Australian Government

Australia's National Programme of Action for the Protection of the Marine Environment from Land-Based Activities

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case study 4: water quality improvement plans on the swan coastal plain

the swan coastal plain

The Swan Coastal Plain (see Figure 1) is the coastal strip of land in the south-west of Western Australia, up to 20 kilometres across, extending from the Moore River to Dunsborough, bordered by the Indian Ocean to the west and the Dandaragan, Darling and Whicher Scarps to the east and south.

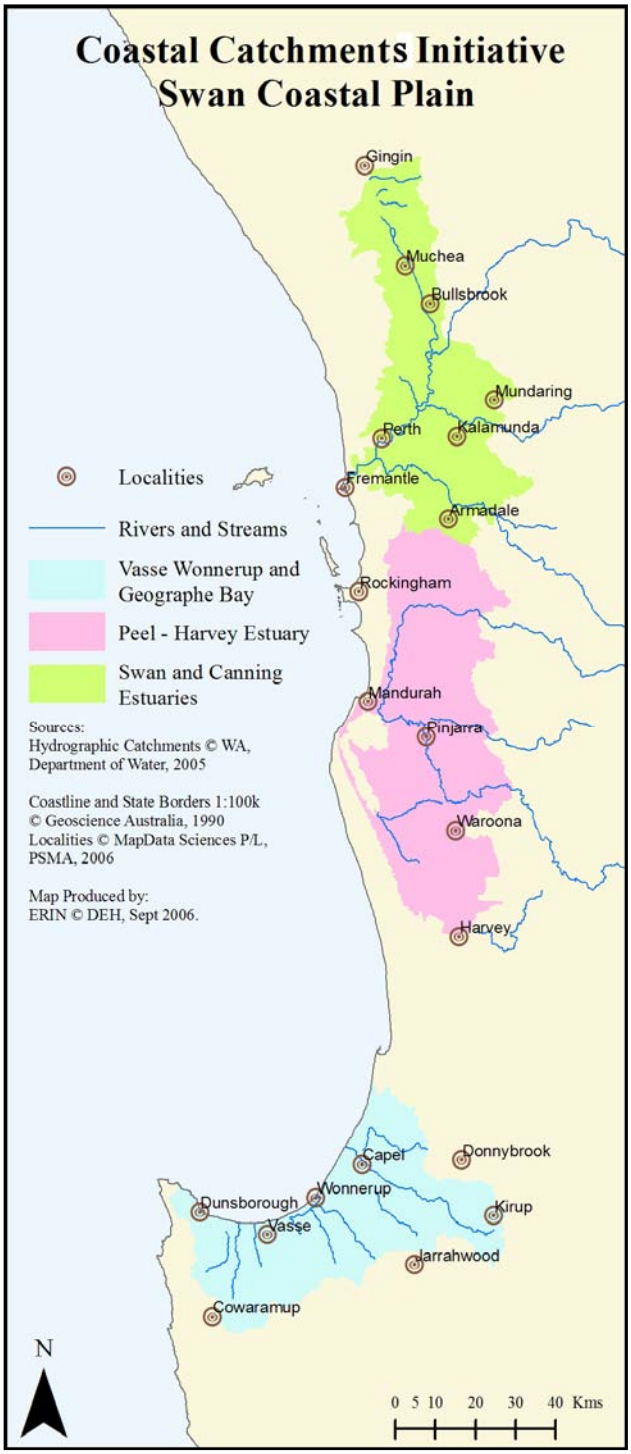
The climate of the Swan Coastal Plain is mediterranean with wet winters and dry hot summers. The coastal plain has low relief, the soils are generally siliceous with poor nutrient-binding capacity. The plain has extensive wetland systems, mostly caused by the surface expressions of superficial groundwater tables. Several large groundwater aquifers, which discharge to the eastern and western sides of the coastal plain, are used for public water supply. Its river systems, which include inland catchments, discharge to poorly flushed estuaries and coastal lagoons.

The Swan Coastal Plain is important historically, economically and socially in Western Australia being first settled in 1829 and location of the State capital and 1.6 million people, the majority of Western Australia's population.

The major pollutants of concern on the Swan Coastal Plain are the nutrients: phosphorus and nitrogen. Open, poorly circulating, and shallow river conditions together with long hot summers provide ideal conditions for algal growth and make rivers and estuaries susceptible to blooms. Annual algal blooms are resulting in fish kills, loss of recreational amenity and impacts on aquatic biodiversity.

