Estuary Management Issues, Themes & Options for Port Stephens & Myall Lakes
Report No. 1287/R04/RD2

Prepared for:

PORT STEPHENS AND MYALL LAKES
ESTUARY MANAGEMENT COMMITTEE

REFERENCE DOCUMENT 2

ESTUARY MANAGEMENT ISSUES, THEMES AND OPTIONS FOR PORT STEPHENS AND MYALL LAKES

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HOW TO USE THIS DOCUMENT

The Estuary Management Study for Port Stephens and Myall Lakes comprises three reference documents


This document is about the estuary management process. It reviews the environmental management concepts and strategic frameworks that relate to the ecologically sustainable development of estuaries, with examples of the application of these concepts to the issues that need to be addressed in managing Port Stephens and Myall Lakes. It discusses who is involved in estuary management (and why), and includes a review of current legislation and policy, and concurrent planning initiatives. It incorporates community input about the value of the estuary, and what types of activities should be encouraged and discouraged to protect the environment and community lifestyles.

Reference Document 2: Estuary Management Issues, Themes and Options for Port Stephens and Myall Lakes

This document presents the core information about the estuary. It reviews what we know about the interaction of biophysical and socio-economic processes in the estuary, using the results of past and current studies, and is as up to date as possible. It discusses how these interactions produce issues of concern to the community, and State and local government, and how decisions can be made about the priority of management responses.

This information is the basis on which the community's decisions about the future of the estuary will be made. The document provides an analysis of the environmental values of Port Stephens and Myall Lakes, using the results of both scientific studies and comments provided by the local community. The document also assesses the sensitivity of diverse community and environmental values in the estuary to pressures associated with environmental change and continuing pressure for growth and development.

Information about overall strategic directions for the future of the estuary, and a range of management themes that would be compatible with this direction, are provided in Reference Document 2, together with suggested management objectives, targets and indicators for sustainable management of the estuary.

Reference Document 3: Community Feedback - Port Stephens and Myall Lakes

This document describes the community participation process for the estuary management study and presents the comments and observations that community members contributed to the project. Much of this input is also noted throughout Reference Documents 1 and 2.
SOME IMPORTANT TERMS USED IN THIS DOCUMENT

The Estuary Management Study presents ideas for the sustainable management of Port Stephens and Myall Lakes, organised on both a geographic and thematic basis.

- A management zone is an area of estuary and foreshore that is relatively uniform in its physical and/or socio-economic characteristics, is identified as a unit by the community, or is faced with similar challenges for the future.

- A management theme is a broad concept that describes a particular area of activity or outcome that is desirable for the sustainable future of the estuary, e.g., conservation of natural and cultural values; managing estuary dynamics.

Other important terms in the management study include:

- Community vision: The ‘big picture’ description of the type of environment and lifestyle that the local community wishes to achieve/maintain in the future.

- Management objectives describe particular outcomes. For each theme, there may be several specific objectives. These can be qualitative or quantitative.

- Targets and indicators describe the information that would need to be collected so that decision makers and the community can monitor the success of various management actions. This information is essential for adaptive and creative management of the estuary, and also for justifying expenditure on the protection or restoration of particular values or features.

- Management issues are questions, conflicts, potential interactions and conflicts about which decisions need to be made. For instance, what types of facilities should be provided for the recreational boating community; where should they be located; what measures are needed to ensure safe waterway access and that recreational boaters have the understanding and skills to minimise their impacts on other users. How important is the protection of riparian vegetation to the community and how can it be protected/restored.

- Management actions are tasks that address the important management issues for the estuary. They may be planning, remediation, education, monitoring, and may be the responsibility of state government, local government, industry or the local community.
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APPENDICES

APPENDIX 1 - Survey Questions for Recreational Boating

APPENDIX 2 - Statement of Joint Intent Used by South Coast Estuary Plans
1.0 ISSUES ANALYSIS AND ASSESSMENT

1.1 SENSITIVITY ANALYSIS

1.1.1 Definition of Sensitivity and the Risk Management Process

In considering the issues and locations that should have priority for management in Port Stephens and Myall Lakes, the following matters have been taken into consideration:

- Robustness of the local environment - the extent of process or morphological change that can be expected to occur in response to various pressures. These pressures may include changing physical conditions (such as rainfall or storm intensity), or resource utilisation (such as commercial and recreational fishing), or changing loads of pollutants (such as from new or more intensive catchment land uses).

- Level of understanding of ecological and physical processes. The behaviour of some natural systems in response to development or other pressures is relatively well understood, but the response of other systems may be very difficult to predict. This may result from either system complexity, or a lack of research or monitoring data that can be analysed to better understand the way that a system has behaved in the past. Often, only anecdotal information is available. Whilst this can be useful complementary information to combine with limited scientific data, it is difficult to make reliable predictions using anecdotal information alone.

For Port Stephens, as for many NSW estuaries, there are significant gaps in both the information that is available about the state of the waterway over time, or its response to varying types of pressures. Some of these data gaps have been identified in the Estuary Processes Study, and are discussed further below.

Where the lack of data is considered to be a significant hindrance to effective, adaptive planning for the estuary, actions are suggested in the draft Environmental Management Plan to improve the reliability, amount and integration of monitoring and research information.

This section briefly reviews the limitations to understanding the environmental health of Port Stephens and Myall Lakes and the processes that are driving change.

It then considers a range of locations and environmental or community values that are considered to potentially be at risk from current or proposed land uses, or from changes to physical processes, or because the nature of the interaction between development and environmental outcome is poorly understood.

The locations and values that are summarised in Table 1.1:

<table>
<thead>
<tr>
<th>Location or value</th>
<th>Risks considered</th>
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<tbody>
<tr>
<td>Water quality</td>
<td>Rural runoff, urban stormwater, water quality in Nelson Bay harbour (flushing capacity and inputs), runoff from acid sulphate soils, incidence of algal blooms in Myall Lakes National Park, leachate from landfills, discharges of human wastes from commercial and recreational vessels, lack of consistent long term data</td>
</tr>
<tr>
<td>Bank and beach erosion</td>
<td>Jimmys Beach, Shoal Bay, Tanilba Bay, destruction of Myall Point</td>
</tr>
</tbody>
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Table 1.1 - Sensitive Locations and Environmental Values (cont)

<table>
<thead>
<tr>
<th>Location or value</th>
<th>Risks considered</th>
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<tr>
<td>Riparian vegetation and wetlands</td>
<td>Koala habitat, SEPP14 wetlands, Migratory wader agreements, conservation priorities, fish habitat, aesthetic values</td>
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<td>Aesthetics</td>
<td>Natural visual catchment, litter in high tourist usage areas</td>
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<tr>
<td>Peace and quiet of lifestyle</td>
<td>New development on northern shore of Port Stephens, adequacy of services (recreational facilities)</td>
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<tr>
<td>Navigation and waterway safety</td>
<td>Access to the waterway, safety of navigation, launching ramp usage issues, power boats in high conservation areas</td>
</tr>
<tr>
<td>Human health issues</td>
<td>Mosquito breeding and Ross River Fever, biological contamination impacts on primary contact recreation and shellfish consumption</td>
</tr>
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</table>

Magnitude of process change, and frequency of perturbations

The NSW Estuary Management Manual notes that an estuary and its catchment form a complex system of ecological, physical, chemical and social processes which interact in a highly involved and at times unexpected fashion.

The Manual further notes that many existing estuary problems have arisen from "unwise developments in the past, when the complexity and interrelationships of the ecological, physical and chemical processes of an estuary and its catchment were poorly understood"

Although there is now a significant data bank of information about the functioning of many of the estuaries in NSW, much of the information has been collected in a piecemeal fashion, or only for short periods, or for specific projects, so that much decision making is still hampered by a lack of confidence in our understanding of natural process interactions.

The Estuary Processes Study for Port Stephens and Myall Lakes (DPWS 1998) provides a compilation and interpretation of previous physical and ecological studies of Port Stephens and Myall Lakes, plus providing the results of additional short term monitoring and investigation of water quality and ecology in the estuary, conducted as part of the Processes Study.

The conclusions of the Estuary Processes Study, and the comments it provides on significant issues suggest that the processes affecting the ecological diversity and health of Port Stephens and Myall Lakes are understood in broad terms, but that detailed interactions generally remain undocumented. Issues about which information for making management decisions is scanty include:

- Effects of catchment runoff on water quality This refers to both runoff from the largely agricultural and forested hinterland on the water quality of the upper estuary, and of the Myall Lakes, and the impact of urban stormwater runoff on the nearshore water quality of the lower Port. Some of these concerns are currently being addressed through monitoring conducted by the Oyster Quality Assurance Program (QAP) and Port Stephens Council's Catchment Assessment Program. However, an integrated water quality monitoring program for the entire estuary remains a priority.

- Relationship between variations in water quality and ecological responses, such as overgrowths on sea grass, and the occurrence of algal blooms in Myall Lakes. A combined agency working group has commenced project planning to address these issues.
• Extent of groundwater contamination by septic tanks and other catchment land uses

• Long term natural ranges of variance for water quality, particularly in relation to the persistence of fresh water in The Broadwater

• Recreational fishing catches in Port Stephens and Myall Lakes (including fin fish and crustacea), and the relative rates of growth of these catches compared with commercial catches

• The extent to which water quality in the Upper Port and Myall Lakes is approaching a trigger point for significant changes in natural estuarine productivity cycles. This issue has caused significant community concern in recent months because of the persistent blue-green algae bloom in the Broadwater in Myall River. Dr Graeme Harris (CSIRO) has recently advised the local community that the occurrence of algal blooms is a sure sign that the lake/estuary is stressed by nutrient loads in wet years. He also noted that phosphorus levels in the lake system appear to be extremely low by general standards, but that the very long residence times in the lake make the system particularly sensitive to nutrient accumulation

• The most efficient way to protect infrastructure and private development from shoreline erosion at Jimmys Beach and Shoal Bay. This issue is currently being addressed in detailed reviews of Coastline Hazard Studies (MHL 1998 and current)

• Long term changes in sea grass distribution (species density and general locations), which can be used to place recent surveys in context

• Whether there are currently any indicators of impacts of increased recreational boating on the health of the estuary. Community reports indicate that access to the waterway for recreational boating is a major issue in peak demand periods, when ramp facilities may be both dangerous and over crowded

• What is the appropriate balance between population growth, technological controls and conservation management to protect the natural and community values of the Lower Port

Magnitude of Process Change

Two of the key physical controls on the dynamics of estuarine processes are catchment runoff and marine influences driven by tidal cycles and storm frequency/magnitude

There is no shortage of evidence that both catchment based and marine factors vary considerably over time, with cyclicity operating at a variety of scales (e.g. El Niño/La Niña cycles). These long term cycles have major implications for the management of the estuary. These include

• The current process and health status needs to be considered in its context

• What is the natural range of shoreline fluctuations, and natural range of catchment flow/tidal flow interactions in the estuary?

• How adaptable are current management strategies to long term variations
As an indication of the range of magnitude of process drivers in Port Stephens, data for catchment runoff and frequency of large storm events is presented below.

Variations in annual rainfall for the study area, over the last 120 years, are illustrated in Figure 1.1. The graph shows trends for Nelson Bay and for Stroud. It is clear that there have been significant blocks of time where rainfall was either well above, or well below, the nominal “average”. As examples, the 1940s were generally relatively dry, but the 1950s were marked by a series of very wet years. Similarly, the 1980s were generally dry, but the 1990s include multiple years of above average rainfall. Recent assessments of blue green algae blooms in Myall Lakes have suggested that wet years present a much higher risk to estuary water quality and ecology than do dry years.

These medium term variations in rainfall affect the balance of freshwater and marine water in the estuary, and can greatly influence the extent of shoaling in the entrance, the load of nutrients, bacteria, acid and suspended sediment from the catchment, and the nutrient balance through sediment/water interactions.

The storm frequency on the NSW Central and Lower North is illustrated in Figure 1.2. This information reinforces the amount of variation in the strength of natural processes in the estuary. Although some variations may be attributed to improved monitoring of wave height in recent decades, it is clear that storm frequency has varied by an order of magnitude since records have been kept for this area. Storm frequency has particular implications for the outer estuary. For instance, the extent of wave attack on Jimmy’s Beach and Shoal Bay depends on the frequency, direction and magnitude of wave attack. The final destruction of Myall Point by one of several large storms in the 1920s, and the subsequent impacts that this has had on the stability of Winda Woppa and Jimmy’s Beach further illustrate the step changes that storms can achieve.

In this instance, the data has been arranged in terms of decade blocks, and other ways of grouping it (with longer or shorter time periods are also possible). It is notable that although the 1970s are recorded as a decade with relatively low storm frequency, this period also included the largest magnitude storm recorded from the NSW coast this century (May 1974).

Recent investigations by DLWC have shown that the increased storminess of the late 1990s has resulted in some coastal features being exposed for the first time since 1974.

1.2 LOCATIONS AND VALUES AT RISK

1.2.1 Water Quality

Water quality in Port Stephens and Myall Lakes is affected by catchment inputs, rates of flushing and rates of uptake/release of pollutants by sediments and biota.

The Estuary Processes Study observes that in general, water quality in the entire estuary complies with the ANZECC guidelines for protection of aquatic ecosystems, although there are some signs of eutrophication “at the extremities”, such as the upstream part of Tilligerry Creek, the upper Myall River and the Karuah River. Water quality in Tilligerry Creek is illustrated in Plate 1.

This general observation was confirmed by the EPA review of water quality prior to the setting of interim water quality objectives for the estuary. The EPA assessment is shown in Figure 1.3.
Yearly Rainfall in Port Stephens - Myall Lakes Estuary Catchment Area (1881 to 1998)

FIGURE 1.1
Rainfall Records

Source: Bureau of Meteorology

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For period 1880 to 1985 storm events classified as waves >1.6 metres.

For period 1986 to 1997 storm events classified as offshore peak wave height >5 metres.

Source: Manly Hydraulics Laboratory, 1998.
Water Quality in Tilligerry Creek

PLATE 1
High turbidity levels in upper Tilligerry Creek (above), associated with catchment inputs and resuspension of fine sediments by tidal currents. Compare with turbidity of outer port (below) at same time.
Despite these generally good assessments, the water quality of some parts of the estuary is considered to be at risk of degradation. These risks can be minimised with modifications to current catchment management practices.

The principal risks to the water quality of Port Stephens and the Myall Lakes are:

- Urban stormwater (nutrients, biological pollutants, sediment, litter)
- Rural runoff (nutrients, biological pollutants, sediment) Runoff from on-site wastewater treatment systems are included in this category.
- Drainage from oxidised acid sulphate soils.

Point source discharges such as large marinas and municipal waste water treatment plants also have the potential to impact on the health of the estuary.

Examples of parts of the estuary that are particularly sensitive to declining water quality are provided below.

1.2.1.1 Rural Runoff

Myall Lakes

The Estuary Processes Study noted that water quality in Myall Lakes is generally good, except after major rainfall events from the upper Myall River. The Processes Study also noted that since much of the catchment of the Lakes is forested or protected (eg by National Park boundaries) the risk of water quality decline was low. However, flushing times in Myall Lake are in the order of 400 to 800 days, so the nutrient load delivered to the lake system from these events is trapped for all practical purposes. The predominantly freshwater, and long residence times for pollutants indicate a high risk of algal blooms. The tolerance of the Myall Lakes system to phosphorus loads which may be delivered from the rural catchment or remobilised from sediment or biological sinks, is not known.

Since the Estuary Processes Study was completed, three algal blooms have occurred in the Broadwater and lower Boolambayte Lake. The algae alert was lifted for only a short period in April 2000 between the second and third occurrence. NPWS and DLWC investigated the nature of the April 1999 algal bloom and its likely antecedents. A preliminary analysis of the causes and impacts of the first algal bloom was reported (in draft form) in November 1999.

The algal bloom, with algal counts as high as 15000 cells/ml, led to a high alert for cyanobacteria on 7 April 1999, and warning signs were placed around the lake system in accordance with the Regional Algal Contingency Plan. At the same time, NSW Fisheries initiated a fishing closure for commercial and recreational fishing in the affected areas, because of concerns about potential toxin accumulation in shellfish and fin fish.

DLWC have observed that cyanobacteria have very low growth rates compared with some other phytoplankton, and are encouraged by waterways with long retention times. DLWC have also suggested that rainfall that occurred prior to the bloom in Myall Lakes may have delivered additional nutrients to the system from catchment runoff, but also from inflows of groundwater from wetland areas, and inundation of some foreshore areas leading to decay of vegetation.

