State of the Derwent
Year 2000 Report Card

The Derwent Estuary

The Derwent Estuary lies at the heart of the Hobart metropolitan area and is an asset of great natural beauty and diversity. Named for the Celtic word 'clear water' in 1794, the Derwent is an integral part of Tasmania's cultural, economic and natural heritage. The estuary is an important and productive ecosystem and supports a wide range of habitats and species.

Approximately 40% of Tasmania's population - 175,000 people - live around the estuary's margins. The Derwent is widely used for recreation, boating, fishing, marine transport and industry. Further upstream, the Derwent River supplies the majority of the region's drinking water supply and is an important source of hydroelectric power.

A number of environmental issues affect the Derwent Estuary, in particular:

- heavy metal contamination;
- introduced marine pests;
- loss of estuarine habitat and species;
- intermittent faecal contamination of recreational waters;
- depressed oxygen levels and organically enriched sediments;
- elevated nutrient concentrations;
- environmental flows and barriers.

Although there have been significant improvements in the treatment of sewage and industrial wastes over the past decade, the Derwent remains a significantly degraded estuary. A strategic and coordinated planning approach across all levels of government, industry and the community is our best hope for a clean and healthy estuary in the future.

Management and restoration

The Derwent Estuary Program (DEP) – a joint State, Local and Commonwealth Government initiative to restore and protect the Derwent Estuary – started in 1999.

The program was initially designed to address environmental quality issues such as industrial and urban water pollution, contaminated sediments, introduced species and loss of estuarine ecosystems. More recently, foreshore issues have also been added to the program.

The goal of the first two years of the DEP has been the development of a coordinated environmental management strategy for the Derwent Estuary, together with agreements for the implementation of specific projects.

In addition to the three levels of government, many other stakeholders play an active role, including industries, community groups and research institutions. The first two years of the Program have been largely funded by a coastal planning grant from *Coasts and Clean Seas* – a program of Australia's Natural Heritage Trust. Additional financial support has been provided by Tasmania's Department of Primary Industries, Water and Environment and by the local government councils of Brighton, Clarence, Derwent Valley, Glenorchy, Hobart and Kingborough.

DERWENT ESTUARY PROGRAM

Environmental monitoring and reporting

A fundamental requirement for effective natural resource management is an on-going and reliable source of environmental data.

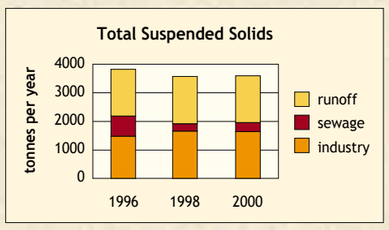
This principle formed the basis of the Derwent Estuary Monitoring Agreement, signed in August 2000 by the state government, six local councils and three industrial and commercial partners (Norske Skog Paper, Pasminco Hobart Smelter and Hobart Water). The signatories agreed to coordinate their independent monitoring programs to provide better information on the estuary as a whole, and to report annually on environmental conditions and trends in the Derwent.

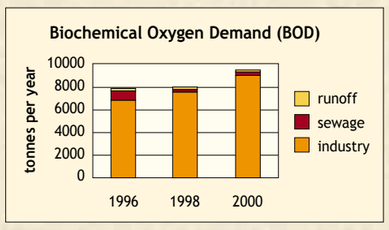
This document represents our first annual 'report card' to the community and summarises monitoring data and other relevant information collected during the year 2000.

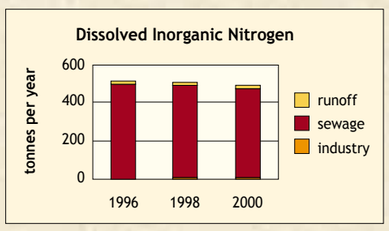
Monitoring activities carried out during 2000 included the following:

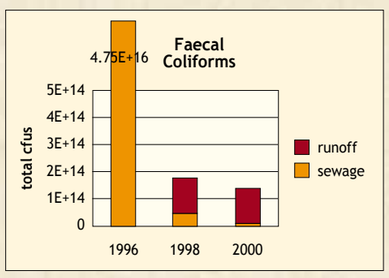
- weekly recreational water quality testing during summer months;
- quarterly water quality monitoring for a wider range of indicators;
- an annual survey of mercury in flathead and heavy metals in shellfish;
- a baseline survey of estuarine habitat types and distribution;
- a baseline survey of estuarine sediment quality.

