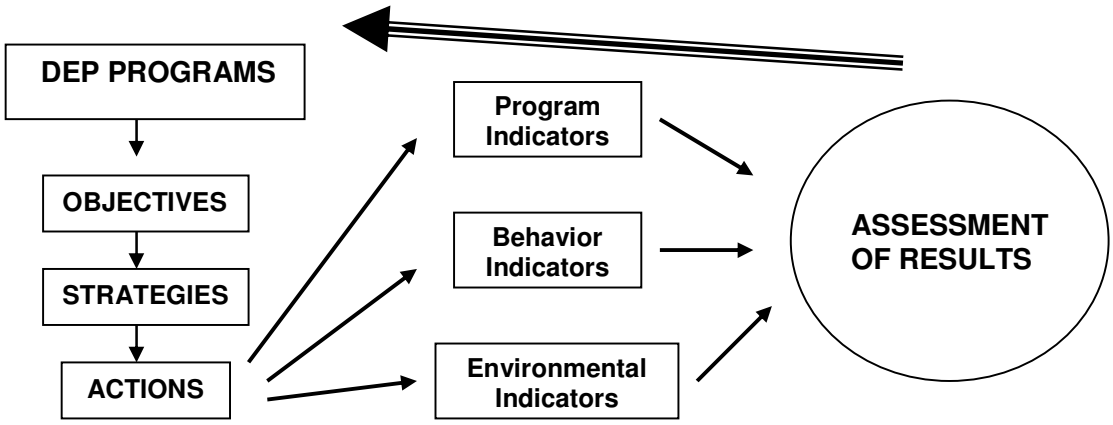
Local Communities and Individuals
The Derwent estuary is home to nearly 200,000 people, and collectively, we play potentially the largest role in managing the estuary through our personal actions and choices. Local communities and individuals can support the objectives and strategies of the DEP by:

- Becoming informed about the Derwent ;
- Minimising adverse effects on the estuary through personal actions and choices;
- Getting involved in community groups and projects;
- Ensuring that elected representatives are aware of community concerns and act accordingly.

10.5 Monitoring, review, revision and reporting

Monitoring and targeted research are essential elements of environmental management, clarifying the issues and their causes, informing our actions, evaluating our successes and failures and providing a critical feedback loop to our original objectives and strategies. The DEP Monitoring and Science Plan provides a framework for coordinated monitoring and reporting and is discussed in more detail in Section 8.

Development of specific indicators, environmental objectives and interim benchmarks for the Derwent has been identified as a high priority in this management plan and will be advanced as part of the implementation strategy. The use of these indicators to monitor, assess and report on the effectiveness of management actions is an integral component of 'adaptive management', as illustrated in the diagram below. It is anticipated that several different types of indicators may be developed, including program indicators (e.g. total funds raised), behavior indicators (e.g. annual pollutant loads discharged) and environmental indicators (e.g. zinc levels in oysters).



Periodic review and revision of the overall management plan, management strategies and proposed actions is essential. An implementation review is proposed to be carried out biennially, with a detailed review and revision of the management plan every five years.

Information about program goals, strategies, actions and outcomes will be communicated by way of annual program and monitoring reports, newsletters, the Derwent Estuary Program's internet site and public forums and presentations.

11 ACTION PLAN 2009 TO 2014

REDUCING AND MANAGING POLLUTION

Improving recreational water quality

	Priority			Key stakeholders
Actions	**H**	**M**	**L**	
Improve public information • Annual Derwent Swim Guide report/feature • Weekly Beachwatch report/website • Develop & install signage	X			DEP, DHHS, Councils
Improve water quality at D- and C-rated beaches • Targeted investigations & follow-up actions at Nutgrove, Howrah, Bellerive and Kingston beaches	X			Councils, DEP
Improve water quality at D-rated bays • Targeted investigations & follow-up actions at Marieville, Cornelian, Newtown, Elwick and Watermans Dock.		X		Councils, DEP