Although no detailed monitoring of nutrient concentrations was undertaken during the algal bloom, a single sampling run by Hunter Water, some three weeks after the bloom first
appeared, revealed total phosphorous and soluble phosphorous levels well above the levels identified by ANZECC 1992 for nuisance algal growth to occur. It should be noted that ANZECC provides an indicative range for nutrient levels in waterways, and suggests that specific levels need to be derived for local conditions. Insufficient information is available about nutrient levels in Myall Lakes for local trigger points to be established.

Given the extremely long retention times for fresh water in the lake system, it would seem likely that ecologically 'safe' phosphorous levels would be at the lower end of the range.

The DLWC draft report on the algal outbreak provides a range of recommendations for further monitoring and investigation of nutrient levels and nutrient budgets in the lake system, as well as recommendations for systematic responses from all stakeholders in the event of another incident.

These recommendations have been taken into account in the preparation of the draft management actions and priorities in the draft Estuary Management Plan.

A second algal bloom was notified in late December 1999. Blue-green algae extend through the Broadwater, into the upper Myall River and part of the lower Myall River, and have resulted in fisheries closures. This bloom has raised major and urgent concerns about the potential for toxins to affect oyster leases, together with serious concerns about how little is understood about both the processes during the blooms in estuarine areas, and the interaction of algal toxins with the oyster industry. Both blooms demonstrate a high risk to the tourism and recreation values of the National Park.

Concerns have also been expressed about the potential for on site effluent disposal at Legges Camp (Myall Shores) to affect the quality of groundwater. NPWS has initiated a program of surface and groundwater monitoring, to clarify the impacts of wastewater management at Myall Shores and to refine the management procedures accordingly. CSIRO (Graeme Harris pers. comm, April 2000) has subsequently expressed the view that potential nutrient loads from wastewater management within the National Park are very low compared with the nutrient load from the largely rural catchment.

As a result of inter-agency discussions spurred by the recent algal blooms in Myall Lakes National Park, an action plan has been prepared. The following actions, focusing principally on rural catchment management, are proposed:

- A data logger will be installed at Bulahdelah to provide ongoing and event based water quality information for the Myall River,
- Groundwater monitoring for the lake shoreline,
- A study of nutrient cycling from the lake sediments,
- DLWC will enhance its involvement in local Landcare and catchment planning,
- Free farm and catchment management advice is available to landholders from the State agencies (e.g. NSW Agriculture),
- Field days for Farming for the Future and Property Planning projects,
- Field days and demonstrations on stream bank erosion,
• a catchment planner will be appointed (DLWC) to work with the community to develop action plans for nutrient reduction,

• incentives (such as Rivercare funds) are available for streambank erosion and management,

• NHT funds are available for on ground activities,

• regular updates on actions and outcomes will be provided to the community action committee and in local newspapers

It should be noted that no quick fix solutions are available to address catchment nutrient loads or nutrient loads derived from in-lake sediments. Improvements in lake health will be gradual, particularly in wet years.

Karuah River

Water quality in the upper estuarine reaches of the Karuah River is also sensitive to runoff from rural lands. Port Stephens Council conducted audits of a number of point sources (septic tanks and intensive agricultural activities such as chicken farms), within this rural catchment in 1998. Other recent studies (EPA 1996 and Anink 1999), prepared with the support of the Karuah Great Lakes CMC, have also highlighted the existing and potential impacts of rural runoff on nutrient loads, turbidity, biological contaminants in the upper estuary.

As an example of the potential impacts of rural runoff on water quality, Great Lakes Council has advised that faecal coliform readings of 28500 cfu were reported at Allworth in December 1999. For primary contact recreation, a median value of 150 cfu is recommended.

The Catchment Assessment Program estimated that there were 2-3 million chickens being raised at any one time in the upper Karuah River catchment, with an estimated 26000 to 39000 cubic metres of waste produced in the catchment each year. Although most farmers follow good management practices in storing and utilising the waste, there is considerable potential for improved management, to reduce the risk of runoff contaminated with nutrients, viruses, bacteria, fungi and protozoa reaching the estuary.

Similarly, the results of the catchment audit in the upper reaches of Tilligerry Creek also indicated a high potential for contamination of the estuarine waters by nutrients and bacteria, principally associated with poor management practices in the application of chicken manure to pasture. An increase in this type of intensive agriculture has also occurred in the Myall River catchment in recent years.

The recent incident involving an aviation fuel spill from the RAAF Base (28 December 1999), and records of other similar events in 1993 and the late 1970s, demonstrate the importance of careful site management by all catchment land users. Although, in this particular case, natural bioremediation of upper Tilligerry Creek is expected to occur fairly quickly, the better management of refuelling and stormwater systems is essential, including a site audit, and preparation of spill contingency plans to protect surface waters and groundwater.

1.2.1.2 Stormwater Management

Port Stephens Council has recently completed a Stormwater Management Plan for the urban parts of the Local Government Area, in accordance with the requirements of the EPA.
Investigations conducted for the plan included water quality monitoring in the estuary adjacent to urban areas (see Figure 1.4). The results of this monitoring in terms of compliance with current Interim Environmental Objectives (EPA 1998 and 1999) are shown in Figure 1.5. This figure also illustrates additional impacts of stormwater runoff on the health of nearshore estuarine habitats. Most stormwater drains around the urbanised shoreline of Port Stephens are clearly identifiable on aerial photographs because of the accumulation of sediment as alluvial fans in the nearshore zone. It is evident that sediment is being delivered to the shallow nearshore water at rates greater than it can be readily colonised by sea grass.

The most contentious location in relation to stormwater pollution is the Nelson Bay harbour. This area not only receives stormwater runoff from the most heavily developed part of the catchment area, but also collects any spills from marina operations (including fuel, antifouling and sewage), wastes from the Fishing Co-operative, as well as collecting a range of litter which may blow into the water from foreshore reserves.

The harbour area is also relatively poorly flushed and there have been complaints about its water quality since its construction in 1986. A plan of the harbour showing potential sources of contaminants is provided in Figure 1.6. The water quality of the harbour is illustrated in Plate 2.

Despite all these potential contaminants, the sandy beach within the harbour is frequently used for swimming/paddling by small children.

In 1998, DLWC conducted a short one-off monitoring program in the harbour to provide a preliminary indication of water quality variations after rain.

The parameters tested were pH, conductivity, turbidity, temperature, dissolved oxygen, coliforms, nitrogen, phosphorus, oil and grease, salinity, tidal movement, and wind speed and direction. These parameters were monitored at hourly intervals on two days (one wet and one dry), except for coliforms, which were monitored every three hours.

Three locations were tested - midway between the Police wharf and the Fish Co-operative, at the jetty in line with the main stormwater outlet, and at the Waterways courtesy buoy just outside the entrance to the harbour.

The monitoring results were compared with the standards listed in the ANZECC guidelines for protection of aquatic ecosystems, primary contact recreation (noting the specific sampling requirements) and consumption of raw shellfish.

The results of this limited sampling indicated that both nitrogen and phosphorus levels in the harbour exceed the range suggested by ANZECC. Oil and grease levels also did not comply with ANZECC guidelines for recreation, because of diesel odours and a visible slick on the surface.

The coliform results were marginal for primary contact recreation, although maximum coliform counts were as high as 1100 cfu in wet weather and 1400 cfu in dry weather. Coliform counts were well outside the standard for consumption of raw shellfish in both wet and dry conditions.

These results are based on very limited sampling, but do indicate a need for additional careful monitoring of water quality in the harbour, to clarify the real extent of the risks to human health, and to the ecological values of the harbour. Anecdotal evidence suggests that sea grass has declined in the harbour.
FIGURE 1.4
Port Stephens Council
Stormwater Quality Monitoring Sites

Umwelt (Australia) Pty Limited
Northern
Western
Flshermans Wharf
Preparation
Plant
and
Ice Plant
Fishermen's Waterways
Current construction
work, roads and
carparking
Umwelt (Australia) Pty Limited
Source DLWC (based on Croft & Associates 1989

FIGURE 16
Activities, Pollution Sources
in Nelson Bay Harbour

A4 Scale 1:3,500 Ref No 1287/R04/RD2_VI/apsc_059_dgn
Factors affecting Water Quality in Nelson Bay Harbour

PLATE 2
Catchment stormwater runoff, litter, oil and grease from boating activities, lack of wastewater holding tanks, wastes from harbourside activities and poor flushing
Over the last six months, several new initiatives to improve water quality in Nelson Bay Harbour have been agreed by Council, agencies and lessees. These actions include:

- appointment of a 'caretaker' with responsibility for regular removal of gross pollutants / litter from the harbour,
- installation of additional litter bins on the western breakwall and boat harbour precinct,
- preparation of a protocol between the local Fire Brigade, Waterways and the caretaker for clean up of minor oil spills,
- a program of regular control of vermin on the rock walls,
- Council and DLWC will provide equipment and personnel for a further water quality monitoring program,
- Council has allocated funds in its Draft 2000/2001 budget for the construction of a gross pollutant trap in Victoria Parade. Council will also follow up on litter baskets or local stormwater pits around the marina,
- DLWC will discuss additional litter / waste management issues with the Fishermen’s Co-op.

1.2.1.3 Water Quality in Nelson Bay Harbour - Feasibility of Improving Flushing

As part of the preparation of the Estuary Management Study, the Water Research Laboratory (WRL) has reviewed previous comments about the flushing of the harbour and conducted a preliminary feasibility investigation of options to improve the flushing of the Nelson Bay Harbour.

The causes of poor water quality within the harbour include excessive inputs of pollutants, poor water circulation within the harbour and poor exchange of harbour water with the waters of the Port. While much can be done to manage inputs to the harbour, (although the contribution to faecal coliforms from birds is difficult to eliminate) water quality still can remain poor if there is not good water circulation and exchange. Even low pollutant inputs can build up to unacceptable levels within a harbour with poor circulation and exchange.

Manly Hydraulics Laboratory (MHL) (1987) presents a review of the circulation and tidal exchange of the harbour. This report found that there was little clearance of the harbour water on ebb tide and that much of the water that leaves the harbour on the ebb tide returns to the harbour on the flood tide. Further, the report found that there was little opportunity to generate any significant exchange of the harbour water with that in the South Channel.

The report recommended:

1. Further water quality sampling to determine better the causes and extent of pollution, and, if the result confirmed poor water quality.
2. Consider removal of the causes of pollution, and/or
3. Try to improve the flushing of the harbour.

In respect of (3), the report considered that improvements were unlikely to be effected without any major construction work.
Options to Improve Circulation and Exchange

MHL (1987) presented two options to improve water circulation and exchange

- construct a pipe venturi extending from the western end of the harbour to the fast flowing currents in the South Channel to withdraw water into the South Channel,

- construct a small spur wall perpendicular to the harbour breakwater with a pipe to induce flow into the harbour

Both options were rejected, the first for the reason that insufficient suction could be developed to withdraw adequate volumes of water from the harbour, and the second for the technical reason that the velocity head of some 0.05 metres available to drive water through the pipes was insufficient to be effective. However, the analytical work done to support this was not documented.

Since that work was done, Nielsen and McCowan (1994) presented a case where the tidal velocity head available at Corlette in Port Stephens was sufficient to flush the Anchorage harbour entirely each day through two 1.2 metre diameter Hardie Iplex “Black Brute” pipes. That head, being some 36 mm, is commensurate with the available velocity head at Nelson Bay, which should be sufficient to induce adequate flushing of the Nelson Bay harbour.

Natural Flushing Schema

At Nelson Bay, the tidal streams outside the harbour run at around 1 m/s (Nielsen, 1979; PWD, 1970) giving an available head to drive water through pipes of some 50 mm. However, at Nelson Bay any pipes would have to be directed into the flow as there are no other stagnation points available to tap the available velocity head, otherwise a spur wall perpendicular to the existing breakaway would have to be built, as suggested in MHL (1987).

The total volume of water within Nelson Bay harbour is some 300000 m³. Should it be desirable to flush out the entire harbour each day on the ebb tides, the total discharge of a pipe system would need to be around 7 m³/s.

The discharge of a pipe is governed by

\[ Q = (h_{le} + h_{lx} + h_f + fL/d)V^2/2g \]

where \( H \) is the available head to drive the discharge, \( V \) is the velocity of the flow in the pipe with diameter \( d \), length \( l \) and friction factor \( f \), \( h_{le} \) and \( h_{lx} \) are the entry and exit head loss coefficients, \( h_f \) is the head loss at a pipe bend and \( g \) is gravitational acceleration.

Using the usual entrance and exit head loss coefficients of 0.5 and 1.0 with a coefficient of 0.4 for a 45° elbow (Vennard, 1961), a friction factor \( f = 0.01 \), pipe length 30 metres and available head of 0.05 metres, the entire volume of the harbour could be discharged each day using four 2.1 metre diameter Hardie Iplex “Black Brute” (or similar) pipes, or with six pipes of 1.5 metre diameter. Half those numbers of pipes would be required to flush out the harbour every second day, and only a third of those numbers would be required to achieve the result twice a week.

These preliminary computations show that adequate flushing of the harbour can be induced using the available velocity head in the tidal streams that exist outside the harbour. It is emphasised here that these computations are based on limitations and assumptions.
particular, there is not enough field data to support the assumptions of the tidal velocity head available to induce flushing and field measurements would need to be undertaken. The only published data is in Nielsen (1979) and PWD (1970). These measurements were taken prior to the breakwall construction and which were one-off measurements rather than complete tidal gaugings. Further, the best orientation of any pipe vents could be designed only with further detailed field data of velocity streams outside the Harbour.

**Mechanical Flushing**

As an alternative to the natural flushing arrangement outlined above, flushing out of "hot spots" of poor water quality, such as around the western end of the harbour, could be effected mechanically using a low-head, high-discharge pumping arrangement. Electricity would appear to be readily available at the site and, after capital cost for installation, running costs would be expected to be low.

**Conclusions**

The limited water quality monitoring data that is available for Nelson Bay harbour, together with a range of anecdotal reports and personal observations, combine to suggest that water quality in the harbour is a real issue, with potential to become worse. The issue can be addressed through better management of input pollutants (such as the controls discussed in Council's stormwater management plan), with improving water circulation within the harbour and flushing of the harbour with water from Port Stephens.

There is sufficient tidal energy available outside of the harbour to induce adequate flushing of Nelson Bay harbour through the judicious design of pipe vents. Adequate designs could be completed only following more detailed field data acquisition of the tidal streams around the harbour.

Alternatively, the site is suited to the mechanical flushing out of poor water quality "hotspots" from within the harbour using low-head, high-discharge pumps. It is considered that this could be achieved with reasonable pump operating and maintenance costs.

Recommendations for further water quality monitoring in Nelson Bay harbour, and for more detailed investigation and design of water circulation and flushing options, are included in the draft Estuary Management Plan.

**1.2.1.4 Acid Sulphate Soils**

A further potentially significant threat to water quality in the estuary is the oxidation of acid sulphate soils (ASS), leading to discharges of low pH water into the estuary. Although extensive areas of the immediate hinterland of Port Stephens is mapped as having a high risk of ASS occurring near the surface (see Figure 1.7), there are only limited records of acid discharge events. These have been mostly in the catchment of Tilligerry Creek, although acid water has also discharged from a gravel quarry on the floodplain of the Karuah River at Allworth.

Port Stephens Council, in conjunction with relevant State agencies, local landholders, oyster growers and the Karuah CMC, is supervising the preparation of a detailed investigation of acid sulphate processes at Anna Bay and is also preparing a broad ASS Strategy for the local government area. Given the demonstrated impact of ASS on water quality in other estuaries, it is essential that management recommendations arising from this strategy be implemented.
1.2.1.5 Leachate from Landfills

In Cromartys Bay, the oyster industry has expressed concern about the potential for leachate from Council’s Salamander Landfill site to discharge into the estuary. The operation of the landfill is regulated by the EPA. The potential for contamination of waters was investigated during Council’s Catchment Assessment Program, with a program of both surface water and groundwater monitoring. Some investigations were also required as a condition of the EPA licence. Additional studies of the impacts of leachate on groundwater were conducted in association with the preparation of an environmental management plan for the landfill (CMPS&F 1997).

The studies demonstrated that some contamination of groundwater had occurred, and high faecal coliform levels were recorded from drains around the landfill site in 1997 and 1998. Council commissioned CSIRO to clarify the sources of faecal coliforms, using DNA fingerprinting and sterol analysis. This study demonstrated that numerous strains of E. coli were being delivered to Cromartys Bay. However, the study also showed that human faecal contamination was not contributing to the bacterial load, and that the bulk of faecal coliforms were from birds. This suggests that the landfill is indirectly responsible for high faecal coliform numbers, as the birds are attracted by putrescible wastes at the landfill site.