Nutrient loads to marine embayments and estuaries along the Swan Coastal Plain are derived from agricultural and urban activity. This is through the application of mineral fertilisers, in some instances historical industrial and waste disposal sites, the construction of extensive drainage networks, the loss of wetlands and their capacity to assimilate nutrients and in some cases discharges from onsite sewerage systems.

Figure 1: Swan Coastal Plain



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The Australian and Western Australian Governments are working collaboratively to reduce land-based sources of nutrients on the coastal plain, targeting through the *Coastal Catchments Initiative* (CCI) three iconic coastal waterways and catchments. These are the Ramsar listed Peel-Harvey Estuary, the Swan-Canning Rivers and Geographe Bay and its catchment which includes the Vasse-Wonnerup wetlands.

Though there are many programmes, policies and projects relevant here, this case study will outline the CCI programmes for each waterway, the governance arrangements for those 'hotspots', and integrative approaches being taken across the programmes to benefit the region.

the peel-harvey cci programme

Since the 1960s the Peel-Harvey Estuary has experienced ecologically harmful algal blooms, largely caused by nutrient exports from agricultural activities in its coastal plain catchment. By the late 1980s the Western Australian government had completed scientific studies and an environmental management plan for the estuary to reduce algal blooms. The plan identified a series of measures, including development and implementation of a catchment management plan, a statutory environmental protection policy, and construction of a channel between the Peel Inlet and the ocean to increase tidal exchange.

In 1992 the Western Australian Government established the *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992*, which prescribes ecologically sustainable load targets for total phosphorus to the estuary, attributable to the three major sub-catchments.

In 2003 the Australian and Western Australian Governments initiated a series of projects that would lead to preparation of a Water Quality Improvement Plan (WQIP) and a framework for its implementation. The draft WQIP, which is being prepared by the Western Australian Environment Protection Authority, addresses phosphorus loads to this estuarine system. Current and proposed phosphorus loads, their sources, and measures to achieve those load targets are set out in Table 1.

A series of projects were undertaken to inform the science and policy that underpins the WQIP. The projects where undertaken by relevant government agencies, integrated through programme meetings and professional collaboration. The projects were completed over a 2-3yr period, and are comprised of projects that address:

- water quality monitoring. A water quality monitoring strategy was prepared to calibrate an existing catchment predictive water quality model. A series of gauging stations were established or upgraded to meet this purpose as well as provide the capacity for long-term monitoring and tracking implementation;
- predictive modelling and decision-support tools. The Large Scale Catchment Management (LASCAM) model is now calibrated to predict the effects of climate change and changes in catchment land use and land management in order to achieve the WQIP phosphorus load targets. The model is also providing essential information to guide planning and development in the catchment. decision-support tools were prepared to evaluate and promote the relative effectiveness of management practices and treatment trains in agricultural systems, and the rate of practice adoption required to achieve the WQIP load targets;

- water sensitive urban design (WSUD). WSUD planning policies and technical guidelines have been prepared for incorporation into town planning schemes and to underpin statutory decision-making. The policies are based on achievement of the WQIP load targets, reflecting local environmental conditions and sub-catchment targets. State agencies are working with local government to institutionalise these provisions, a key element to WQIP implementation;
- agricultural source controls. Projects were implemented for both broadacre and intensive agricultural activities. This included developing and implementing programmes to reduce nutrient loss from horticultural and dairy industries, as well as surveying, evaluating and demonstrating effective agricultural practices that reduce or eliminate nutrients leaching from farms (eg. soil testing to determine application rates). Modelling of inputs and outputs of nutrients in agricultural sub-catchments is providing information to manage application rates and, secondly, for developing scenarios for the Decision Support System (DSS model; and
- licensing and regulatory arrangements. The objective of this project was to develop innovative measures to regulate both point and diffuse sources of nutrient contamination. The existing licensed premises have been identified and areas of potentially a high risk of nutrient discharge were identified using existing datasets. This information will be incorporated into the DSS and used to determine the loads from those sources required to meet desired water quality in the receiving waters.

Table 1: Current and Target Phosphorus Loads to the Peel-Harvey System.