Reducing and managing heavy metal contamination

Actions	**H**	**M**	**L**	**Key stakeholders**
Reduce heavy metal loads from industries *(see Managing industrial discharges)*	X			Nyrstar Hobart Smelter, EPA, DEP
Improve public information on seafood safety • Regular seafood safety reports/features • Develop & install signage	X			DEP, DHHS, Councils, Nyrstar
• Develop Derwent dredging and reclamation guidelines to minimize disturbance of contaminated areas	X			DEP, DEPHA

Preventing Eutrophication

Actions	**H**	**M**	**L**	**Key stakeholders**
Develop nutrient indicators, targets, models and Decision Support System	X			DEP, DEPHA, councils, CSIRO
Reduce organic and nutrient loads from industries *(see Managing industrial discharges)*		X		Norske Skog, EPA, DEP
Reduce/maintain nutrient loads from sewage treatment plants *(see Managing sewage treatment plants)*		X		Councils, EPA, DEP

Managing Sewage Discharges

Actions	**H**	**M**	**L**	**Key stakeholders**
Report annual pollutant loads discharged by sewage treatment plants	X			DEP, EPA, Councils
Reduce/no net increase in nutrient loads from sewage treatment plants until targets have been established	X			Councils, EPA, DEP
Reduce sewage spills & stormwater cross-connections, with a focus on risks to recreational areas	X			Councils, EPA, DEP
Investigate and promote effluent reuse • Review/report on effluent reuse via current schemes • Support/facilitate funding applications		X		Councils, EPA, DEP
Improve trade waste management		X		Councils, industries, DEPHA, DEP

Managing Industrial Discharges

	Priority			Key stakeholders
Actions	**H**	**M**	**L**	
Report annual pollutant loads discharged by industries	X			DEP EPA, industries
Reduce pollution loads from major industries • Nyrstar Hobart Smelter – capture and treat heavy metal-contaminated groundwater and stormwater • Norske Skog Boyer – continue emission reductions through wastewater treatment and process changes	 X X			 Nyrstar, DEPHA Norske Skog, DEPHA
Review/report on emissions and site run-off from smaller scale industries (Level 2 and Level 1)		X		DEP EPA, councils, industries
Review/report on potential risks from historic contaminated sites bordering on the Derwent		X		DEP EPA, councils

Managing Urban Run-off

Actions	**H**	**M**	**L**	**Key stakeholders**
Model, monitor and prioritise stormwater catchments	X			DEP councils, DEPHA
Promote WSUD in new developments	X			DEP councils, DEPHA
Seek opportunities to retrofit stormwater projects in priority catchments		X		DEP councils, DEPHA
Target land uses and practices that generate stormwater pollution • Construction sites • Road runoff • Commercial & industrial areas	X			DEP councils, DEPHA
Prepare and implement stormwater management plans		X		DEP councils, DEPHA
Stormwater education and information • Professional development & training courses	X			DEP councils, DEPHA

Managing Boat Wastes

Actions	**H**	**M**	**L**	**Key stakeholders**
Investigate current practices, needs and impacts		X		DEP, DEPHA, MAST TasPorts, Councils
Facilitate adoption of slipway guidelines, other BMPs and provision of facilities	X			EPA, DEP, Councils, TasPorts, MAST
Education and awareness-raising • Recreational boating & fishing guide		X		DEP, MAST, DEPHA, Councils, TasPorts

NATURAL SYSTEMS

Conserving and Enhancing Estuarine Habitat and Species

	Priority			Key stakeholders
Actions	**H**	**M**	**L**	
Prepare Derwent Conservation Action Plan as a basis for setting priorities and focusing actions	X			DEP
Develop/implement management strategies for critical habitats • Upper Derwent wetlands/seagrasses • Ralphs Bay tidal flats & saltmarshes • Lower Derwent rocky reefs		X		DEP, DEPHA, DPIW
Management of iconic/threatened species • Spotted handfish • Little penguins	X	X		DEP, DEPHA, DPIW
Education & interpretation • Derwent habitat atlas • Focus on key species (birds, fish)	X	X		DEP, DEPHA