A number of actions were recommended to improve water management at the landfill, and to reduce the potential for surface and groundwater contamination. A number of these recommendations, such as partial capping, regrading of the surface, and improved management of leachate irrigation, have been implemented.

Other sources of polluted runoff into Cromartys Bay were found to be landscaping suppliers in the Salamander Industrial Estate, and runoff from residential areas. Action has since been taken to improve water management at premises within the industrial estate.

1.2.2 Other Sources of Water Contamination - Human Wastes from Recreational and Commercial Vessels

There are some 4964 boats registered in the Port Stephens and Myall Lakes area. Of these, 155 are surveyed vessels used for charter, houseboats and commercial fishing. Almost all the remainder are private recreational vessels of various sizes. In addition to locally registered vessels, the Port and Myall Lakes are used by large numbers of visiting recreational craft over the summer months. Port Stephens is also the only estuary with easy access and marina facilities for ocean cruising yachts between Brisbane Water and Port Macquarie.

Chappelow and Heysmand (1999) have reviewed the potential impacts of discharges of sewage from vessels into estuarine waterways in NSW. They note that although sewage from vessels is not currently a major source of pollution overall, it is a significant issue because of:

- Increasing population and user pressure on coastal waterways outside the Sydney metropolitan area. Although on a State-wide basis, 87% of registered vessels are less than 6 metres in length, the number of vessels remaining in the larger size classes, and the total number of small vessels, indicate the potential for significant volumes of wastes to be discharged into confined waters,

- A public expectation that vessel sourced sewage be properly managed,
FIGURE 1.7
Acid Sulphate Soil Distribution
• The high sensitivity of some areas regularly used by recreational vessels, which have
  poor water circulation or flushing and are also used for swimming, consumption of raw
  shellfish, etc,

• Although not all health incidents are reported, there is epidemiological evidence of
  increased risks of gastrointestinal, ear, nose, eye and throat infections from bathing in
  water contaminated with human wastes

The legislation to deal with sewage discharges from vessels varies considerably from one
part of Australia to another

In Western Australia and Queensland, draft position papers on appropriate management of
sewage from boats were published in 1998 and 1999 In both cases, there are
recommendations from unambiguous prohibition of sewage discharges within marinas, boat
harbours, rivers, creeks or estuaries, sanctuary zones (marine reserves), within 500 metres of
an aquaculture operation, or recognised primary contact recreation areas

In NSW, the Protection of the Environment Operations Act (POEO) prohibits pollution of
waters, but is difficult to enforce in situations with multiple small, diffuse sources The Act
also provides for the first time in NSW for licensing of larger marinas and slipways

The Management of Waters and Waterside Lands Regulations require certain vessels, in
certain waters to be fitted with a holding tank for sewage and galley waste This Regulation
currently applies only in Sydney Harbour, the Murray River and other inland waters The
regulation also requires that marinas in Sydney Harbour with more than nine berths provide
a pump out facility

The Regulation does not currently apply in Port Stephens or Myall Lakes, although a barge
mounted pump out facility has operated in Myall Lakes for some time, and a public pumpout
facility is located at Legges Camp, Myall Shores Three public pumpout facilities have
recently been commissioned in Port Stephens, with a further two being considered There
are currently five private pumpout facilities in Port Stephens, with varying charges for the
use of the service The public pumpout facilities are located at Nelson Bay, Soldiers Point
and Tea Gardens, with new facilities expected to be constructed at Lemon Tree Passage and
Karuah during 2000

As noted in Section 1.2.8, preliminary survey results suggest that the general recreational
boating community in Port Stephens does not regard sewage management from small
recreational vessels as a major issue Notwithstanding this, concerns have been expressed by
Council and the Waterways Authority about the health risks associated with inappropriate
sewage management in Nelson Bay Harbour and in sheltered bays such as Fame Cove

Although use of pumpouts in Myall Lakes is not required by Regulation, there has been
strong public pressure from local recreational boating groups (yachts and cruiser size) to
increase the number and use of holding tanks

Records of the amount of sewage collected from holding tanks on Myall Lakes have been
kept by NPWS/Waterways Authority for several years, and show a steady increase The
volume of sewage collected in Myall Lakes in 1998/99 was 293110 litres

In March 2000, the Waterways Authority published a discussion paper “Sewage Pollution
from Vessels” for public comment The discussion paper proposes a two-tiered risk
management approach to the control of sewage pollution from vessels, leading to some 24
regulatory, management and education actions Key actions of relevance to Port Stephens
include
• the discharge of untreated sewage from vessels be prohibited in all NSW waters,
• certain areas would be designated no discharge zones, even for treated sewage
  - waterways with aquaculture,
  - waterways used for drinking water supplies,
  - in or near a bathing area, mooring areas, marina and anchorage areas,
  - areas identified at sensitive ecosystems or designated marine parks,
• all vessels of certain size and use classes (generally commercial vessels and/or vessels of
  > 6 metres length) to be required to have a toilet and holding tank fitted,
• adequate shore based toilet facilities to be provided as an alternative to on board toilets,
  especially for areas with large numbers of small boats

Depending on community comments on this discussion paper, there is considerable potential
that most, if not all, of Port Stephens and Myall Lakes could be designated as a no discharge
zone

1.2.3 Bank and Beach Erosion

Outer Port Stephens is a dynamic sedimentary environment, with major readjustments to
shoals and beach alignments over a long period. Shoreline erosion has been documented as
a significant issue at Shoal Bay and Jimmys Beach for more than forty years and there are
anecdotal reports of the Jimmys Beach - Yacaaba Spit being breached by storm waves at the
end of the nineteenth century. Beach erosion processes at these locations are driven by
patterns of wave attack. Apart from local impacts of shoreline vegetation and nearshore sea
grass habitats, this erosion has major economic implications due to
• Threats to tourist and residential infrastructure. Since residential development commenced along Winda Woppa in 1967, 130 dwellings with an estimated value of $130 million have been constructed. Of these, 48 are located in The Boulevard, along the beach front. Shoreline erosion also presents threats to the safety of the Shoal Bay jetty and boat ramp,
• Threats to recreational amenity of the beaches. A rock wall at the eastern end of Shoal Bay has prevented ongoing shoreline retreat, but has resulted in the loss of the beach in front of the wall, so that it is not possible to walk along this section of the "beach" in most tide and weather conditions,
• Potential reductions in rates of tourist visitation, associated with loss of amenity and
  safety issues

Erosion of both Shoal Bay and Jimmys Beach is expected to continue. Indeed, MHL (1998)
notes that in the absence of effective ameliorative works, the rate of shoreline recession is
likely to increase

Detailed studies of shoreline erosion processes have been conducted at both Shoal Bay
(MHL 1998, 1999) and Jimmys Beach (PWD 1987, Lord and Neilsen 1989)

Over the past twenty years, a natural recession rate of 5000 m³/year at Shoal Bay has been
estimated by MHL, although this has largely been masked by sand nourishment programs
and the construction of various walls and groynes. MHL (1998) estimates that the 50 year
The Shoal Bay Coastline Hazard Study has been followed by the preparation of a Coastline Management Plan (management options and impacts) which was presented to Port Stephens Council in May 2000. The preferred management strategy to maintain the amenity of Shoal Bay beach for recreation and tourism is a local beach nourishment program. MHL recommend ongoing relocation of sand updrift, from the western (downdrift) end of the beach. They suggest that the most cost effective means of achieving this relocation would be to truck sand along the beach, and past the jetty area. The along beach movement would be supplemented by across beach reshaping as necessary. Ongoing renourishment could be timed to minimise potential conflicts between recreational beach users and beach maintenance activities.

MHL also note that if sand requirements exceed this local supply at any time, then potential external supplies are available from shoals west of Tomaree Head, or at Anna Bay.

These recommendations will be incorporated into the estuary management plan as they are adopted by Port Stephens Council.

Between 1984 and 1990, a total of approximately 150,000 cubic metres of sand was placed on Jimmy's Beach, over three separate occasions. These ongoing beach nourishment programs at Jimmy's Beach since the 1980s have failed to stabilise the beach profile. MHL (1999) has calculated from photogrammetric analysis a consistent recession trend at Jimmy's Beach of 0.7 m/year, with a total estimated sand loss of 8000 m$^3$/year being eroded over the full active beach profile. With this rate of beach recession, the volume of sand that needs to be supplied (using current emplacement methods) is significantly greater than was originally estimated, and is a major cost to Great Lakes Council.

MHL has been appointed to review the Jimmy's Beach Management Plan that has been implemented over the last ten years, and make recommendations about the future management of the beach. A range of broad strategies are being considered, and have been presented to the local community at the first of several proposed workshops, as well as on the MHL Website. The main options include:

- **Do nothing** – this option has major consequences for residential development and for recreational amenity.
- **Use buffer zones and development controls** to reduce the risk of new development occurring within the coastal hazard zone.
- **Acquisition** – this would involve a property repurchase scheme for those properties most at risk of erosion damage.
- **Configuration dredging** – this involves targeted dredging of the offshore shoal that is considered to be focusing wave energy on particular parts of the beach, and using the sand to reform the beach profile at a lower gradient. A combination of dredging and bar nourishment could also potentially reduce exposure to westerly wave energy.
- **Protective works**, such as the construction of a sea wall. Although this option has been demonstrated to provide protection for property, seawalls generally result in significant loss of beach amenity, through loss of the natural beach morphology. Recent technological innovations mean that it may now be possible to install more temporary structural controls at a relatively low cost.
• Periodic sand nourishment The study is considering alternative methods of emplacing the sand on the beach, to reduce short term reworking, and enhance improvements to beach gradient

The recommendations of the review of the Jimmys Beach Management Plan, which is due to be exhibited in draft form in August 2000, will be incorporated into the Estuary Management Plan for Port Stephens and Myall Lakes as they become available

Other minor areas of bank erosion have been identified in Tilligerry Creek, and the Karuah River. More serious shoreline erosion has been occurring at Tanilba Bay over several years, with particular concern being expressed after storms in May 1994. The shoreline erosion affects shoreline amenity, but also is affecting the stability of riparian vegetation in the Tilligerry Habitat Area.

Sand migrates along the Tanilba foreshore from west to east. A study of processes affecting the stability of the shoreline and appropriate management strategies was conducted by Geomarine in 1997. Broad scale erosion of this shoreline is related to the degree of exposure to wind waves, with the problem being locally worse because of a range of obstructions to the natural littoral drift, with shore normal flows from stormwater drains being the most important factor.

Management actions proposed as a result of this study were directed at broad scale wave erosion and at local erosion caused by disruption of littoral drift.

For broad scale erosion, the consultant noted that there was no simple solution, and some solutions would be very costly. For instance, it would be possible to construct an artificial barrier offshore, or an artificial headland, both of which would reduce wave energy reaching the beach. Both options are estimated to cost at least $500000, with no real guarantee of their effectiveness. Beach nourishment was also considered an option, but no information was available about sources of appropriate sand.

Options to address localised erosion included removing existing rock walls and nourishing the beach with sand of an appropriate grain size, construction of new rock embankments, and better dispersion of flows from stormwater drains.

Residents at Pindimar have made several representations about foreshore erosion at Pindimar (particularly South Pindimar), which they consider may be exacerbated as oyster leases along the shoreline gradually break up. Erosion of this shoreline may well be associated with wide ranging sediment redistribution along the north shore of the outer port (Corne Channel - Jimmys Beach), and causal processes need to be clearly identified.

1.2.4 Riparian Vegetation, Seagrass and Wetlands

The retention of a relatively high proportion of natural vegetation around the shoreline of Port Stephens and Myall Lakes contributes to high conservation value, and high recreational and aesthetic values.

The Estuary Processes Study identified that approximately 65% of the catchment area of the estuary is naturally vegetated (Conacher Travers Pty Ltd 1998). This naturally vegetated catchment area is a key factor in the current health of the waterway. The Estuary Processes Study did not present detail about the extent and health of riparian vegetation around the estuary, and the protection of shoreline vegetation was not identified as a key issue in early analysis by the Estuary Management Committee.
Notes
1. Base plan from photogrammetric plot by DLWC from 22 June 1994 photography
2. Immediate impact line is limit of wave erosion at present
3. 50-year impact line eludes allowance for long-term recession plus storm bite
4. No allowance for future sea level rise and foundation stability was included in determination of impact lines

Legend
- Water Line plotted from aerial photograph 22 June 1994
- Average landward position of active beach (dune face at present)
- Immediate impact line
- 50-year impact line
- Buildings

FIGURE 1.8
Shoal Bay Hazard Zone

Umwelt (Australia) Pty Limited
Source Figure 23 - Shoal Bay Coastline Hazard Study
The extent of riparian vegetation, and the extent of natural vegetation in the immediate visual catchment of the estuary were both identified as important community issues at the Community workshops conducted for the Estuary Management Study.

To clarify the extent of riparian and visual catchment vegetation, broad scale vegetation mapping has been undertaken using recent (October 1998) aerial photographs of Port Stephens. The riparian vegetation of Myall Lakes National Park has not been included in this exercise, as virtually the entire foreshore of the park retains healthy natural riparian vegetation, including extensive reed beds. Three broad types of habitat extending to the estuary foreshore in Port Stephens have been mapped, together with areas of mangrove foreshore and developed foreshore from which most riparian vegetation has been removed:

- Woodland/Open forest,
- Wetland,
- Grassland/agricultural land

The distribution of these habitat types is illustrated in Figures 1.9 and 1.10.

In addition to the general habitat mapping provided by the Estuary Processes Study and this study, Port Stephens Council has recently placed on exhibition detailed mapping and habitat analysis in relation to the koala population of the area. A number of areas of “Preferred Koala Habitat” are part of the riparian vegetation of the estuary. Two large areas of high value koala habitat are located:

- Along the northern shore of Tilligerry Creek, and
- Around the south western shore of Cromartys Bay. This area links directly to a large area of Preferred Koala Habitat on the Tomaree Peninsula. A substantial area of “Supplementary Koala Habitat” adjoins the shoreline between Corlette and Salamander Bay, and remnant areas of natural vegetation on Soldiers Point are also mapped as Supplementary Koala Habitat.

Smaller patches of Preferred Koala Habitat are situated along the shoreline of Big Swan Bay, Tanilba Bay/Lemon Tree Passage, on the southern shore of Tilligerry Creek, adjacent to the wetlands of Twelve Mile Creek, and along the Karuah River upstream of the highway bridge.

Most natural riparian vegetation has been removed from the southern shoreline of outer Port Stephens, where absolute waterfront properties occupy most of the shoreline between Nelson Bay, Corlette and Soldiers Point. Absolute waterfront residential development also occurs in North Arm Cove. At Lemon Tree Passage and Tanilba Bay, most properties have waterfront reserve frontage, however, in these areas, the quality/diversity of natural vegetation is much reduced, except in the Tilligerry Habitat Area.

Along the southern shore of the Outer Port, development is also affecting the visual catchment of the waterway, with new subdivisions extending onto the slopes of the vegetated hills that form the backdrop for this area.

The remaining areas of foreshore vegetation along the southern shore of the Outer Port are considered to be of high conservation value, and should be protected or enhanced.