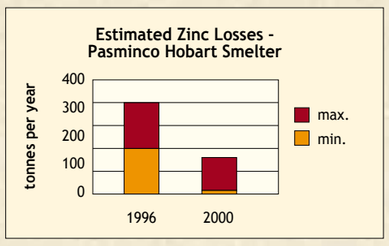
Pollution Sources, Loads and Trends 2000











Pollution enters the Derwent Estuary from a variety of sources that are commonly referred to as point sources or diffuse sources.

During 2000, point sources included 10 sewage treatment plants and two large industries (Norske Skog paper mill and Pasminco Hobart zinc smelter). Diffuse sources included urban runoff, tips and contaminated sites, catchment inputs carried by the Derwent and Jordan Rivers, air pollution, and wastes associated with shipping, ports and marinas. Some pollutants are also derived from contaminated sediments within the estuary itself.

Contaminants associated with these various sources include pathogens, nutrients, organic matter, wood extractives such as resin acids, silt, litter, and a range of toxicants including heavy metals and hydrocarbons.

A review of the various sources and loads discharged to the Derwent indicates that, during 2000:

- Sewage treatment plants discharged the majority of nutrients;
- Stormwater accounted for the majority of faecal bacteria;
- Pasminco discharged the majority of heavy metals (primarily as groundwater emissions);
- Norske Skog discharged the majority of organic matter and resin acids.

Pasminco

Pasminco landfill rehabilitation

A review of recent trends reveals that, since 1996, there have been significant reductions in pollutant loads to the Derwent, particularly heavy metals discharged by industry (greater than 50% reduction) and faecal bacteria discharged by sewage treatment plants (greater than 90% reduction).

These have resulted to a large degree from site improvements at the Pasminco Hobart Smelter and from improved treatment and effluent reuse at several sewage treatment plants (particularly Sandy Bay/Selfs Point, Brighton/Bridgewater and Rokeby). Organic matter loads (BOD) have increased by about 13% during this time, associated with increased production at the Norske Skog paper mill.

New Town Rivulet in flood

Environmental Flows and Barriers

The Derwent is the largest river in southeastern Tasmania, with a mean annual flow of 90 cubic metres/second. The river is heavily used for hydropower generation, public and industrial water supplies, fish farms and irrigation. Since the 1920s, about 30% of the river's original flows have been lost.

Freshwater flows from the Derwent play an essential role in the condition of the estuary, driving the overall circulation, providing flushing flows, determining the location and type of habitat, and the timing and extent of migratory fish runs. The Derwent Estuary Program has identified the management of freshwater flows and physical barriers to fish migration as important issues in the region.

Derwent Water and Sediment Quality 2000

Is recreational water quality improving or declining?

Each summer, recreational water quality is measured weekly at about 30 sites around the Derwent (see map on flip side for specific locations). Two bacterial indicators are used, as recommended by national guidelines: faecal coliforms and enterococci. Enterococci is increasingly considered to be the preferred indicator in coastal waters.

Results over the last 12 years have shown progressive improvements in water quality as sewage treatment plants have been upgraded, particularly in the middle and upper parts of the estuary. The Jordan River and Browns River have also seen marked improvements in recent years.

During the past 3 years, most sites have met recreational water quality guidelines for primary contact – particularly the main recreational beaches to the south of the Tasman Bridge. However, it is strongly recommended that swimming and other full-immersion sports be avoided for several days following heavy rains and at all times near rivulets and major stormwater outfalls.

Recreational water quality data for the 2000/2001 season is difficult to interpret due to occasional high levels of *Klebsiella* bacteria (see box below).

Are other indicators of water quality improving or declining?

Long-term data sets for ***heavy metals*** suggest significant decreases in water column concentrations of zinc, cadmium and other metals over the past thirty years. New Town Bay has shown significant reductions in water column zinc levels since a cut-off wall was installed between the Pasminco landfill and estuary in 1997.