Pollutant Source by river system	Current P Load (t/yr)	Target P Load (t/yr)	Load Reduction (%)
Serpentine River catchment			
– Soil store and atmospheric	23.87	9.56	60
– Grazing	25.63	10.27	60
– Residential	13.87	5.56	60
– Intensive Horticulture	5.04	2.02	60
– Other industrial and agriculture	0.25	0.1	60
Total Serpentine	68.6	27.5	60
Murray River catchment			
– Soil store and atmospheric	6.53	6.53	0
– Grazing	0.90	0.90	0
– Residential	1.00	1.00	0
– Intensive Horticulture	1.27	1.27	0
– Other industrial and agriculture	5.54	5.54	0
Total Murray	15.2	15.2	0
Harvey River catchment			
– Soil store and atmospheric	18.68	10.89	42
– Grazing	30.75	17.91	42
– Residential	11.09	6.46	42
– Intensive Horticulture	0.06	0.04	42
– Other industrial and agriculture	0.27	0.16	42
Total Harvey	60.9	35.5	42
Other sources Dawesville and Mandurah Channel Internal loading (sediments) Groundwater	NK	NK	NK
Total current & target loads	145	78[1]	46

NOTE: P = phosphorus. NK = not known. "other agriculture" includes cropping, forestry and non-intensive horticulture. Source: Draft Water Quality Improvement Plan for the Peel-Harvey Estuarine System.

[1] In 1992 the EPA set a target of 75 tonnes. Given modelling approximations this is the same as the EPA figure.

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In addition a riparian stock exclusion project was undertaken to facilitate landholder engagement in the overarching CCI programme and WQIP, and in association with the upgraded monitoring programme, to evaluate the effectiveness of riparian stock exclusion and rehabilitation in reducing nutrient loads.

The results of the component projects of the CCI programme indicate that:

- excessive nutrients predominantly emanate from diffuse sources;
- phosphorus load discharge from the three river systems is approximately 145 tonnes and a reduction of at least 48 per cent is required to meet the target set by the EPA in 1992;
- nearly 70 per cent of the phosphorus discharges come from agricultural activities; and
- urban areas account for only 6 per cent of the land use by area but contribute more than 20 per cent of the phosphorus inputs – and this figure is rising, with gardens, lawns and on-site sewerage systems (septic tanks) being the source of this pollution.

The WQIP aims to reduce phosphorus discharges from the Peel-Harvey coastal catchment through changes to agricultural and urban practices and land use planning. Key recommendations to achieve load reduction targets include:

1. Using slow-release, low water soluble fertilisers, applied after the break of season and at reduced rates, on sandy soils in rural areas. Reducing the solubility of phosphorus in fertilisers applied on agricultural areas will reduce phosphorus discharges to the estuary by 13 per cent. In the Serpentine catchment this would result in an 18 per cent reduction.
2. Undertaking soil amendment on sandy soils. Using soil additives or conditioners such as 'yellow sand' and 'red mud' to help absorb phosphorus is very effective in stopping it leaching into the Peel-Harvey waters. This includes soil remediation for new urban developments in areas with sandy soils.
3. Promoting the continued use of a low water soluble domestic fertiliser for domestic gardens, and designing low water and fertiliser use gardens.
4. Connecting all current and future homes to reticulated sewerage or effective alternative onsite systems to replace existing septic tanks.
5. Eliminating phosphorus discharges from licensed agricultural premises, such as turf farms or intensive feedlots.
6. Implementing agricultural practices, which reduce phosphorus discharges including: a) replacing annual pastures with perennial pastures; b) effective effluent management, and c) better managing irrigation systems.
7. Strategic reafforestation of some agricultural lands, or combining with agriculture to produce agro-forestry.
8. Having Local Planning Policies, Strategies and Planning Conditions incorporate and implement Best Management Practices where applicable.
9. Ensuring all new developments incorporate water and nutrient sensitive design according to local planning policies and technical manuals.
10. Modifying agricultural and urban drainage system to enhance their ability to remove nutrients.

The proposed actions are a mix of voluntary and regulatory measures. The mix selected may possibly change over time if, for instance, either land uses change following further development approvals or if longer term monitoring reveals that water quality is not improving.

Governance arrangements for the Peel-Harvey WQIP are currently being considered by the State government. In anticipation of the finalised WQIP, the South West Catchments Council (a group funded under the national NRM programmes) has allocated approximately $1.1 million over 2006-08 for implementation of the plan, targeting maintenance of water quality monitoring and decision-support systems.