The northern shores of Port Stephens retain a relatively high proportion of natural vegetation, particularly in the Inner Port area. There are also several Nature Reserves in this area.
area, including Corne Island and Bull Island (see Figure 1.5 of Reference Document 1) Part of Fame Cove is included in the Myall Lakes National Park Although much of the northern shoreline retains natural vegetation, many areas are privately owned, with potential for a range of land uses within the existing zoning

Insufficient information is currently available to comment about the trend in the area of mangrove in Port Stephens Mangroves provide high value estuarine habitat, and this information should be incorporated in any strategic review of the conservation value of riparian vegetation in the estuary

The distribution of seagrass in Port Stephens is illustrated in Figure 1.11 Three species of seagrass have been identified in Port Stephens (Zostern, Halophila and Posidonia) Recent survey of seagrass habitat (Umwelt for NSW Fisheries, 1999) has confirmed the extent and health of seagrass, and also highlighted the impacts of stormwater and boat moorings on local seagrass distribution and quality

An important issue for the sustainable management of the estuary is the preparation of a strategic plan for retaining high conservation value areas in conservation based management This does not necessarily require public acquisition of the land (see existing extent of Crown Lands in Figure 1.12) Other options could include the preparation of voluntary conservation management agreements with landowners, with appropriate incentives if necessary This strategy is introduced in Goal 1 of the NSW Coastal Policy (to Protect, rehabilitate and improve the natural environment)

Other strategies suggested in the Coastal Policy for the protection of both riparian and estuarine vegetation (such as sea grass beds) include

- Councils to classify open space and land with Conservation value as community land under the Local Government Act
- Existing controls be effectively implemented to protect valuable components of coastal ecosystems (eg SEPP 14, Fish Habitat Protection Plans, RAMSAR listings, catchment runoff controls)
- Local Environment Plans be prepared with appropriate zonings and other provisions to protect areas of recognised conservation value

The Port Stephens Council Comprehensive Koala Plan of Management (1999), recommends that significant areas of koala habitat be protected by rezoning to Environmental Protection (new 7a) Areas that have been included in this recommendation include the riparian vegetation between Tanilba Bay and Oyster Cove (public and private lands), the Taylors Beach area on the southern shore of Cromartys Bay (privately owned), and the parcel of land in the Twelve Mile Creek catchment (publicly owned)

The new 7a zone would prohibit silica and sand mining, subdivision for dwellings, and subdivision of concessional lots in certain areas It would also require that Development Consent be obtained prior to vegetation clearing

- Regional open space networks to protect natural habitats wherever possible

A range of actions to achieve enhanced conservation of riparian vegetation around the Port Stephens estuary is suggested for consideration in the draft Estuary Management Plan
FIGURE 19
SEPP 14 Wetlands

Legend

Moderate
SEPP 14 Wetlands

Umwelt (Australia) Pty Limited
FIGURE 1.10
Riparian Vegetation of Port Stephens

Umwelt (Australia) Pty Limited

Not To Scale
Ref No.:1287/R04/R02_VU/psc_028.dgn
FIGURE 1.11
Changes in Seagrass Distribution between 1985 and 1999

Source: West et al 1985

Additional Areas Mapped in 1999

1985
- Posidonia australis
- Halophila ovalis
- Zostera capricorni
- Mangroves
- Saltmarsh communities

Additional Areas Mapped in 1999
- Posidonia australis
- Halophila ovalis
- Zostera capricorni

FIGURE 1.11
Changes in Seagrass Distribution between 1985 and 1999

Source: West et al 1985
FIGURE 1.12
Crown Reserves
1.2.5 **Oyster Lease Management**

The potential for contamination of oysters by pollutants deriving from urban runoff, or from poorly managed on site wastewater systems has been amply demonstrated. The implications of oyster contamination for the industry, and the duty of care held by State and local government, have been explored in detail in the Federal Court of Australia, following the outbreak of Hepatitis A at Wallis Lake (Ryan v Great Lakes Council FCA177).

The NSW Shellfish Quality Assurance Program (QAP) is a compulsory program for oyster growers, operating under the Fisheries Management Act (1994) and Fisheries Management (Aquaculture) Regulation (1995). It requires oyster growers to monitor the status of all oysters going to market. The QAP is an important, integrative component of existing estuary monitoring. In addition, the NSW oyster industry is trying to arrive at a process of having estuaries (or areas within estuaries) classified according to the Australian Shellfish Sanitation Control Program. The Program sets out a detailed methodology and audit/accreditation process for having areas within estuaries classified in terms of harvest suitability. To achieve this classification requires a detailed sanitary survey and sampling procedure that must meet minimum requirements to be classified. There is also a follow up audit process that needs to be complied with.

Recent studies of potential contamination sources in Port Stephens and Wallis Lake have also highlighted the need for improved “housekeeping” by the oyster industry, particularly in relation to the management of human wastes. General waste management, such as the proper disposal of discarded racks and sticks also requires attention.

The waste management issue is being addressed on two fronts in Port Stephens. Firstly, the State Government has made available $920000 per annum over four years to remove derelict oyster lease material from expired leases in Port Stephens. NSW Fisheries has conducted an audit of disused oyster leases in the Port, to provide an estimate of the amount of cultivation material that would need to be removed in rehabilitating the derelict leases. There are currently some 400 hectares of expired, derelict leases in the Port. These leases incorporate approximately the following volumes of waste material, some of which may be able to be reused in future aquaculture projects:

- Sticks (metres of rack) 23818
- Rails (metres) 65640
- Posts (number) 318621
- Depot sticks (blocks) 8601
- Rocks (square metres) 200

This program will also address a number of stockpiles of old lease timbers around the Port (volumes currently being audited). Responsibility for clean up of other derelict leases currently remains with the lease holders.

NSW Fisheries has commenced the preparation of an Aquaculture Industry Development Plan (AIDP) for Port Stephens, to be completed by mid 2000. It is to be expected that this plan will...
• identify areas most suitable for various aquaculture activities,

• provide guidance on best management practices for oyster industry wastes to minimise the impact of aquaculture on the local environment, and

• specify a range of environmental monitoring requirements to ensure that the environmental impacts of the industry are minimised and the potential for contamination of aquaculture products is also minimised

Aquaculture industries that may be considered for Port Stephens include oysters (primarily Sydney Rock and Pacific Oysters), clams, Akoya pearls, and marine fin fish. There has been particular recent interest in Akoya Pearls and marine fin fish, with apparently successful trials taking place in Port Stephens and its immediate marine zone over the last two years. Snapper from the trial fish farm have been available for sale through regional fishing cooperatives since April 2000.

Oyster lease and fishery management also involves protection of fisheries habitat. As noted in Reference Document 1, seagrass distribution in the study area is locally impacted by sediment deposition at stormwater drains and by swing moorings. Seagrass habitat protection is also an issue for any dredging program. Healthy seagrass habitat is a major benefit of effective urban stormwater control.

1.2.6 Aesthetics – Estuary Context

One of the significant features of Port Stephens, and a defining characteristic of Myall Lakes, is the naturalness of the skyline, when viewed from the water, or from shoreline vantage points. Examples of ridgelines that have been identified by the community as valuable aesthetic assets are provided in Plates 3 and 4. This bushland context has been identified as an important value by both workshop participants and in written submissions. The potential for new development to reduce the vegetation along ridgelines has also been raised in these submissions. Areas of concern include extensions to the Salamander Bay urban area, and potential urban growth areas at Pindimar, North Arm Cove, and the northern shore of the Karuah River.

The extensive areas of natural riparian vegetation along the foreshores of upper Port Stephens have also been noted by community submissions for their aesthetic value as well as their habitat value (see Reference Document 3).

A number of community comments were received about the aesthetic values of the estuary context, in response to the exhibition of the draft Estuary Management Study. These included:

• protection of existing riparian vegetation,

• protect foreshores and visible high ground by requirements for new housing setbacks, maintenance of forested lands in the visual catchment, maintaining vegetated buffers along main roads, and limiting development on the Tomaree Peninsula.

1.2.7 Peace and Quiet of Lifestyle

Participants in community workshops at Nelson Bay, Hawks Nest and Bulahdelah have all noted the social value of the traditional small village development around Port Stephens, with concerns expressed both about large scale urban development and intensive tourist
Aesthetic value of Port Stephens
Natural Vegetation within Visual Catchment

PLATE 3
Vegetated skyline is being encroached upon in
Management Zone A
Aesthetic value of Port Stephens
Natural Vegetation within Visual Catchment

PLATE 4
Tilligerry habitat area (southern shore inner port)

Umwelt (Australia) Pty Limited
Ref No.: 1287/R04/RD2_V1/psc_039.dgn
development around the waterway. It should be noted that both urban construction and tourist development are major components of the local economy.

The community perception of the risks associated with further intensive development is that it would increase noise levels, traffic levels, and result in overcrowding of community facilities such as boat ramps and foreshore parking areas.

This issue has been raised particularly in relation to the potential growth of the Tea Gardens/Hawks Nest area, where poorly managed rapid growth would have the potential for detrimental impacts on both social values and natural values. In response to perceived pressures for major rezonings in this area (at North Hawks Nest, and west of Tea Gardens), as well as expected population growth demand as the Freeway from Sydney is upgraded, Great Lakes Council has commenced the preparation of a Conservation and Development Strategy (see Figure 1.13).

Council has defined conservation for this study as visual qualities, amenity, plants and animals and natural features, so that the study encompasses both natural and social values. The study involves extensive community consultation, and is designed to address issues such as:

- What kind of development is wanted in this area, and where should it be located?
- What kinds of services will be needed?
- What values does the community place on nature conservation?
- What is the right balance between new development and conservation of the natural and social values of the area?
- What forces are driving increasing demand for residential and tourist development in this area?
- What are the environmental constraints to further development, and what natural features are important?
- What is the relationship between further urban development and demand for water based recreational facilities (e.g., boat ramps and jetties, moorings),
- What is the current zoned supply of land?

The land management strategy that emerges from this study will have significant implications for the management of the estuary. The study has also attracted the interest of the NSW Coastal Council, as it requires that Great Lakes Council clearly articulate the relationship of Ecologically Sustainable Development to its development policies, in an environment which is regarded as sensitive to environmental change. Potential impacts include direct and indirect impacts on the following aspects of the management of the estuary (see Table 1.2).
Table 1.2 - Impacts and Management Options -
Further Urban Development at Tea Gardens/Hawks Nest

<table>
<thead>
<tr>
<th>Impact of development</th>
<th>Management options to mitigate against impacts</th>
</tr>
</thead>
</table>
| Urban stormwater impacts on surface and groundwater quality                           | • Retention and infiltration and/or treatment of stormwater,  
|                                                                                        | • Community awareness programs to reduce excessive use of fertilisers, influence landscaping selections, water reuse etc |
| Increased demand for recreational boating facilities, including launching and boarding, and maintenance of navigation channels | • Monitor waterway use and adequacy of facilities, and evidence of conflicts between user groups or impacts on ecology/bank stability,  
|                                                                                        | • Acquisition and management of foreshore open space |
| Increased pressure on recreational values of Myall Lakes National Park                | • Link to management strategies for National Park to address demand (eg entry permits and fees) |
| Increased pressure on SEPP14 wetland habitats and riparian vegetation - from clearing for development, runoff impacts, weed infestation, recreational boating activity impacts on bank stability and sea grass | • Setbacks (buffers) for all development from foreshore areas and wetlands,  
|                                                                                        | • Careful planning and management of foreshore reserves,  
|                                                                                        | • Some high conservation areas set aside from all development,  
|                                                                                        | • Enforcement of LEP requirements re wetland protection and design/management of stormwater controls,  
|                                                                                        | • Specified camping areas in Myall Lakes National Park and elsewhere |
| Urban stormwater impacts on foreshore sedimentation                                   | • Retention and infiltration of stormwater to keep stormwater flows as close to natural as possible,  
|                                                                                        | • Erosion and sediment controls for all new development |
| Reduction in 'naturalness' of the area, eg by loss of ridgeline and riparian vegetation, and bushland open space | • LEP and DCP requirements for scale and nature of new development,  
|                                                                                        | • Use existing legislation in integrated manner to protect riparian vegetation and bushland habitat areas |

A community consultation program was conducted between September and December 1999.
Community input was received about a range of economic, environmental and social issues and concerns. Many of the comments made are also relevant to planning for effective estuary management, including:

- Must protect important habitats and important environmental assets Options include
  - identify habitat corridors before development occurs, including fauna corridors along waterways,  
  - set criteria against which to assess environmental performance of development,  
  - buffers around wetlands,  
  - identify and manage acid sulphate soils

- Growth is needed, but not high use, and not like the Central Coast Preserve village character Promote ecotourism in areas of medium environmental value
FIGURE 1.13
SEPP 14 Wetlands & Potential Urban Development Areas, Tea Gardens & Hawks Nest

Legend:
- SEPP 14 Wetlands
- Potential Urban Release Areas
- Study Area Boundary
- Context Area Boundary

Umwelt (Australia) Pty Limited
Source: Great Lakes Council
1.2.8 Navigation and Waterway Safety

There are 4964 boats registered in the Port Stephens and Myall Lakes area (by postcode), equivalent to 2.8% of all boats registered in NSW. Of these 147 were oyster punts/work boats, 60 were hire and drive vessels (small powerboats), and 155 were surveyed vessels (charter boats, houseboats and fishing boats).

Two principal groups of issues have been identified in relation to navigation and waterway safety:

Navigability of the waterway

- The shallowing and migration of the main navigation channel around Corrie Island and into the Lower Myall River
- Obstacles in the waterway, such as derelict oyster leases
- Shallowing of nearshore areas and navigation channels due to deposition of deltas at stormwater drains

Access to the waterway

- Safety of ramps and jetties
- Locations of ramps and jetties

The risks associated with obstacles such as oyster leases are currently being addressed through the preparation of a Statement of Environmental Effects for the removal of derelict lease material from the waterway.

The behaviour of the Corrie Island channel illustrates well the sensitivity of the estuary to marine sedimentation patterns, and the impacts that changes in these patterns can have on economic activity.

MHL (1998) notes particular navigation problems in the channel along the western side of Corrie Island. Prior to the destruction of Myall Point during major storms in 1927 to 1929, the main entrance to the Myall River was along the eastern side of Corrie Island. This channel is now heavily shoaled, and dangerous for navigation. An alternative channel was dredged on the western side of Corrie Island to improve access for timber droghers. This channel is also now extensively shoaled, and NSW Waterways have had to relocate channel markers. Expressions of Interest have recently been called by Great Lakes Council for a new maintenance dredging program in this area to provide safe navigation into the Myall River. Progress with dredging the channel is hampered by the high costs to be borne by a small regional Council. A number of cost sharing options have been noted by the Estuary Management Committee, including potential sale of sand for fill on construction sites, and budget contributions from Port Stephens Council and waterway users. It is understood that Great Lakes Council is continuing discussions about funding options with DLWC and a dredging contractor. Any arrangement that involves sale of sand from the channel will require explicit requirements in terms of maintaining maximum and minimum channel depth and width, and consistent navigation conditions.

Six boating incidents were reported by the Waterways Authority from Port Stephens and Myall Lakes in 1997-98. This small sample provides an indication of the range of potential incidents and conflicts associated with recreational boating.
• At Bombah Point, a hire boat was blown into a moored yacht during strong winds,
• At Dutchies Beach, a propeller fell off a moving boat and it collided with an anchored vessel,
• In Myall Lake, the occupants of a houseboat were harassed by the occupants of a runabout,
• At Corlette point, two hired jet skis collided, and
• Near the south head of the Port, a fishing boat struck rocks and started to take on water

1.2.8.1 Community Views on Waterway Accessibility

The second major issue in relation to waterway accessibility and safety is the location and management of boat ramps and jetties. A number of community submissions have raised concerns about crowding at some ramps (particularly Little Beach in peak summer demand periods), lack of parking for boat trailers, constricted launching areas, and difficult launching and retrieval conditions in windy conditions.

The locations of boat ramps and jetties in Port Stephens is illustrated in Figure 1.14. Port Stephens Council has received petitions with some 278 signatures, raising concerns about the crowding and safety of the Little Beach ramp during busy periods. Apart from these petitions, little data has been gathered to date to investigate the nature and extent of concerns. As a preliminary investigation, and to clarify the issues, a survey of boat ramp users has been conducted as part of this study. The survey form is included in Appendix 1.

A total of 45 responses were obtained to the preliminary survey, over two weekends. Recreational boat users were interviewed at Little Beach, Shoal Bay, Salamander Bay, Soldiers Point, Lemon Tree Passage and Karuah ramps. Boat users were also interviewed at the main Williams River Ramp to provide an indication of the alternative recreational boating opportunities in the Local Government Area.

The preliminary survey sought responses from boat ramp users on a range of issues. In particular, the survey sought to establish

• Current levels of ramp usage,
• User's views about issues and problems,
• The reasons that particular boat ramps were chosen by users,
• User views on the environmental impacts of recreational boating, and
• The main users and user groups at the ramps and surrounding waters

The principal findings of the preliminary survey are as follows

• 40% of the respondents reside in the Port Stephens Council area, but 20% were from the Newcastle Local government area, and at the time of this survey, 17% were from Sydney. The remainder were from elsewhere in the lower and middle Hunter (eg Cessnock, Maitland and Singleton). It is to be expected that these percentages will vary during holiday periods, and during major fishing competition events,
Source: Figure 1 - Port Stephens Facilities Assessment
Author: C. Thomas-Patterson Britton & Partners Pty Ltd
Dated: 30/7/97

Legend:
T Locations of public amenities in foreshore parks

FIGURE 1.14
Location of Public Foreshore Facilities within Port Stephens

Not To Scale
Rel No: 1287/R04/RD2_V1/psc_024 dgn
Most ramp users interviewed participated in recreational boating on a weekly basis (not necessarily at weekends). Of 45 respondents, only 2 were using the facility for the first time.

51% of respondents were using a runabout type boat, up to 7.5 metres long, with a further 26% having a runabout or speedboat up to 12.5 metres long. Most speed boats were actually used for skiing activities on the Williams River.