Dissolved oxygen levels in the upper estuary have improved since the pulp mill at Boyer implemented primary treatment in 1990, but oxygen levels are still low at depth during summer months and low flow conditions. This is probably due in part to a natural tendency towards oxygen depletion in the upper reaches of stratified estuaries, combined with the effects of the pulp mill effluent.

Nutrient and chlorophyll a data is more difficult to interpret due to a shorter record and considerable natural variability. Nutrient levels are somewhat elevated at mid estuary sites, however, chlorophyll *a* levels are usually moderate to low. There are no clear trends for most of the estuary, with the exception of Prince of Wales Bay, where levels appear to have doubled over the past 4 years.

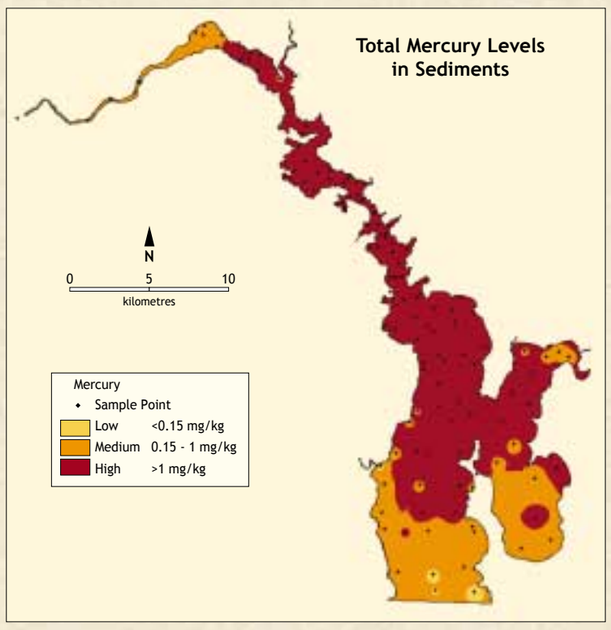
Is the area of contaminated sediments increasing or decreasing?

A detailed survey of sediment quality was completed for the entire Derwent in 2000, consisting of 123 short cores. Results indicate that the majority of sediments within the Derwent do not meet proposed sediment quality guidelines for a number of trace metals, particularly for mercury, lead, zinc and cadmium. Sediments are also highly enriched in organic matter.

Area of Derwent Estuary sediments as compared to probable ecological effects guidelines.

Metal	negligible effects	low to medium	medium to high
Mercury	1%	34%	65%
Lead	23%	38%	39%
Zinc	32%	20%	48%
Cadmium	36%	52%	12%
Copper	74%	23%	4%
Arsenic	79%	14%	7%

Restoration of contaminated sediments is technically challenging and very costly. Further information is needed on sediment toxicity, sediment-water fluxes of heavy metals and current sedimentation rates before the effectiveness of potential remediation options can be evaluated.



Klebsiella – The Sewage Spill That Wasn't?

On 29 January 2001, routine monitoring picked up very high levels of faecal coliforms in the upper estuary, decreasing in a downstream direction. Levels at several popular swimming beaches were also elevated. In contrast, levels of the second indicator (enterococci) were low throughout the estuary. No significant sewage spill had been reported, however, as a precautionary measure, the beaches at Nutgrove, Little Sandy Bay and Bellerive were temporarily closed.

Subsequent investigations revealed that a type of bacteria commonly found in pulp mill effluent *(Klebsiella)* may have resulted in a false positive test for faecal coliforms. International studies indicate that this type of bacteria is not considered to be a significant public health problem in recreational waters. Continued monitoring has shown that effluent from the Norske Skog paper mill at Boyer is a significant source of *Klebsiella* to the upper estuary, with occasional pulses extending as far down as the Tasman Bridge. This situation has not been documented in previous years' monitoring and may be linked to unusually warm weather conditions.

The state government, councils and Norske Skog Boyer are currently working together to enhance the recreational water quality monitoring program to better reflect potential risks to public health.

Derwent Habitat and Species 2000

Are contaminant levels in seafood increasing or decreasing?