A draft Peel-Harvey WQIP is due for public release and comment in September 2006, with the final WQIP due to be completed late 2006.

Building on the Peel-Harvey CCI, the Australian and Western Australian Governments established in mid 2006 further CCI programmes to protect and improve water quality in the Swan-Canning Estuarine System, Geographe Bay and the Ramsar-listed Vasse-Wonnerup wetlands.

swan-canning wqip

The Swan-Canning Estuary is the major natural feature of metropolitan Perth. Its upper reaches in particular have experienced extensive deoxygenation events and algal blooms, causing fish kills, notifications against consuming shellfish and occasionally closures of swimming sites.

The Swan-Canning WQIP is to be prepared by the Swan River Trust. The Swan River Trust was established in 1989 and constituted under the Swan River Trust Act 1988. It is a statutory authority responsible to the Minister for the Environment and is made up of a management committee of eight representatives from the community, State and local government authorities and about 40 full-time professional, technical and administrative staff provided by the Department of Environment and Conservation. The Trust is responsible for planning, protecting and managing Perth's river system.

Water quality is an integral part of the Swan River Trust's work. The Trust works to maintain and improve the health of the Swan and Canning rivers through a number of programs including the Swan-Canning Cleanup Program, which supports catchment management to reduce nutrient inputs into the Swan and Canning rivers. The WQIP and related programme of projects will underpin a revised Cleanup Program.

The Trust's current activities, as well as development of the WQIP, are designed to implement the *Environmental Protection (Swan and Canning Rivers) Policy 1998*.

vasse-geographe wqip

The Vasse-Geographe WQIP will be prepared by the Geographe Catchment Council (GeoCatch). GeoCatch is a formal water resources management committee. Membership of the council consists of 11 community representatives including local government Councillors. Positions are also held by 4 senior representatives of the key government agencies. Based in Busselton, GeoCatch maintains strong community and industry ties through its community members and projects.

Significantly the Vasse-Geographe WQIP includes protecting water quality in the Ramsar-listed Vasse-Wonnerup wetlands. As part of the WQIP, an ecological character description will be prepared which sets out the wetland's attributes and functions, and from that the WQIP will set water quality targets to protect those characteristics. Geographe Bay supports extensive seagrass meadows that provide important fish habitat and is a recreational icon for Western Australians.

joint projects

The Swan-Canning and Vasse Geographe WQIPs are supported by a series of jointly managed projects, each contributing to development and implementation of the WQIPs. The projects build on the outputs from the Peel-Harvey CCI particularly focusing on WSUD, agricultural sources, predictive modelling and monitoring activities and development of decision-support tools:

- the WSUD project will see implementation of a strategy to implement WSUD principles and practices along the Swan Coastal Plain, with an emphasis on the Swan-Canning and Vasse-Geographe catchments. The project is undertaken as a collaboration between the two key state agencies and the Western Australian Local Government Association.

  This strategy will include a statutory WSUD Framework, finalisation of stormwater management guidelines, calibration of urban design modelling tools for water quality protection, incorporation of model planning provisions and policy into town planning schemes that incorporate the WQIP objectives, guidelines and design tools, and a capacity building programme for local government and industry;

- the agricultural sources project will, amongst other matters, review all existing sustainable agricultural projects for relevant information and collaborative opportunities, survey land uses and management practices, undertake small-catchment projects to evaluate interventions and estimate the extent of uptake of those interventions to achieve WQIP objectives;

- the modelling and monitoring project will prepare catchment and receiving water quality models and modelling and monitoring strategies for the respective WQIPs, undertake critical monitoring and investigative activities for model calibration, and conduct gaming and analysis of likely changes in land use and land management to achieve the WQIP objectives. This project will draw on outputs from the WSUD and agricultural projects; and

- computer based decision-support tools will be prepared to facilitate community consultation on the WQIPs, evaluate the net-cost of land management interventions, explore with non-expert users enterprise and sub-catchment scale management options and support ongoing plan implementation.

The modelling, monitoring, decision-support and small catchment projects are the basis to adaptive implementation of the WQIPs. The science underpinning WQIP development will be completed during the first two years of this three programme, with WQIP preparation, consultation and finalisation the focus of year three. A common programme Steering Committee to both WQIPs, and collaborative project teams, ensures project and programme integration. The science, management interventions, institutional responses and planning tools derived from the three CCI programmes will be relevant along the entire Swan Coastal Plain.