The areas of Port Stephens that were nominated as popular for recreational boating were Nelson Bay (11%), Pacific Ocean (10.2%), Salamander Bay (9.5%), and Shoal Bay (8.9%).

Boat users during this preliminary survey were mostly using the waterway for fishing, with a low proportion nominating sightseeing. It should be noted that the weather was cool and overcast on the days of this survey, and different results could be expected in different weather conditions.

Respondents explained their choice of ramp in terms of proximity to their home (or holiday residence). The poor condition of or lack of access to alternative ramps was also nominated.

Although some users explained their choice of ramp in terms of poor condition or lack of access to alternatives, most respondents indicated that they were satisfied with the access, facilities and usability of the ramp they had chosen. A number of respondents nominated “slippery ramp” (poorly maintained) as a reason to avoid certain facilities. Exposure to wind/swell conditions was also nominated as a reason to avoid some ramps in certain conditions.

Many respondents (44%) felt that recreational boating had no real impact on the waterway, explaining that “the locals all do the right thing.” Respondents did nominate a number of potential boating impacts, including unburnt exhaust gas, litter, fuel spills, maintenance practices, disturbance of fish stocks, damage to sea grass beds and inappropriate disposal of sewage and bilge water. They attributed these impacts to the commercial boating sector.

None of the respondents had a holding tank for sewage on their vessel. Given the size of most of the vessels that were described, many would have practical difficulties installing a holding tank. However, a proportion of recreational craft using either the ramps or nearby jetties would be large enough to have a holding tank fitted. Minor design changes could increase the feasibility of waste storage on small vessels.

The most commonly mentioned improvements to boat ramps were the provision of boat washes and hoses, more ramps, more garbage bins (with controls to prevent resident dumping), and regular removal of slime from the ramps to increase safety. More than a quarter of respondents suggested the need for more toilets and showers. Given the high usage of ramps and foreshore facilities by relatively small boats, the adequacy of on-shore public amenities is an important consideration for reducing the potential for human wastes to be disposed of directly into the waterway. The locations of existing amenities are shown in Figure 1.14.

In addition to discussions with recreational boat users in the field, contact has been made with a range of recreational boating clubs, to clarify their concerns. The Newcastle and Port Stephens Game Fishing Club has raised a number of serious concerns about the management...
of boat launching ramps during consultation for the preparation of the Estuary Management Study. Similar concerns have also been raised by members of the Port Stephens Yacht Squadron, and the Lake Macquarie Yacht Club (whose members use Port Stephens at times). Issues raised by these user groups include

- The Little Beach ramp is dangerous to use in summer because of overcrowding, leading to long waiting times, and competition for space both on the ramp, in the nearshore, and in car parking areas,
- There are major problems with wind and swell conditions for launching and boarding,
- The Game Fishing Club reported a number of injuries such as broken bones and loss of fingers which have resulted from overcrowding on the Little Beach ramp and the adjacent boarding jetty in windy conditions,
- Parking is extremely difficult at Little Beach in peak demand periods because the car park is used for multiple purposes, such as caravan park visitors, tourists, traffic going to the tea house, swimmers and the children's playground nearby, as well as boat trailers,
- The Soldiers Point ramp is heavily used, but is dangerous at low tide,
- The Soldiers Point ramp is too far from the heads to be popular with people planning trips outside the heads,
- Water depths off the Soldiers Point ramp are very shallow, partly because of sand nourishment to alleviate erosion problems nearby. Ramp users feel this sand is migrating along the shore, across the ramp, towards the marina. Shallow water depths make the ramp dangerous at low tide,
- Access to the Soldiers Point ramp by junior dinghy sailors is poor, with boats having to be carried approximately 200 metres from the car park to the ramp,
- The Shoal Bay ramp is dangerous because of a short slab, it is open to most wind and wave conditions, and is very shallow. The ramp is in need of repair, and there is not enough parking for boat trailers.
- User groups have suggested that safety issues need urgent consideration. They have suggested introduction of instructive signage to improve the flow of boats on the ramp (eg so that three vessels can be fitted across the Little Beach ramp). They have suggested a separate facility for tourists who may have little experience with crowded ramp conditions. They have also suggested a regional scale facility at Bagnalls Beach. The current regional scale ramp is at Tea Gardens, and is remote from the major user groups along the southern shore of Port Stephens.

Further analysis of the origins and destinations of boat users will facilitate improved demand management.

It is of note that the information obtained from the preliminary survey of boat ramp users is not entirely consistent with the opinions expressed by the recreational boating clubs. Reasons for apparent differences in levels of concern will be explored further when a larger sample of ramp users is available.

A range of management recommendations to promote sustainable recreational boating activity is outlined in the draft Estuary Management Plan.
1.2.9 Human Health Issues

Mosquito Carried Viruses

An emerging issue for coast and estuary management in southern Australia is the increasing incidence of a range of tropical diseases that are associated with mosquito breeding in estuarine environments. The most commonly reported disease is Ross River Fever, with a total of 696 cases reported in the Hunter since the introduction of the Public Health Act in 1991.

Notifications for the Hunter and for postcode areas around the Port Stephens and Myall Lakes estuary are summarised in Table 1.3.

Table 1.3 - Confirmed Ross River Fever Notifications for the Hunter and Port Stephens Estuary Areas

<table>
<thead>
<tr>
<th>Year</th>
<th>Hunter Notifications</th>
<th>Study area notifications (based on postcodes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>301</td>
<td>51 (predominantly in postcode 2315 and 2324)</td>
</tr>
<tr>
<td>1998</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>1999</td>
<td>143</td>
<td>43 (half of these in postcode 2324)</td>
</tr>
</tbody>
</table>

(Data supplied by Hunter Area Health Service, Public Health Unit. No separate postcode data for 1992-1996)

The Public Health Unit of the Hunter Area Health Service has advised that these numbers of notifications represent only those cases that were confirmed by blood tests. Their view is that the disease has been under reported, but that reporting is improving as local medical practices become more aware of its likely incidence. The very large number of notifications in 1997 reflects a State-wide anomaly in that year, which has not been explained. The Hunter reported the highest number of cases of Ross River Fever per head of population in that year. The Public Health Unit also has advised of nine cases of Barmah Forest Virus in the study area since 1997. The two viruses are similar in that both are transmitted by mosquitoes breeding in wetland areas, and produce similar symptoms.

Ross River Fever is transmitted by mosquitoes, many of which breed in estuarine wetlands. The increasing incidence of the disease may be attributed to a combination of changes to drainage regimes in coastal wetlands (particularly saltmarsh), and to climatic changes (either short term or long term) which improve habitat conditions for mosquito breeding, and encourage southern migration of tropical species. In addition, increasing urban development around coastal wetland areas will increase the exposure of larger numbers of people to infection (and the potential influx of carriers).

Port Stephens Council has recognised its responsibility to provide a safe environment for residents and has conducted reviews of salt marsh distribution and drainage, as well as considering options to modify mosquito habitat in high risk areas.
Council has identified all potential breeding sites around Port Stephens (in the Port Stephens Local Government Area). It plans to develop a management strategy to control mosquito breeding.

In the interim, a limited number of small ‘hot spot’ areas, adjacent to residential land are being treated with larvicide. Council is also supporting the work of a PhD student, in conjunction with the Kooragang Wetlands Rehabilitation project and the University of Newcastle. The research project is studying the impact of habitat modification on the local ecosystem and will present a management plan if the process is not harmful to the environment. Habitat modification is a method of managing mosquitoes. The project focuses on a natural wetland site adjacent to the Karuah golf course. The three year project will be completed at the end of 2000.

**Biological contamination of estuary products**

As noted in Section 1.2.5, the outbreak of Hepatitis A associated with consumption of virus contaminated oysters in Wallis Lake highlighted the risks to human health associated with estuaries with even relatively low levels of urban development. Whilst there has been no evidence of such health problems in Port Stephens, the precursor conditions have been recognised. These include the presence of unsewered urban and tourist development on the foreshore of the estuary, even at some distance from oyster leases.

The Oyster Quality Assurance Program is designed to minimise the risk of potentially contaminated oysters reaching the market for consumption. In addition, the use of strategic enforcement by regulatory authorities has impressed on waterway users the importance of great care in managing wastes. The successful prosecution of a caravan park owner at Karuah for discharge of raw sewage to the estuary illustrates this approach. This case resulted in the first prison sentence for an environmental offence in NSW.

Following blue-green algae blooms in Myall Lakes, oyster growers in the Tea Gardens area are keen to source research on the potential for algal biotoxins to move down the lower Myall River and accumulate in oysters. The context of a freshwater lake system with oyster growing areas downstream is very rare in Australia.
2.0 ESTUARY MANAGEMENT THEMES AND MANAGEMENT OBJECTIVES

The fundamental management objective that underpins the NSW Estuaries Program is

• To manage existing and future human interactions with estuary processes in accordance with the principles of ESD

Ecologically sustainable development also provides the conceptual basis for the NSW Coastal Policy. In its recent Draft discussion paper, the Coastal Council stresses the 'triple bottom line' of ecologically sustainable development, arguing strongly the importance of integrating economic, social and environmental constraints and opportunities in the long term, associated with land management and natural resource management decisions. Port Stephens and Great Lakes Councils are covered by the NSW Coastal Policy, and are therefore required to reflect the principles of ecologically sustainable development in planning and management decisions.

Both Councils are committed to achieving ecologically sustainable development. In this context, four principles underpin all strategic planning related to the estuary.

• The precautionary principle The lack of full scientific evidence should not be used as a justification for the postponement of the introduction of measures to prevent or mitigate environmental degradation.

• Intergenerational equity Each generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for future generations.

• Conservation of biological diversity and ecological integrity Measures should be taken to prevent and protect against the extinction of plant and animal species due to human activities.

• Improved valuation and pricing of environmental resources The quality and value of environmental resources should be maintained and enhanced through appropriate management, preventing degradation and damage.

A framework for managing the estuary that draws on these principles would include the following

• A decision making framework that balances scientific certainty with community aspirations (precautionary principle),

• Conservation and restoration of significant natural and cultural values (diversity and integrity),

• The contribution of estuary-based activities in the local and regional economy is maintained or enhanced (improved valuation), and

• Social equity and improved communication underpin management of estuarine natural resources (intergenerational equity, precautionary principle).

Six management themes were proposed in the Discussion Paper. In response to comments from the community, both at the first round of community workshops and in a number of written submissions, an additional management theme (community lifestyle values) is
proposed for Port Stephens and Myall Lakes. The seven core management themes proposed for the estuary are

- Waterway access and community facilities,
- Community lifestyle values,
- Conservation of significant natural and cultural values,
- Managing estuary productivity,
- Managing estuary dynamics,
- Managing the interaction of the estuary and catchment development inputs,
- Integrated and co-operative management

Different combinations of these themes will provide the focus of management for various parts of the estuary. The relationship between the key management themes, principles of ESD and the focus for different parts of the estuary is outlined in Table 2.1

<table>
<thead>
<tr>
<th>ESD Principle</th>
<th>Key Management Theme</th>
<th>Management Zone Focus</th>
</tr>
</thead>
</table>
| Precautionary principle | • Integrated and co-operative management  
| | • Conservation of significant natural and cultural values  
| | • Managing estuary productivity | Whole of estuary |
| Intergenerational equity | • Integrated and co-operative management  
| | • Community lifestyles  
| | • Conservation of natural and cultural values | Whole of estuary  
| | | Whole of estuary, but particularly Tea Gardens/Hawks Nest, Pindimar (Management Zones E and F)  
| | | Whole of estuary, but particularly northern shore of Inner Port (Management Zones E and all of Myall system (H)) |
| Conservation of biological diversity and ecological integrity | • Managing estuary dynamics  
| | • Management of catchment development inputs  
| | • Conservation of natural and cultural values | Outer Port Stephens (shoreline erosion), Management Zones A1 and F3, living with low flushing times in Myall Lakes (Management Zones G and H)  
| | | Upper Karuah (Management Zone D1), Tilligerry Creek (Management Zone B2), urban areas on southern shore of Port Stephens (Management Zones A1, A2, B1, B3)  
| | | Whole of estuary, with particular emphasis on North shore of Inner Port Stephens (Management Zones E, F1), catchments of Big Swan Bay (C2), Karuah catchment (D) and the whole of the Myall Lakes system (Management Zones G and H) |
The principal management themes for each of the main management zones proposed for the estuary are summarised in Table 2.2. The table indicates management themes that are the focus of management in each zone, in order of importance.

### Table 2.2 - Management Themes and Focus

<table>
<thead>
<tr>
<th>Management Zone</th>
<th>Management Theme</th>
</tr>
</thead>
</table>
| Zone A          | • Waterway access and community facilities  
|                 | • Management of catchment development inputs  
|                 | • Managing estuary dynamics  
| Lesser focus    | • Conservation of significant natural and cultural values  |
| Zone B          | • Managing estuary productivity  
|                 | • Managing catchment development inputs  
|                 | • Conservation of significant natural and cultural values  
| Lesser focus    | • Community lifestyle values  |
| Zone C          | • Managing estuary productivity  
|                 | • Managing catchment development inputs  
|                 | • Conservation of significant natural and cultural values  |
| Zone D          | • Managing catchment development inputs  
|                 | • Managing estuary productivity  
|                 | • Protection of significant natural and cultural values  |
| Zone E          | • Conservation of significant natural and cultural values  
|                 | • Community lifestyle values  
|                 | • Waterway access and community facilities  |
| Zone F          | • Managing estuary dynamics  
|                 | • Protection of significant natural and cultural values  
|                 | • Community lifestyle values  |
| Zone G          | • Managing catchment development inputs  
|                 | • Waterway access and community facilities  |
| Zone H          | • Protection of significant natural and cultural values  
|                 | • Waterway access and community facilities  
|                 | • Community lifestyle values  |
| Whole of estuary| • Integrated and co-operative management  
|                 | • Conservation of significant natural and cultural values  
|                 | • Community lifestyle values  
|                 | • Managing catchment development inputs  
|                 | • Managing estuary productivity  
|                 | • Waterway access and community facilities  |
2.1 MANAGEMENT OBJECTIVES

A range of management objectives relating to each of these themes is outlined in Table 2.3. Some management objectives are relevant to more than one management theme, and have been listed accordingly.

For each management objective, potential performance targets and performance indicators have also been suggested. Monitoring on the performance indicators and assessment of the results against performance targets over time provides the basis for assessing the extent to which the resultant Estuary Management Plan has delivered its objectives.