Pasminco Hobart Smelter has monitored mercury levels in Derwent Estuary flathead for 19 years. The results indicate that mercury levels in flathead are currently well below National Food Guidelines and continue to decline.

Heavy metals in Derwent Estuary shellfish have been monitored by Pasminco for 10 years. Results indicate that heavy metal levels in mussels and oysters have not declined consistently, though there have been some promising reductions in certain regions (e.g. above Tasman Bridge) for specific metals (e.g. zinc, cadmium).

At present, shellfish should not be harvested/consumed from any areas of the Derwent (including Ralphs Bay) as heavy metal levels are from two to ten times in excess of the National Food Guidelines. Other contaminants (e.g. pesticides and PCBs) and other seafood types (range of fish, crays, abalones) have not been surveyed in Derwent Estuary.

Is fish and wildlife habitat increasing or declining?

During 2000, a detailed baseline survey of Derwent Estuary habitats was completed by the Tasmanian Aquaculture and Fisheries Institute (University of Tasmania). This survey provides our first 'snapshot' of existing habitat types and their distribution (wetlands, brackish and marine, seagrasses and rocky reefs/macroalgae).

G. Edgar

Wetlands and brackish seagrasses were found to cover large areas of the upper estuary, and several significant areas of rocky reef habitat were mapped in the lower Derwent (particularly along the western shoreline). Marine seagrass beds were relatively rare, while unvegetated, soft-bottom habitats were by far the most abundant (96% of total area).

Several previous and on-going studies and anecdotal information suggest that wetlands and seagrass beds may have been more abundant in the past and sediments were considerably sandier.

Are marine pests increasing or decreasing?

Introduced marine pests pose a serious threat to the overall ecology and native species of the Derwent Estuary. Over 20 introduced marine species have been identified in the Derwent Estuary and there are probably many more unrecorded species. Many of these species appear to flourish in the Derwent, taking advantage of the disturbed or altered environment. The northern Pacific seastar *(Asterias amurensis)*, Japanese seaweed *(Undaria pinnatifida)* and toxic dinoflagellate *(Gymnodinium catenatum)* are of greatest concern.

Northern Pacific seastar populations are extremely high (estimated 3 million), but seem to be stable or declining, possibly because their preferred prey (bivalves) is declining.

Japanese seaweed is well-established in the Tinderbox Marine Reserve, but does not appear to have spread further north into the Derwent at the present time.

Toxic dinoflagellates bloom periodically in the Derwent (and the Huon) and are sometimes called 'red tides'. These single-celled organisms accumulate in shellfish and if eaten by humans can cause Paralytic Shellfish Poisoning, a potentially fatal condition.

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Platypus

Ecological Risk Assessment - Norske Skog Paper

In March 1999, the pulp and paper mill located at Boyer commenced a 1.7 million dollar Ecological Risk Assessment (ERA) of the impacts of the mill's effluent on the estuary between New Norfolk and Bridgewater. The assessment is now near completion and has included detailed studies of water and sediment quality, toxicity testing, nutrient cycling and biogeochemical processes; biological surveys of fish, invertebrates and wetlands; and extensive modeling. The outcome will be an improved understanding of upper estuary ecology, together with an assessment of risks of the existing discharge to this system. The ERA will be used in optimising future effluent treatment options for the mill's main effluent stream.