Enhancing Recreational Fisheries

Actions	**H**	**M**	**L**	**Key stakeholders**
Survey and monitor migratory fish and barriers to migration • map existing barriers and critical habitats		X		Inland Fisheries DEP, TCT
Education & promotion • Public information about seafood safety • Derwent recreational fishing guide	X	X		DEP, Fishcare, DHHS

Managing Introduced Species

Actions	**H**	**M**	**L**	**Key stakeholders**
Control weeds and pests at key sites • Eradicate rice grass	X			Land managers & Community groups DEP
Prevention • Analyse risks • Emergency response plan • Slipway management		X		DPIW/DEP TasPorts, industries
Support regional IMP & weed management activities		X		Land managers & Community groups

Managing environmental flows and catchment water quality

Actions	**H**	**M**	**L**	**Key stakeholders**
Develop catchment environmental flows and water quality indicators, targets, models and DSS	X			DEP, DPIW, DEPHA, Hobart Water, Hydro, Derwent NRM, councils
Coordinated management framework • Participate in regional initiatives	X			DEP, DPIW, DEPHA, Hobart Water, Hydro, Derwent NRM, councils
Environmental flows • Support actions to conserve water & enhance flows		X		DPIW DEP, Hydro
Catchment water quality • Support actions to improve water quality		X		DPIW, DEPHA DEP, Hobart Water, Hydro

FORESHORE USE, ACCESS & AMENITY

Foreshore planning and development

	Priority			Key stakeholders
Actions	**H**	**M**	**L**	
Foreshore information systems • Compile Derwent foreshore GIS database	X			DEP
Regional vision & planning framework	X			DEP
Planning and assessment tools • Reclamation guidelines • Sea level rise • Foreshore structures		X		DEP, Crown Lands, Councils
State of Derwent reporting (expand to include foreshore)	X			DEP

Foreshore access, open space and tracks

Actions	**H**	**M**	**L**	**Key stakeholders**
Refine and implement regional tracks strategy	X			DEP Councils, PWS
Develop regional open space strategy		X		DEP PWS, Crown Lands, Councils
Support land manager & community management of foreshore parks and reserves		X		Councils, PWS DEP

Foreshore and maritime heritage

Actions	**H**	**M**	**L**	**Key stakeholders**
Implement high priority actions from Derwent Interpretations Plan	X			DEP Councils, PWS
Improve heritage information		X		
Support local initiatives and regional approach		X		DEP DEPHA, TMAG, Councils

CLIMATE CHANGE

Actions	**H**	**M**	**L**	**Key stakeholders**
Prepare issues and options paper and identify high priority actions for DEP support	X			DEP
Support/participate in regional/state initiatives		X		State Government, CCC DEP

MONITORING AND INVESTIGATIONS

	Priority			Key stakeholders
Actions	**H**	**M**	**L**	
Continue summer recreational water quality monitoring program (weekly); incorporate rainfall response analyses & predictive models	X			DEP, DHHS, DEPHA, Councils
Continue ambient water quality monitoring (monthly)	X			DEP, DEPHA, Norske Skog, Nyrstar, Hobart Water
Survey/monitor sediment quality		X		DEP, DEPHA
Survey/monitor critical habitats, e.g. • foreshore vegetation • wetlands & salt marshes • tidal flats • seagrasses • rocky intertidal and reefs	 X X	 X X X		DEP, DPIW, TAFI
Survey/monitor keystone and protected species, e.g. • fish • birds • invertebrates • spotted handfish • little penguins • platypus	 X X X	 X X X		DEP, DPIW, TAFI, CSIRO
Investigate heavy metals and biota (bioaccumulation and toxicity) • survey metal levels in seafood/other biota • continue/enhance caged oyster experiments • investigate food chain pathways • investigate toxicity and benthic communities	 X X X	 X		DEP, DEPHA, DPIW, DHHS, TAFI
Investigate nutrient processes and how system responds to changing inputs	X			DEP, DEPHA, TAFI
Investigate primary production/response, e.g. distribution/biomass of seagrasses, macroalgae, phytoplankton and microphytobenthos		X		DEP, DEPHA, TAFI
Survey/monitor marine pests and coastal weeds	X			DEP, DPIW
Review/enhance catchment monitoring and reporting	X			DEP, DPIW, DEPHA, Hobart Water, Hydro
Review/enhance Channel & Storm Bay monitoring and reporting	X			DEP, DPIW, DEPHA