Table 2.3 - Management Objectives, Targets and Indicators

<table>
<thead>
<tr>
<th>Management Theme: Waterway Access and Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Objective</td>
</tr>
<tr>
<td>To ensure that fair and equitable public access to the waterway and its foreshores is managed, retained or improved</td>
</tr>
<tr>
<td>To manage recreational demand so that the natural and social values of foreshore lands are also protected</td>
</tr>
<tr>
<td>To maintain safe navigation on the waterway</td>
</tr>
</tbody>
</table>
Management Theme: Waterway Access and Facilities (cont)

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target(s)</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
</table>
| To manage waterway usage so that the potential for conflicts between users is minimised | • Planning and management controls reflect the safety and environmental health needs of all user groups | • Number of complaints to Council and Waterways Authority about conflicts of use,  
• numbers of incidents arising from conflicts of use,  
• satisfaction of commercial and recreational boating industries with waterway access,  
• compliance with primary contact recreation standards for water quality |

Management Theme: Community Lifestyle Values – Naturalness

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>To protect the aesthetic value of the natural estuarine foreshore and skyline</td>
<td>High scenic value shoreline and ridgelines are maintained</td>
<td>• proportion of bank which has no visible signs of human development</td>
</tr>
</tbody>
</table>
| To promote tourism and recreational activity that is consistent with the protection of natural and cultural values | • Tourist activity does not detract from the aesthetic and water quality values of the foreshore and waterway,  
• Significant Aboriginal and European heritage sites are recorded and interpreted in tourism strategies | • number of incidents involving fuel spills etc from recreational vessels and from marinas,  
• length and rate of usage of walking paths and cycleways |
| To protect European heritage sites and significant cultural landscapes around the estuary | • Heritage sites are assessed and appropriate conservation measures are in place | Condition of European heritage sites, |
| To control the location, scale and design of new urban and commercial development so that community lifestyle values are protected | • New development is consistent with valued characteristics of the existing urban landscape,  
• New development is designed and constructed to protect water quality and ecological values | • Changes in water quality monitoring results in relation to urban growth  
• Consistency of development with Council design and landscaping policies |
Management Theme: Conservation of Significant Natural and Cultural Values

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>To protect and restore native riparian vegetation and wetland habitats (including</td>
<td>- No further decline in the area and health of SEPP14 wetlands,</td>
<td>• Proportion of estuary bank with intact, indigenous, weed free riparian vegetation</td>
</tr>
<tr>
<td>rare or threatened species)</td>
<td>- Natural riparian vegetation is restored over an agreed proportion of the estuary</td>
<td>• Ongoing structural or species integrity of rare habitat types</td>
</tr>
<tr>
<td></td>
<td>foreshore (this number needs to be determined with the community)</td>
<td></td>
</tr>
<tr>
<td>To protect and restore native aquatic habitats within their natural range of</td>
<td>- No long term decline in estuarine primary producer species,</td>
<td>• Sea grass density/biomass at key monitoring sites</td>
</tr>
<tr>
<td>variance</td>
<td>- Species diversity is maintained and the ecological dynamics of the estuary are</td>
<td>• Species diversity (fauna) at key monitoring sites</td>
</tr>
<tr>
<td></td>
<td>understood</td>
<td>• Numbers of dolphins in the estuary</td>
</tr>
<tr>
<td>To achieve and maintain an standard of water quality that protects the diversity and</td>
<td>- Water quality objectives are achieved within agreed timeframes</td>
<td>• See EPA interim water quality objectives for Port Stephens and Myall Lakes (Protection of aquatic</td>
</tr>
<tr>
<td>productivity of aquatic ecosystems, and allows recreational and aesthetic enjoyment</td>
<td></td>
<td>ecosystems, protection of primary contact recreation, consumption of shell fish)</td>
</tr>
<tr>
<td>of the estuary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To manage catchment sediment loads so that deposition is maintained at a rate that</td>
<td>- Major catchment sources of accelerated erosion are identified and controlled</td>
<td>• Rates of change and absolute area and volume of sediment deltas off stormwater drain outlets,</td>
</tr>
<tr>
<td>is consistent with the protection of water quality and aquatic ecosystems</td>
<td></td>
<td>• Changes in sea grass distribution in the nearshore area off urban development</td>
</tr>
<tr>
<td>To conserve scientifically and culturally significant Aboriginal sites</td>
<td>- Known sites of value to the Aboriginal community are conserved and planning</td>
<td>• proportion of recommendations of a regional cultural heritage conservation strategy (Aboriginal</td>
</tr>
<tr>
<td></td>
<td>processes recognise the potential for significant Aboriginal sites to be affected</td>
<td>sites in estuarine areas) that are implemented within agreed time frames,</td>
</tr>
<tr>
<td></td>
<td>by new foreshore development</td>
<td>• level of satisfaction of the Aboriginal community with cultural heritage management outcomes</td>
</tr>
<tr>
<td>To stabilise shoreline erosion and shoaling caused by the effects of human</td>
<td>- Erosion process understood and quantified</td>
<td></td>
</tr>
<tr>
<td>intervention in estuarine processes</td>
<td>- Long term stabilisation / control measures identified</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Rate of shoreline retreat at key sites, with management measures in place</td>
</tr>
<tr>
<td>To recognise the variability of natural processes (magnitude and frequency) that</td>
<td>- Long term planning and rehabilitation priorities recognise the potential</td>
<td>• Number, and type of emergency actions to protect infrastructure or ecological values during</td>
</tr>
<tr>
<td>may affect the estuary when planning for human uses/rehabilitation of the estuary</td>
<td>extent of climatic change impacts, and the range of &quot;natural&quot; processes in the</td>
<td>extreme climate events</td>
</tr>
<tr>
<td>and foreshore (this would include the potential for Greenhouse related climatic</td>
<td>estuary</td>
<td></td>
</tr>
<tr>
<td>change and sea level rise)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Management Theme: Conservation of Significant Natural and Cultural Values (cont)

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>To protect groundwater quality and quantity</td>
<td>• Groundwater dependent ecosystems are maintained in a healthy condition, • Water extraction and catchment land uses do not compromise significant regional groundwater resources</td>
<td>• Proportion of monitoring sites where agreed parameters meet interim objectives set by EPA in October 1999 Parameters to be amended as necessary in consultation with Regional Groundwater Management Committee</td>
</tr>
</tbody>
</table>

Management Theme: Productivity Management

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>To promote sustainable estuarine aquaculture productivity</td>
<td>• Estuary production is not degraded by human use of the waterway and its catchment, • Natural constraints on productivity are understood, and yields vary with natural conditions rather than pollutant loads, • Aquaculture industry operates in accordance with a best practice code to protect the environment</td>
<td>• Measure of primary estuary production, • Proportion of compliance of all aquaculture operators with industry codes of practice, • Value of product marketed per annum • Commercial and recreational fish catches (return per unit effort) • Sea grass density/biomass in and around aquaculture leases (change from baseline condition) • Extent of industry downtime because of water quality issues (oyster QAP)</td>
</tr>
<tr>
<td>To devise strategic planning and development assessment processes that encourage ecologically sustainable development and provide clear guidance to the development industry</td>
<td>• Council(s) and DUAP provide clear guidance to the community and proponents of new development about policies and expectations in relation to new development in and around the estuary • Port Stephens and Great Lakes Councils provide a consistent development framework for the whole of the estuary and its catchment</td>
<td>• Time taken to process development applications for estuary related activity • Extent of compliance with consent conditions • Number of breaches of environmental legislation (eg NPW Act, Threatened Species Conservation Act) by new development, • Number of referrals of development applications to the Land and Environment Court, • Level of compliance with Coastal Policy recommendations and guidelines • Rate of growth of employment in the estuary based tourist sector of the local economy</td>
</tr>
</tbody>
</table>
Management Theme: Productivity Management (cont)

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
</table>
| To promote integrated monitoring and reporting of economic and environmental indicators for the estuary | • High level of community awareness and understanding of the links between environmental and economic well being | • Community and industry satisfaction with reporting of environmental and economic outcomes,  
• Case studies of demonstrable improvements in economic outcomes with improved environmental management |
| To promote tourism and recreational activity that is consistent the protection of natural and cultural (including social) values | • Tourist activity does not detract from the aesthetic and water quality values of the foreshore and waterway, | • number of incidents involving fuel spills etc from recreational vessels and from marinas,  
• length and rate of usage of walking paths and cycleways |
| To promote the location, scale and design of new urban and commercial development so that natural values and community lifestyle values are protected | • Innovative urban design that highlights, respects and draws on the natural and social character of the local area | • Compliance with Council DCPs for urban design  
• Length and rate of usage of walking paths and cycleways  
• Proportion of urban area with native vegetation retained  
• Condition of native vegetation corridors within urban areas  
• Size and health of koala population in habitat areas adjacent to the estuary |

Management Theme: Managing Estuary Dynamics

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
</table>
| To recognise the variability of natural processes (magnitude and frequency) that may affect the estuary when planning for human uses/rehabilitation of the waterway and foreshore | • New development is located outside natural hazard zones Actions put in place to reduce risks for existing development within nature hazard zones | • Volume of sand on Jimmys Beach and Shoal Bay beach  
• Storm frequency and magnitude  
• Monthly rainfall  
• Volume of sand extracted/ accumulated in navigation channels  
• Catchment sediment yields at key monitoring sites |
Management Theme: Catchment Development Inputs

<table>
<thead>
<tr>
<th>Management Objectives</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>To provide for integrated management of the estuary and its catchment</td>
<td>Management decisions for both the catchment and the estuary take into consideration the impact of catchment runoff (quality and quantity) on the healthy functioning of the estuary</td>
<td>• Rates of change and absolute volumes of sediment delta at stormwater drains,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Turbidity of the upper estuary,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Weed infestation on the foreshore and in the waterway,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water quality and flows at flood gates</td>
</tr>
<tr>
<td>To manage catchment derived sediment loads so that deposition is maintained within the range of natural levels in the estuary</td>
<td>Major sources of accelerated erosion in the catchment are understood and controlled</td>
<td>• Rate of deposition at stormwater drains</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Measured yields from rural lands</td>
</tr>
<tr>
<td>To achieve and maintain a standard of water quality in the estuary that protects the diversity and productivity of aquatic ecosystems and allows recreational and aesthetic enjoyment of the waterway</td>
<td>Water quality objectives for protection of aquatic ecosystems, primary contact recreation and consumption of raw shellfish are achieved in all rainfall conditions (This target will have specific timeframes attached to it)</td>
<td>• Extent of compliance with established criteria</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appropriate water quality standards that account natural variation are determined (eg for nutrients)</td>
</tr>
</tbody>
</table>

Management Theme: Integrated and Co-operative Catchment and Estuary Management

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>To create a plan that is easily understood, makes best use of currently available information, and incorporates a monitoring, reporting and review process to facilitate adaptation and refinement as more information becomes available</td>
<td>Plan is structured to provide clear guidance to all stakeholders about practical implementation and review procedures</td>
<td>• Progress against key performance indicators is available for public review at regular intervals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Incorporation of management actions into budgets and work plans of relevant stakeholders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Plan includes monitoring of indicators of the health of the estuary, economic benefits and achievements of specific actions, so that management can be refined</td>
</tr>
<tr>
<td>To formulate a plan that is based on clear management objectives, performance targets and indicators for environmental, social and economic criteria, which can be monitored and reported</td>
<td>• Management objectives, indicators and targets have broad community support,</td>
<td>• Agency sign off on integrated management plan,</td>
</tr>
<tr>
<td></td>
<td>• Indicators provide for integrated monitoring of progress towards agreed objectives</td>
<td>• Plan is consistent with regional natural resource and development priorities</td>
</tr>
</tbody>
</table>
Management Theme: Integrated and Co-operative Catchment and Estuary Management (cont)

<table>
<thead>
<tr>
<th>Management Objective</th>
<th>Performance Target</th>
<th>Suggested Performance Indicators</th>
</tr>
</thead>
</table>
| To provide a framework for co-ordinated agency participation in the implementation of the plan that recognises regional priorities for action | • The management plan includes a mechanism for orderly and co-ordinated implementation | • Agency sign off on integrated management plan  
• Plan is consistent with regional natural resource and development priorities |
| To acknowledge that community environmental performance expectations will continue to evolve over time, as will political responses in terms of policy and regulation | • Plan includes clear monitoring, reporting and review cycles that are implemented  
• Plan is based on the concept of continuing improvement in environmental and community outcomes | • Community responses to reporting and review cycles eg in relation to correct identification of priorities, rates of change of environmental outcomes, |
| To maximise opportunities for community participation in estuary management | • Plan includes mechanisms for key stakeholder involvement and also engages the broader community | • Number (and size) of Landcare, Rivercare and Coastcare groups,  
• Proportion of the estuary and catchment groups,  
• Funds obtained for community rehabilitation projects related to estuary issues |
| To achieve the management objectives within a timeframe which is acceptable to the community and the stakeholders | • Plan includes time scheduling of all actions and objectives | • Completion of various activities and actions within the timeframe stated in the Plan |

2.2 DECISION MAKING FRAMEWORK

Establishing a transparent decision making framework that implements the principles of ESD in a systematic and understandable way is a major challenge not only for management of estuaries, but for planning and management of development in general. However, because of the high level of development pressure on estuarine environments, often within an inherited land use planning framework, the decision making process is relatively controversial.

The recently released draft Coastal Council Discussion Paper on ESD in the coastal zone provides a range of suggested objectives that could be used to translate the principles of ESD into strategic and development assessment planning outcomes. Although the Coastal Council stresses that the principles of ESD and the objectives that flow from them should not be viewed as either pro environment or anti development, the implementation of the actions suggested by the Coastal Council will involve substantial changes to decision making processes within local government. Critical to much of the discussion about ESD is collecting, interpreting and disseminating a range of baseline environmental data to allow strategic planning decisions to be made (and justified) and to improve the community’s ability to participate meaningfully in the decision making process. This implies a shift in the way planning regulations are made and implemented.
At the operational level, a range of criteria can be considered for making decisions about the sustainable management of estuaries. These include:

- Costs and benefits (to whom) – what is achievable and equitable in the distribution of costs and benefits. Is it possible to allocate real environmental and social costs to particular land or water uses?
- Efficiency
- Ongoing support (need for up front action)
- Facilitates adaptive management
- Maximise opportunities for partnerships and participation
- Clarify key processes to lead into other actions
- Risk of not implementing – what are the implications of the do nothing option?
- Funding – existing, time frames of funding programs, agency and Council budget cycles, industry investment through the development process or in remediation, in kind contributions from the community.
- Action addresses multiple issues - synergies
- Action addresses high priority objectives – from community perspective
- Consistency with regional scale priorities
- Outcome from action is secure and predictable
- Changes achieved by the strategy are identifiable and can be reported to the community
- Changes are reversible and contingency measure, are available to address unforeseen impacts
- Action has both short and longer term benefits

A number of recent publications address decision making in relation to allocation of resources for restoration of natural habitat. These are relevant to those parts of the Port Stephens and Myall Lakes estuary where major management challenges are linked to the behaviour of natural processes (e.g., see Rutherford et al. 1999).

An important objective for a good decision making framework is effective monitoring and reporting of agreed indicators of estuarine health and economic value. This information can then be used to refine the decision making framework, and to refine specific management actions over time, so that the benefits to the community and the environment are maximised.

Concepts to be considered include improved understanding of the relative value of different types of economic activity in the regional economy and the provision of economic incentives for changes in land management practices (the concepts of equity and user pays).
2.3 MANAGEMENT PRIORITIES - NATURAL SYSTEM REHABILITATION AND MANAGEMENT

A range of guidelines and protocols for establishing the ecological health of streams have emerged in recent years (e.g., DNRE 1997 and Anderson 1993). Although these have been primarily directed at assessment of freshwater reaches, work is continuing on adaptations of the guidelines to enhance their application to estuarine environments. In addition to protocols for assessing the health of various reaches of any river or estuary, agencies and community groups are now regularly making decisions about where scarce funds should be expended to promote the rehabilitation of degraded streams.

Recent management guidance in this regard has been provided by Rutherford et al. (1999) and also by Cohen and Bnerley (1999). Several important concepts emerge, including:

- Are there ecological problems in the estuary that could be considered virtually 'lost causes' given the timeframe and costs needed to repair existing damage, i.e., that are so bad that they would exclude biological communities?

- Are the problems affecting a species or a habitat limiting, or of nuisance value?

- Would managing a particular problem provide additional influence over the community and funding bodies (e.g., presence of 'charismatic species')?

- Consider the rarity of the ecological asset in the region, the trajectory of the condition of the estuarine reach (is it improving or declining in condition), how easy is it to do something useful about the problem, and is this problem threatening other areas?

The rehabilitation priority recommended by Rutherford et al., in relation to conservation of biodiversity, is:

1. Save reaches that support valuable species or communities before reaches supporting common communities,

2. Protect streams that are in the best general condition, before improving those in poor condition,

3. Stop streams deteriorating before trying to accelerate recovery,

4. Improve the condition of damaged reaches, beginning with those that are easy to fix,

5. While there are still reaches that need protecting or improving, don't bother trying to fix reaches that are extremely degraded. The priority of these reaches will increase if their instability threatens other parts of the estuary, or they include significant community assets that need to be protected for other reasons

The ecological and geomorphic information that is currently available from Port Stephens and Myall Lakes is insufficient to make all (or any) of these assessments. It appears that there are no known threatened species that are entirely dependent on habitats within the estuarine environment and foreshore areas.

The Estuary Processes Study provides little information about the condition of riparian vegetation communities around the estuary.
Therefore, in determining appropriate short to medium term actions for the management of the historical land use/process interactions in the estuary, a simplified set of criteria will need to be developed, that utilise the information that is available in the community, and allow for refinement of management solutions over time.

2.4 MANAGEMENT PRIORITIES - FRAMEWORK TO FACILITATE IMPLEMENTATION

One of the most important aspects of the Estuary Management Plan is that it include an effective strategy for expeditious and orderly implementation. Issues associated with this include:

- multiple stakeholders with potentially conflicting interests in terms of timeframes and priorities,
- actions to be co-ordinated between two local government areas,
- funding sources operate with multiple timeframes, objectives and requirements,
- competition for funds between estuaries,
- need to deal with catchment issues (source control) to meet estuary objectives. There are separate administrative arrangements for catchment and estuary management,
- importance of maintaining government (political) agency and community interest and commitment.

A useful option, and one that has been applied successfully in other integrated natural resource management programs, is to employ a co-ordinator. This position has primary responsibility for preparing a unified case for funding and management, for addressing potential conflicts, and for ensuring that all stakeholders remain informed and ready to participate. Such a position would be jointly funded by State and local government, potentially involving the Premier’s Department regional co-ordination program.