Seagrasses

G.Edgar

New Norfolk

New Norfolk

Norske Skog Paper

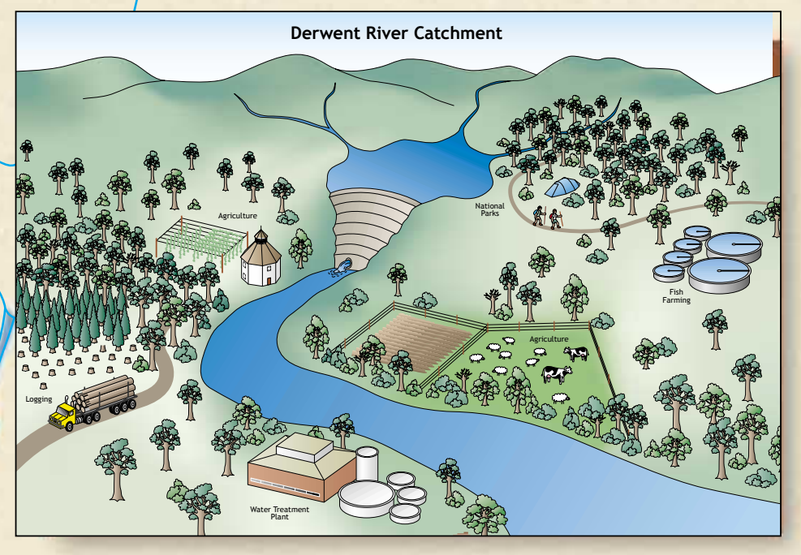
Black Swans

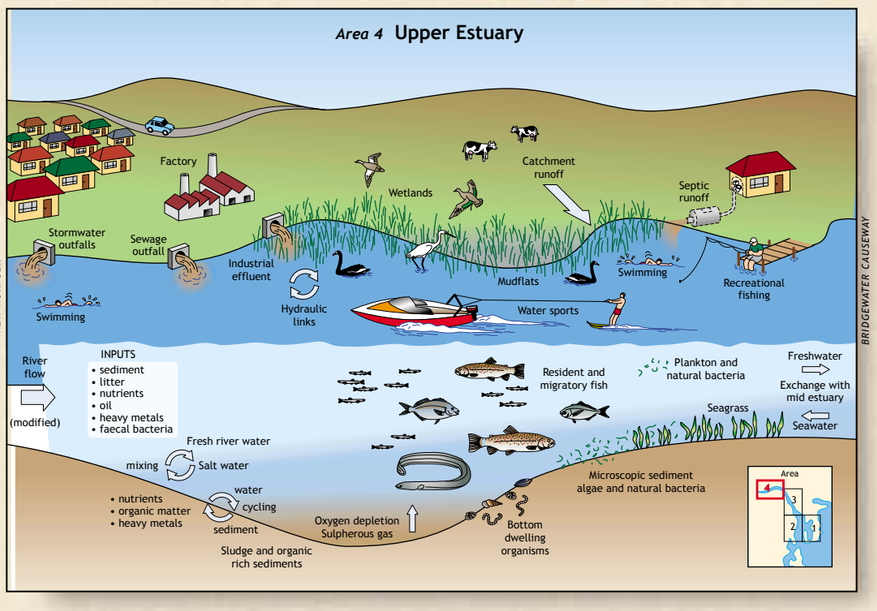
Bridgewater

Bridgewater Causeway

River Jordan

Derwent River Catchment





Austins Ferry

Old Beach

Claremont

Dogshear Point

Cameron Bay

RIVER

Bowen Bridge

GLENORCHY

East Risdon

Prince Of Wales Bay

Pasminco Hobart Smelter

Moonah

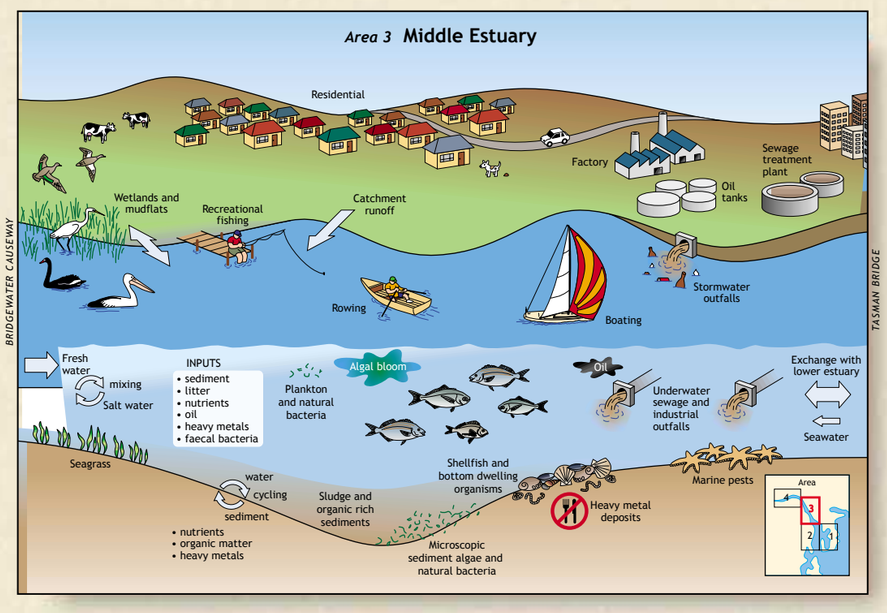
Selfs Point

New Town

Total Effluent Reuse - Brighton Council

In December 1999, the Brighton Council achieved its goal of eliminating all sewage discharges to the Derwent Estuary. This was accomplished through the reuse of sewage effluent, first from the Brighton sewage lagoon (1998) and then from the larger Bridgewater sewage treatment plant (1999). Some stormwater is also being captured and reused as part of this project. The total volume of effluent being reused is 2.3 ML per day. This water will assist the economic viability of some 1000 hectares of farmland with cropping of vegetable seeds, poppies, fodder crops and other specialist products.

Natural Heritage Trust



Derwent Estuary Habitat and Sediment Quality Surveys

During 2000, a detailed baseline survey of estuarine habitats was completed by the Tasmanian Aquaculture and Fisheries Institute (TAFI) at the University of Tasmania. This survey provides our first 'snapshot' of existing habitat types and their distribution, including wetlands, brackish and marine, seagrasses and rocky reefs/macroalgae and unvegetated soft-bottom habitats. At the same time, a detailed survey of sediment quality (grain size, organic matter and heavy metals) was completed, consisting of 123 short cores. This survey was supported by DPIWE, Pasminco and TAFI/University of Tasmania.