COMMUNICATIONS

	Priority			Key stakeholders
Actions	**H**	**M**	**L**	
Maintain/increase stakeholder support				
• Roadshows, presentations and briefings	X			DEP
• Derwent cruise (biennial)	X			
Increase awareness of Derwent issues and DEP partnership				
• Calendar of regular media releases	X			DEP
• Maintain/enhance DEP website and eBulletin	X			
• Promote DEP at events and forums	X			
• Repeat community survey (3 yearly)		X		
Maintain/enhance scientific credibility				
• Produce Annual Report Card	X			DEP
• Issue 5-year State of Derwent report and hold Derwent Science Management conference	X X			TAFI, CSIRO
• Enhance research partnerships with UTas/TAFI and CSIRO	X X			
• Participate in conferences and workshops		X		
• Publish in peer-reviewed journals				
Increase community awareness, use and enjoyment				
• Implement priority actions from Derwent Interpretation Plan	X			DEP
• Scope/pursue opportunities for a Derwent interpretation centre		X		
• Sponsor/support activities to get people out on the estuary	X			

APPENDIX 1 : DERWENT ESTUARY PROGRAM PARTICIPANTS

Steering Committee	Technical Working Group
• Scott Gadd, Secretary, DEPHA (Chair) • Andrew Paul, General Manager, Clarence City Council • Christine Mucha, CEO, Hobart Regional Water Authority • Stuart Heggie, Director of Environmental Health, DHHS • Brent Armstrong, General Manager, Hobart City Council • Stephen Mackey, General Manager, Derwent Valley Council • John Laugher, Norske Skog Paper Mills (Australia) • Frank Pearce, General Manager, Glenorchy City Council • Francis Terwinghe, General Manager, Nystar Hobart • Ron Sanderson, General Manager, Brighton Council • Tony Ferrier for General Manager, Kingborough Council • John Lister, Tasmanian Ports Corporation	• John Johnson, TasPorts • Jon Doole, Kingborough Council • Christian Bell, Tasmanian Conservation Trust • Andrew MacDonald, Glenorchy Council • Todd Milne, Nyrstar Hobart Smelter • Alistair Morton, Marine Resources, DPIW • Oliver Heywood, Brighton Council • Chris Rees, Coastal Env/DTAE • Des Richardson, Norske Skog Boyer • Ed Kleywegt/Mat Willis, Hobart City Council • Phil Watson, Clarence City Council • Steven Joyce, Derwent Valley Council • Stephen Pratten, Environment Division, DEPHA • Andy Crawford, Hobart Water

Monitoring Task Force	Stormwater Task Force
• Greg Napthali, Analytical Services Tasmania • Peter Kearney, Norske Skog Paper • John Fawcett, Clarence City Council • Karen Wild-Allen, CSIRO • Lance Stapleton, Hobart Water • Bronwen Tassell, Hobart Water • Merv Kershaw, Tasmanian Conservation Trust • Martin Bicevskis, DHHS • Des Richardson, Norske Skog Paper • Jon Doole, Kingborough Council • Catriona Macleod, TAFI • Mark Dwyer, Hobart City Council • Andrew Crawford, Hobart Water • Todd Milne, Nyrstar Hobart Smelter • Andrew MacDonald, Glenorchy City Council • Phillip Bingley, Derwent Valley Council • Ron Vanderwal, Clarence City Council • Greg Dowson, DEPHA • Brent Basstian Brighton Council	• Oliver Hayward, Brighton Council • Mike Burdon, Glenorchy City Council • Glen Tatnell, Glenorchy City Council • Matt Willis, Hobart City Council • John Fawcett, Clarence City Council • Ted Ross, Dept Infrastructure, Energy & Resources • Scott Rowell, Hobart City Council • Matthew McCrossen, Sullivans Cove Waterfront Authority • Kaylene Allan, NRM South • Abyilene Dobson, Kingborough Council • Alex Woodward, Kingborough Council