2.5 CORE INDICATORS AND PARAMETERS FOR MONITORING, REPORTING AND REVIEW

As discussed in Reference Document 1, an important part of an effective management plan is a process for monitoring, reporting and reviewing performance against agreed targets. For a large and complex estuary system, many diverse monitoring programs and parameters may arise at different times, and for different purposes. This section presents a suite of core indicators that could be used to monitor and review progress in terms of ecologically sustainable development of the estuary. The core indicators provide for integrated reporting of biophysical health of the estuary, together with social and economic performance indicators that are related to estuarine health and productivity. A suggested set of core indicators and parameters is presented in Table 2.4.
Table 2.4 - Core Indicators for Ecologically Sustainable Estuary Management

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Parameters and Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population of LGAs in catchment of estuary</td>
<td>Census data by census district</td>
</tr>
<tr>
<td>Number of tourist visitors, value of tourist economy</td>
<td>Numbers from visitor information centres, industry data or census</td>
</tr>
<tr>
<td>Number and value of DAs in the catchment of the estuary</td>
<td>Council records</td>
</tr>
<tr>
<td>Compliance of management activities with NSW Coastal Policy</td>
<td>Coastal Council Reviews</td>
</tr>
<tr>
<td>Rainfall and discharge (Karuah River and Myall River)</td>
<td>Bureau of Meteorology data, DLWC flow data</td>
</tr>
<tr>
<td>Proportion of foreshore with natural riparian vegetation extending more than 10 metres from shoreline</td>
<td>Aerial photo interpretation and field checking on three yearly basis</td>
</tr>
<tr>
<td>Biophysical indicators of water quality at key sites</td>
<td>Parameters to include pH, nutrients, suspended sediments (clarity), faecal coliforms (with values set in accordance with ANZECC 1992), algae, seagrass density</td>
</tr>
<tr>
<td>Compliance with Water Quality Objectives</td>
<td>Needs new monitoring program</td>
</tr>
<tr>
<td>Oyster production (value and by plate/bag)</td>
<td>Industry statistics (NSW Fisheries)</td>
</tr>
<tr>
<td>Commercial and recreational fishing catches, by fishing effort</td>
<td>NSW Fisheries data, creel surveys</td>
</tr>
<tr>
<td></td>
<td>Potentially use recreational fishing licence numbers</td>
</tr>
<tr>
<td>Number, severity and duration of algal blooms</td>
<td>DLWC data</td>
</tr>
<tr>
<td>Value of production on estuary floodplains (dairy, chickens, plantation forestry)</td>
<td>Industry statistics, NSW Agriculture</td>
</tr>
<tr>
<td>Usage of foreshore facilities</td>
<td>Boat ramps and foreshore parks Would require three yearly user survey</td>
</tr>
<tr>
<td>Number of recreational vessels registered</td>
<td>NSW Waterways data</td>
</tr>
<tr>
<td>All licensed discharges comply with licence requirements</td>
<td>EPA data</td>
</tr>
<tr>
<td>Number of Penalty Infringement Notices issued by Councils/Waterways for offences in and around estuary</td>
<td>Council and Waterways data</td>
</tr>
<tr>
<td>Actions in Estuary Management Plan completed on time and within budget</td>
<td>Reviews by Estuary management Committee or Councils</td>
</tr>
<tr>
<td>Expenditure on estuary management projects</td>
<td></td>
</tr>
<tr>
<td>Number of community responses received to estuary management reviews</td>
<td>Council or Committee data</td>
</tr>
<tr>
<td>Community perceptions of the health of the estuary</td>
<td>Build into Council survey of community attitudes</td>
</tr>
</tbody>
</table>

It is proposed that reporting of these core indicators could become part of State of the Environment reporting by Port Stephens and Great Lakes Councils
3.0 MANAGEMENT OPTIONS

3.1 BROAD RANGE OF OPTIONS FROM ESTUARY MANAGEMENT MANUAL AND BEST PRACTICE GUIDELINES

Awareness and Education

This type of action is intended to enhance the willingness and ability of stakeholders to change either their attitude to an environmental issue or their ability to deal with it. Tools that can be used to achieve these outcomes include signage, media messages, leaflets/newsletters for public distribution at visitor centres, school programs and competitions, displays for special occasions (e.g., Water Week), training programs for Council staff, industry audits and training programs, strategic enforcement of regulatory requirements (with publicity), community participation programs, GIS based data management systems, Internet sites for distribution of information.

Monitoring, Reporting and Communication

This type of action is designed to improve understanding of the natural and economic processes and interactions in the estuary, so that management actions can be refined over time. It is also intended to provide information to the local community so that they can participate in decision making about the management of the estuary in an informed manner.

Monitoring can be conducted to compare the overall health of the estuary with specific baseline data (as in State of the Environment monitoring and reporting), or to assess the success of particular intervention programs. In the latter case, the monitoring design should take into account both environmental and economic effects associated with management decisions. It is important that in each case, the objective of the monitoring program, that the scale and frequency of the sampling strategy are clearly understood and are relevant to the objectives of the program, and that the appropriate monitoring equipment is available for the task.

Examples of this type of action include co-ordinated monitoring programs for sea grass and other habitat areas, water quality, recreational usage, effectiveness of specific programs etc.

Reporting can take place in annual reports, weekly newspaper articles (e.g., Hunter Water Beach Watch results), or with rates notices. Reports can also be presented to Catchment and Estuary Management Committees, Council and State agencies, specific stakeholders and general community.

Targeted Research and Investigation

This type of action should be used where the ecological or physical processes that are driving a management issue are poorly understood, and there is a risk that management funds will not be well spent. Examples include detailed mapping of sensitive habitat areas, modelling and field monitoring of wind and boat wave impacts in areas of bank erosion, responses of habitats to urban stormwater, impacts of maintenance dredging on water quality, water circulation and habitat.

Planning Mechanisms

This type of action has particular value for new development, where it can be used to require the consideration of environmental issues at the planning stage. Where the management tool
3.2 BALANCE BETWEEN ACTION AND PLANNING/FURTHER STUDIES

One of the concerns regularly expressed by community representatives on regional environmental management committees is that management planning exercises too often appear to result in recommendations for a plethora of further investigations and management plans, with insufficient emphasis on direct actions to restore or protect natural and community values. This concern is recognised. However, the distribution of short term actions for Port Stephens and Myall Lakes does place a high level of importance on establishing monitoring programs, detailed management plans and appropriate implementation framework for the estuary. The reasons for this approach are explored in Section 3.5.1.

The input received from the community at discussion meetings and in written submissions suggests that at this time, the local community also places high value on getting a decision making and management framework in place that will protect the natural and social values of the estuary through a period of potentially rapid and diverse socio-economic change.

3.3 FUNDING OPTIONS FOR ESTUARY MANAGEMENT

Funds for implementation of estuary management actions are available or potentially available from a number of sources, with the key areas being:

- General recurrent funds for individual State agencies (projects that are identified within that agency’s normal annual budget),

- General recurrent funds from local government,

- Industry projects,

- A diverse range of State and Federal government natural resource programs that have been developed to target specific priority issues (with funding for local projects),

- Community funds, including sponsorship by local and peak environmental groups.
Each of these funding options, and the opportunities and constraints that they provide is described in further detail below.

**Agency Recurrent Funding**

Most State agencies operate on a strategic planning cycle of three to five years. These programs set overall agency priorities and are available for public scrutiny.

Annual budget for State agencies are spent primarily on operational costs, although there will also be opportunities for one off research or enforcement programs.

Funds may also be available for capital works which may address some estuary management issues - e.g. capital expenditure on a NPWS visitor information centre for the Myall Lakes National Park could address estuary management actions related to community awareness, reporting of monitoring results and co-ordinated community and agency actions.

State agency budget bids are submitted in March and April, with recurrent funds becoming available from mid-year.

**State and Federal Natural Resource Programs**

There is a diverse range of natural resource programs that can be accessed to provide funds for specific projects. These are summarised in Table 3.1.

**Community Funding**

There are two possible types of community contributions to funding. Community groups may contribute in-kind funding through providing no cost labour. This is a significant component of the work achieved by the Landcare and Coastcare programs.

Some larger community environmental organisations also have sufficient capital to provide targeted funding for projects that address their key concerns. For instance, the Foundation for National Parks and Wildlife raises funds for projects that are put forward/supported by the National Parks and Wildlife Service, although these projects do not necessarily have to be within a National Park property.

The organisation raises funds through public appeals, and there is no set funding cycle. Funds can be used in conjunction with funds provided by the corporate sector.

The Foundation is currently funding a Dolphin Research and Management Program for Port Stephens.

The Foundation can also form Friends of National Parks groups in local areas to raise funds for particular National Park areas.
### Table 3.1 - Natural Resource Management Funding Programs

<table>
<thead>
<tr>
<th>Program</th>
<th>Application</th>
<th>Timetable/funds available</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLWC Flood Management Program, Estuaries Program, Coastal Program and Waterways Program</td>
<td>• Estuary program covers preparation of estuary management plans, foreshore improvements (e.g., boardwalks) funds for improving the health of the estuary (rehabilitation plans, targeted dredging), funds for monitoring programs • Waterways program provides funding for public use of waterways, such as jetties, pumpout stations, dredging for navigation and marinas etc • The coastal program provides funds for works in the coastal hazard zone such as the Jimmys Beach and Shoal Bay coastline Management Plans and implementation</td>
<td>All of these programs are funded 50/50 with local government The flood program may be funded 2:1 with council or 4:1 (Federal Government/DLWC Council) The forward program for these funds outlines priorities for 2 to 3 years in advance, and is reviewed on an annual basis. Formal applications for funds under these programs are made by Councils in writing, including a commitment that Council will match the funds. It is best if a DA is in place The program is generally signed by the Minister for DLWC in late October, with funds becoming available some time after that</td>
</tr>
<tr>
<td>DLWC Ports Program</td>
<td></td>
<td>Provides 100% funding for projects related to the fishing industry</td>
</tr>
<tr>
<td>DLWC Rivercare program</td>
<td>Provides funds for community groups (Karuah River currently has a Rivercare project)</td>
<td></td>
</tr>
<tr>
<td>DLWC small towns sewage program</td>
<td>Negotiation between local Councils and DLWC</td>
<td>75% subsidy for provision of reticulated sewage in sensitive areas</td>
</tr>
<tr>
<td>NPWS World Heritage funding/special grants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPWS funding for community projects</td>
<td>Infrastructure for the benefit of the boating community and the marine sector</td>
<td>100% grants for NPWS lands</td>
</tr>
<tr>
<td>Waterways Authority Asset Development and Management Program</td>
<td></td>
<td>Waterways will contribute 50% of project costs, jointly with local government, community. Up to $2 million is available annually, on a 6 monthly cycle</td>
</tr>
<tr>
<td>Catchment Management Committee small projects funds</td>
<td>Funds for community groups for small rehabilitation or restoration projects</td>
<td>Usually less than $5000</td>
</tr>
<tr>
<td>EPA Environmental Trust funds</td>
<td>Three program areas: • Restoration and rehabilitation ($1 million) • Environmental education ($0.5 million) • Research ($0.5 million)</td>
<td>Currently only available to community groups Application forms sent to Landcare co-ordinators in May, close July</td>
</tr>
</tbody>
</table>
Table 3.1 - Natural Resource Management Funding Programs (cont)

<table>
<thead>
<tr>
<th>Program</th>
<th>Application</th>
<th>Timetable/funds available</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA Stormwater funds</td>
<td>Funds provided to local government to support the preparation of stormwater management plans and also for some works to improve stormwater management</td>
<td>Decision on future direction of these funds due in March/April 2000</td>
</tr>
<tr>
<td>NSW Fisheries contributions to research programs that fit with core business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Fisheries funds contributed through NHT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Fisheries enhancement bids</td>
<td>Capital and facilities for special projects, such as the clean up of derelict oyster leases in Port Stephens</td>
<td></td>
</tr>
<tr>
<td>NHT - jointly administered by Environment Australia, Fisheries and Forestry Australia, and managed regionally through Catchment Management Trusts, Regional Catchment Management Committees (now Boards)</td>
<td>Set up by Federal government in 1996, provides funds to 18 environmental and natural resource management programs Relevant programs include: - Coasts and Clean Seas Initiative - Fisheries Action Program - Endangered Species Program - Farm Forestry Program - National Reserve System Program - National Weeds Program - Waterwatch Australia - National Landcare - National Rivercare - National Wetlands Program - Waste Management Awareness Program</td>
<td>Projects must have community involvement - &quot;One stop shop&quot; application - Expressions of Interest November, applications due 25 February 2000 for next round Funds available as early as possible in 2000-2001 financial year - Note that currently in the Hunter, estuary projects have a low priority in the Interim Natural Resources Strategy prepared by Hunter Catchment Management Trust</td>
</tr>
</tbody>
</table>
Table 3.1 - Natural Resource Management Funding Programs (cont)

<table>
<thead>
<tr>
<th>Program</th>
<th>Application</th>
<th>Timetable/funds available</th>
</tr>
</thead>
</table>
| Coasts and Clean Seas Program - includes | • Clean seas program  
• Marine species protection program  
• Coastal monitoring program | • “One stop shop” applications, with separate funding cycle to NHT  
• Clean Seas - projects up to $250000 over life of project  
• Marine species program - up to $100000 over life of project  
• Coastal monitoring - up to $80000 over the life of the project  
• $8.2 million available in 1999/2000, available on a dollar for dollar basis  
• Applications lodged in June, with confirmation in January  
Many current Coast and Clean Seas funded projects focus on improving the quality of stormwater flows into estuaries  
There are four current projects in the Hunter and Central Coast, of which none directly relate to the study area |
| Coastcare also funds small projects from this program, usually $1000 to $30000 |

Other options include  
• Green corps - 10 week programs  
• Rivercare incentive schemes (50% funding for on ground works)  
• History and Education Program - National Council for the Centenary of Federation  
• Algal Management Initiative (DLWC)  
• NSW Wetlands Action Program (DLWC)  
• Land and Water Resources Research and Development Corporation  
• Fisheries Research and Development Corporation | Centenary funds are available in two rounds - one in 1999, one in 2000  
Research funds may be available through LWRDRC, and Fisheries RDC |
Industry Funding

Industry sourced funds may include research and development expenditure, contributions to an integrated monitoring program or contributions to community environmental action or awareness programs.

A current example is the contribution of the oyster industry to water quality monitoring in Port Stephens (e.g., through the Quality Assurance Program). Expenditure by Hunter Water Corporation to provide reticulated sewage for Karuah is also considered to be an industry contribution to protecting the environmental health of the estuary. The contribution of the commercial cruise boat operators to studies of dolphin and whale management in Port Stephens is another current example.

Community responses to the exhibition of the draft Estuary Management Study included a variety of comments about funding (see Reference Document 3). A significant number of responses suggested a 'user pays' approach to funding actions in the estuary. Comments included:

- How should decisions be made about the allocation of scarce resources to diverse issues / stakeholder interests, e.g., funds for oyster lease clean up, shoreline protection in Outer Port, or provision of reticulated sewage to small villages (Nerong, Pindimar).

- Public levy to pay for ongoing management should be considered.

- Stakeholders whose activities affect the estuary should pay for management and rehabilitation.

- User pays principle should apply particularly to aquaculture, tourism, and recreational users.

- Any consideration of access / other fees should carry a guarantee that funds will be spent locally.

- Some management actions (such as zoning) may require little expenditure, but heavy State government subsidies are needed to address problems associated with past neglect (e.g., for capital works).

3.4 FRAMEWORK FOR CO-OPERATION – POLICY AND STATUTORY OPTIONS

One of the problems that has frequently been noted about natural resource management planning documents, a problem that is a major constraint to implementation, is the lack of a coherent framework for ongoing co-operation and commitment by key stakeholders. Such a framework is necessary to provide for:

- Consistent communication about the priorities of stakeholders,

- Co-ordination of budget cycles to maximise the benefits of available funds (e.g., use of seedling money),

- Ensuring that there is an agreed set of regional priorities. This is especially important where multiple local Councils may be responsible for the implementation of one or more...
Estuary Management Plans in a region, so that competing priorities in neighbouring catchments can be resolved,

- Maintaining stakeholder and community focus on the main issues

Some options and opportunities to address improved co-ordination are discussed in the following sections. It should be noted that none of these options have been effectively trialed in an estuarine context. An appropriate regional implementation framework remains an outstanding issue for sustainable estuary management for all of coastal NSW.

### 3.4.1 Structure and Integration of Natural Resource Management Committees

The Estuary Management Study and Estuary Management Plan are prepared under the guidance of an Estuary Management Committee.