Coasts & Clean Seas

Rehabilitation of New Town Bay Landfill and Storage Area - Pasminco Hobart Smelter

This 10 ha industrial landfill and waste storage area adjacent to New Town Bay has been a significant historic source of heavy metal contamination to the Derwent due to groundwater contamination, stormwater runoff and blowing dust. In March 2001, Pasminco completed a major 3-year project that has significantly reduced contaminant losses from this area at a total cost of 5.8 million dollars. Elements include:

- construction of a cut-off wall between the landfill/storage area and the estuary;
- placement of contaminated soils within a 2.2 ha secure, lined landfill with clay capping;
- covering of the 3 ha primary leach residue stockpile with a HDPE plastic cover;
- construction of separate groundwater and stormwater collection systems, with all water reprocessed at the Effluent Treatment Plant;
- revegetation and landscaping of the surrounds using Tasmanian native vegetation;
- an extensive monitoring program.

Lindisfarne

Fur Seal

HOBART

Tasman Bridge

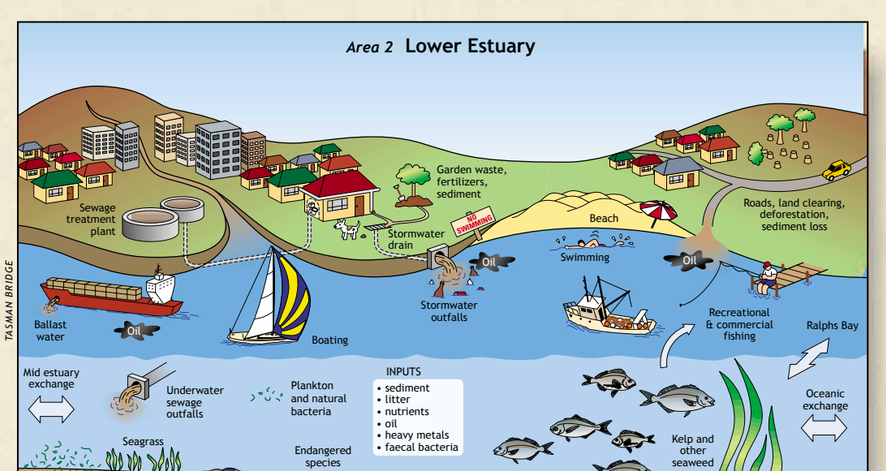
Macquarie Point

Rosny

Bellerive

Advanced Sewage Treatment at Rokeby - Clarence Council

In March 1999, an extensive upgrade of the Rokeby sewerage system was completed. This included the connection of approximately 400 homes (previously on septic systems) and the expansion and upgrading of the sewage treatment plant to provide tertiary treatment (biological nutrient removal), ultraviolet disinfection, and 2-day emergency back-up storage. The present discharge from the Rokeby sewage treatment plant is about 2 ML/day with maximum capacity of about 4 ML/day. Effluent quality from the plant has improved significantly.



Sandy Bay

Howrah

Sandy Bay (outfall from Selfs Point)

Tranmere

Giant Kelp

G.Edgar

Rokeby

Taroona

Taroona

Kingston

Pied Oystercatcher

Browns River Wetlands Construction - Kingborough Council

A series of pollution abatement ponds and associated wetlands were constructed by the council in 2000, together with a pedestrian walkway and bridge. The ponds and wetlands have been designed to improve the quality of stormwater from Kingston's commercial and residential districts prior to its entry into Browns River, which has been affected by high faecal bacteria levels in the past. The amount of litter and silt that is already being trapped is an impressive testimony to the potential future effectiveness of the system.

Natural Heritage Trust

Spotted Handfish

B. Bruce

Blackmans Bay

Opossum Bay

RALPHS BAY

Blackmans Bay

Weedy Seadragon

G.Edgar

Tinderbox

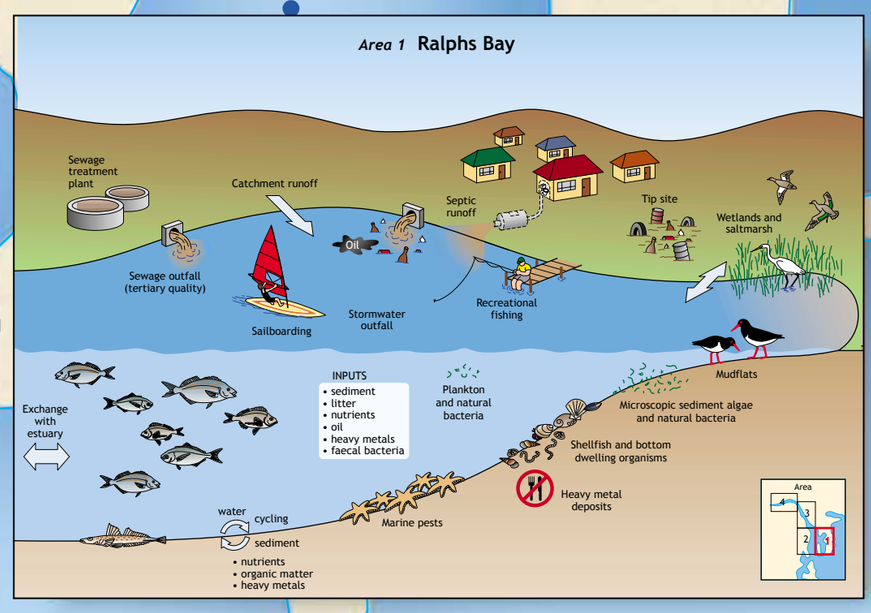
NORTH WEST BAY

Southern Right Whale

Hellemon

South Arm

Iron Pot



CLARENCE CITY

GLENORCHY CITY

DERWENT VALLEY COUNCIL

BRIGHTON COUNCIL

HOBART CITY COUNCIL

KINGBOROUGH COUNCIL

PASMINCO HOBART SMELTER

Norske Skog Boyer

Hobart Water

Natural Heritage Trust

Coasts & Clean Seas

Tasmania

N

0 5

kilometres

Water Quality Monitoring Sites in 2000

- Beach Monitoring Site *(faecal coliforms, enterococci)*
- Ambient Monitoring Site *(temperature, salinity, pH, dissolved oxygen, nutrients, chlorophyll a, metals)*

Sewage Treatment Plant Discharges in 2000

- <2500 kL/d
- 2500 - 5000 kL/d
- >5000 kL/d

Industrial Discharges in 2000

- >50,000 kL/d

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