One of the issues for successful implementation is whether the membership of the Management Committee that supervised plan making is also appropriate for the implementation and review stages of the process. At what level should State Agencies and Councils be represented on Estuary Management Committees, to achieve an adequate level of commitment and sign off on management actions?

The Lake Macquarie experience provides an example of a change to the structure of the supervising committee from the early stages of developing the management plan, to preparing for its implementation.

The Estuary Management Committee that supervised the preparation of the Estuary Management Study and Management Plan comprised a selection of waterway users, local Councillors and local/regional representatives of State agencies.

When the Management Plan was completed, significant difficulties were experienced in obtaining the necessary level of agency sign off (eg through a Memorandum of Understanding) to implement the plan. The Premiers Taskforce that was subsequently established to recast the Estuary Management Plan comprised senior agency representatives (eg at Regional Director level) and the Mayor. The Lake Macquarie Management Committee, which will oversee the implementation of the Task Force recommendations, also comprises agency representatives at Regional Director level (eg DLWC and EPA). The Estuary and Coastline Management Committee, comprising community representatives and local agency / Council personnel, has also been retained as a community reference and review group which meets monthly.

This structure is indicative of

- The importance of sustainable estuary management in State Government natural resource management planning,

- The difficulties in providing adequate cross sectional briefing within organisations if the Regional Director is not represented on the committee,

- The significance of Lake Macquarie in the State economy, but also the significance of management costs in the State budget.

Whilst these characteristics will not be typical of all other estuaries, the concept of committee membership at the Regional Director level is useful for ensuring that competing regional priorities (eg between Port Stephens and Wallis Lake) are understood and taken into consideration.
The involvement of Regional Directors from State agencies also provides consistency with other natural resource committees and strategies. Regional Directors or Regional Managers generally represent the State agencies on the River Management Committees that have been formed to implement the Water Reform program. The interim environmental objectives that have been prepared for each coastal catchment include specific references to the links between catchment management (flows and water quality) and the health and productivity of estuaries. There would appear to be value in equivalent management structures to ensure that the implementation processes remain co-ordinated and compatible.

In December 1999, DLWC announced the formation of new Catchment Management Boards to co-ordinate catchment management in NSW. Eighteen new Boards replace 38 Catchment Management Committees. The Karuah and Great Lakes Catchment Management Committee will become part of a new Catchment Board covering the Karuah, Great Lakes and Manning catchments. It is understood that the Catchment Board will have State and Local government representatives as well as a selection of landholder/land user and environmental interests. The North Coast Regional Catchment Management Committee will cease to have strategic control of the projects implemented by Catchment Management Committees or Boards.

The details of the links and partnering arrangements between Catchment Boards, River Management Committees (established under the Water Reform program) and Estuary Management Committees are yet to be clarified. It should be noted, however, that catchment and estuary management committees / boards have quite separate appointment processes, with Catchment Boards being appointed by the Minister for Land and Water Conservation, and Estuary Committees being appointed by local government.

The Catchment Boards with their regional strategic natural resource planning responsibilities, may provide a forum for resolving the relative priorities of actions identified as high priority in neighbouring Estuary Management Plans.

The regional focus of these committees means that they are the only existing structure that can consider the management actions for any one estuary in their regional context, and could therefore increase the transparency of decisions about allocation of funds between estuaries.

Careful attention would need to be paid to communication to make sure that the general community, and particularly local environmental groups such as Landcare and Coastcare had access to information about regional priorities.

3.4.2 Memorandum of Understanding or Statement of Joint Intent

A Memorandum of Understanding or Statement of Joint Intent (SOJI) has been developed to confirm stakeholder commitment and to guide the implementation of Estuary Management Plans at a number of locations, including the Hawkesbury-Nepean, Berowra Creek, and several estuaries on the NSW South Coast. An example of the wording of a Statement of Joint Intent that was developed for each of three small South Coast estuaries is provided in Appendix 2.

These joint statements provide an 'in principal' statement of commitment from the agencies, but in no way bind them to completing specified actions within the time frames provided in the management plan. Indeed, the SOJI specifically excludes this type of commitment.
"By signing this Statement of Joint Intent, it is agreed that

- The strategies set out in the plan are appropriate to (the estuary), and
- They will be implemented by Council and the nominated agencies in partnership with the community in a co-ordinated and responsible manner, recognising the constraints imposed by financial and human resourcing of the respective organisations.

The timeframes given in the plan are meant as a guideline to assist in the prioritisation of Council and agency workplans. Progress of plan implementation will be reviewed on an annual basis and a new timeframe developed if required."

Each SOJI was signed by

- The General Manager of Council,
- Regional Director DLWC,
- Director of Fisheries; and
- Regional Managers of NPWS, EPA, State Forests, Waterways Authority and DUAP.

Where there are several estuaries within any one region competing for funds and other resources for implementation of management plans, the SOJI does not provide a mechanism for resolving competing priorities. Each agency is committed by each SOJI separately to implement agreed strategies as and when funds become available.

A SOJI provides a valuable first step towards integrated implementation, but is not, by itself, sufficient to achieve orderly and co-ordinated implementation, as there is no assurance that the budget cycles and budget priorities of individual agencies will coincide.

### 3.4.3 Regional Environmental Plan

Regional Environmental Plans can be used to establish a broad planning framework for a large geographic area (e.g., the Hunter REP), but attempts have also been made to apply the regional planning approach (under Part 3 of the EP&A Act) to natural resource management for sensitive regions, such as Jervis Bay and the Williams River.

An REP has the advantage of statutory power, but there are limitations to the issues that can be managed using the statutory planning process alone.

### 3.4.4 Protection of the Environment Policy

The concept of a Protection of the Environment Policy (PEP) was introduced by the Protection of the Environment Operations Act 1997. The Act notes that a PEP can be made in relation to any of

- The whole or any part of the State,
- The environment generally, or any part of it,
- Any activity that may impact on the environment,
• Any form of pollution,
• Any aspect of waste,
• Any kind of technology or process,
• Any kind of chemical or other substance that may impact on the environment, or
• Any National Environment Protection Measure (NEPM)

This definition suggests that a PEP could be a possible mechanism for dealing with issues that are of regional importance, or for setting policy requirements in relation to issues that must be considered in the management of estuaries generally. For instance, there has been some discussion of the use of a PEP to guide the management of Sydney Harbour, or to require the consideration of water quality objectives in the planning process.

If a PEP were to be used as a management tool for estuary management, the process would involve mandatory public participation and full economic and social impact analysis.

No PEPs have yet been developed, so there are currently no examples that could illustrate the scope of environmental management that could be achieved using this tool.

### 3.4.5 Regional Environmental Management Strategy

Several Councils in the Hunter are contributors to the Lower Hunter and Central Coast Regional Environmental Management Strategy (REMS). The strategy was prepared in 1996, and has since that time has sponsored a number of inter Council and Interagency projects, such as the Regional Biodiversity Strategy, and a Regional Erosion and Sediment Control Policy and guidelines. These project make constructive use of existing local government and agency alliances. To date, the Strategy group has not targeted estuary management issues at a regional level, although several member Councils are responsible for the preparation of estuary management plans (eg Wyong, Lake Macquaine, Newcastle, Port Stephens).

Although discussion and negotiation within this group is not necessarily the forum to address competing priorities between estuaries, it does provide significant opportunities for efficient planning for the management of issues that are common to all (or several) estuaries in the region. For instance, the REMS committee could consider a consistent approach to the zoning of waterways in the region, and could also encourage broad regional adoption of the LEP and DCP for better planning in areas underlain by acid sulphate soils.

The advantages and disadvantages of various management frameworks are summarised in Table 3.2.
Table 3.2 - Summary of Possible Implementation Frameworks

<table>
<thead>
<tr>
<th>Structure/Mechanism</th>
<th>Benefits</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuary Management Committee (ongoing membership)</td>
<td>• Continuity of expertise and involvement at community level</td>
<td>• May not be able to attract sufficient agency commitment at work plan and budget level</td>
</tr>
<tr>
<td>Estuary Management Committee (Regional Director level, and linked to River Management Committee and Catchment Board)</td>
<td>• High level agency awareness of issues and commitment to management actions, • Potential for close co-ordination with River Management Committees and Catchment Boards (Regional catchment strategies), to achieve integrated catchment and estuary management</td>
<td>• Potentially unrealistic demands on senior staff time where there are multiple committees within a region, • Would need also a community review committee to highlight local issues of concern</td>
</tr>
<tr>
<td>Statement of Joint Intent</td>
<td>• Provides clear statement of agreed intention</td>
<td>• No real commitment to implementation within specified time frames, • Does not ensure co-ordination of actions</td>
</tr>
<tr>
<td>Protection of the Environment Policy</td>
<td>• Could deal with issues and objectives at the regional scale</td>
<td>• Largely unknown mechanism at this stage, • Major project to develop a PEP, with long lead times - not an option in the short term</td>
</tr>
<tr>
<td>Regional Environmental Plan</td>
<td>• Could provide for consistent planning approaches across the region, • Some success in introducing broad planning controls in the Williams River catchment</td>
<td>• No local examples of successful use of a REP to guide estuary management (Jervis Bay)</td>
</tr>
<tr>
<td>Regional Environmental Management Strategy</td>
<td>• Makes use of existing constructive agency and Council alliances • Track record of preparing planning documents of regional application, and could address some estuary issues</td>
<td>• May not attract sufficient agency commitment at the work planning and budget stage</td>
</tr>
</tbody>
</table>

Community submissions to the exhibition of the draft Estuary Management Study provided some feedback on preferred management structures. Comments included:

- prepare a SEPP for estuary management with State funding for capital works and allowances for recurrent funding in agency budgets,
- co-ordination of agency participation is a must,
- prepare a Statement of Joint Intent to set down the fundamentals on which all parties agree,
- necessary agency and Council commitment should be managed through the Estuary Management Committee.

The Estuary Committee has also discussed potential implementation structures, and prefers that implementation be managed by a new Estuary Management Committee, which may
have slightly different stakeholder representation than the group which has steered the preparation of the Estuary Management Plan.

The Estuary Management Committee also favours a Statement of Joint Intent, which would be signed by Council, agency and community stakeholders.

Community submissions to the exhibition also made some valuable comments about ongoing community participation in the implementation of the Estuary Management Plan. These comments included:

- use television, Internet, local newspapers and radio to reach the broad community,
- ongoing monitoring is essential, with periodic newsletters to all rate payers,
- public review period for major changes to the estuary plan and community participation in reviews of the Plan,
- use Council precinct committees to disseminate information,
- need solid and continuous input/feedback from those with local knowledge,
- it is not feasible for the whole community to agree on everything, and some interests will be incompatible.

3.5 PRIORITY LOCATIONS AND PROCESSES FOR MANAGEMENT

Figures 3.1a to 3.8b illustrate the range of management issues that need to be addressed in Port Stephens and Myall Lakes.

3.5.1 Priority Management Issues for Port Stephens and Myall Lakes

The draft Estuary Management Study presented a diverse suite of management actions for community comment. They represented a suite of management responses that would contribute to ecologically sustainable management of the estuary. The time frames that were suggested for various actions indicated those tasks that should be completed (or at a minimum initiated) within two years of the completion of the Estuary Management Plan. No time frame for the commencement of an action was suggested to be more than five years, although some actions will continue as routine aspects of the management of the estuary for many years.

The actions that were suggested for the first two years of the implementation of the Estuary Management Plan are summarised by management zone in Table 3.3.

Table 3.3 - Action Plan Summary - Tasks to be Initiated within Two Years

<table>
<thead>
<tr>
<th>Zone</th>
<th>Action</th>
<th>Budget Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole of Estuary</td>
<td>Establish integrated catchment and estuary water quality / ecological database and monitoring program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Councils to employ staff / allocate specific responsibility for co-ordinated implementation of catchment / stormwater / estuary management recommendations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implement Septic / safe program for all unsewered areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establish an Implementation Steering Committee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establish a Community Review Committee</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.3 - Action Plan Summary - Tasks to be Initiated within Two Years (cont)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Action</th>
<th>Budget Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole of Estuary</td>
<td>Achieve full stakeholder sign off of Statement of Joint Intent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Appoint a catchment / estuary co-ordinator</td>
<td></td>
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<tr>
<td></td>
<td>Remove priority derelict oyster leases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prepare aquaculture Industry Development Plan</td>
<td>Funded</td>
</tr>
<tr>
<td></td>
<td>Identify priority areas for restoring riparian vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complete acid sulphate management plan</td>
<td>Funded</td>
</tr>
<tr>
<td></td>
<td>Establish sea grass monitoring program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Survey (baseline) of recreational fishing catches</td>
<td>Funded</td>
</tr>
<tr>
<td></td>
<td>Commence estuary wide water quality monitoring program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clarify management responsibilities and response procedures for incidents such as algal blooms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install signage at boat ramps about presence and sensitivity of marine fauna - dolphins, penguins, turtles</td>
<td>Funded</td>
</tr>
<tr>
<td></td>
<td>Confirm zoning, ownership and status of all foreshore lands and identify areas with potential to extend foreshore public reserves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prepare Aboriginal sites management strategy for estuary foreshore</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preliminary actions for boating management plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Survey of user needs,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Signs at ramps and jetties in relation to wake depth and safety awareness program for how to use Little Beach ramp efficiently</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Review size and effectiveness of safe holding areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Investigate alternative parking for some users of Little Beach (eg Shuttle bus)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Investigate options for public ramp in North Arm Cove</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complete public pumpout facilities at five locations in Port Stephens and maintain collection service in Myall Lakes</td>
<td>Funded</td>
</tr>
<tr>
<td></td>
<td>Amend regulation to prohibit discharge of raw sewage to Port Stephens and Myall Lakes from boats - all vessels above 6 metres to have holding tank Ensure adequate on shore facilities for other boat users</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commence preparation of a mooring management plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduct compliance audits of marine and slipway operations, and RAAF Base</td>
<td>Routine Activity</td>
</tr>
<tr>
<td></td>
<td>Conduct baseline survey of riparian vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintain oyster QAP</td>
<td>Industry Funded</td>
</tr>
<tr>
<td></td>
<td>Complete revision of Port Stephens LEP (including waterway uses requiring consent)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitor incidence of arbovirus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduct appropriate research to identify relevant biological indicators of estuary health</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confirm zoning and ownership of all foreshore lands and conduct a review of all structures on foreshore/nearshore lands</td>
<td></td>
</tr>
</tbody>
</table>
FIGURE 3.1a
Management Zone A1
Tomaree Head to Corelette

Legend:
- Marina
- Golf Course
- Stormwater Drain
- EPA Water Quality Assessment

- Reduction in seagrass cover & deteriorating water quality in harbour. Confined navigation space. Multiple commercial users
- Impacts of urban, stormwater on water quality
- Poor flushing of harbour waters
- Potential for conflicts between different types of recreational use of the waterway
- Adequacy of car parking for peak demand periods. Capacity of ramp at peak periods
- Potential for pollution - marina operations
- Stormwater drains discharge onto beach
- 50 year hazard zone is landward of current infrastructure
- Severe Shoreline erosion
- Boat ramp difficult to use in windy conditions
- Development encroaching on upper slopes - visual impacts
Figure 3.1b
Management Zone A2
Corlette to Soldiers Point

Legend:
- Caravan Park
- Marina
- Stormwater Drain
- Rubbish Tip
- EPA Water Quality Assessment

Boat ramp and jetty, no parking available
Urban runoff
Some algal over growth on seagrass
Numerous moorings
Quarry
Salamander Landfill
Industrial Area
Mobile near shore sediment
SEPP 14 Wetlands

Umwelt (Australia) Pty Limited
Management Zone A3

- Very deep water
- Urban development encroaching on skyline - visual amenity from water
- Urban stormwater discharges to bay
- Near shore water quality in Bay may be affected by urban stormwater runoff
- Clean Waters Act restricts discharge of sewage wastes from boats into waters of port, but difficult to enforce
- Myall Point - destroyed by storm waves in 1927
- Strong Currents
- Shoals in outer port direct waves onto Jimmys Beach and Shoal Bay
- Potential conflicts between various types of recreational uses of the waterway
- Urban stormwater discharge to Bay
- Urban stormwater discharge
- Urban stormwater discharge to Bay and across beach

FIGURE 3.1c
Management Zone A3
Outer Port Stephens

Umwelt (Australia) Pty Limited

Not To Scale
Ref No.: 1287/R04/RD2_V1/psc_026.dgn
FIGURE 3.2a
Management Zone B1
Cromartys Bay

Legend:
- Water Quality Monitoring Point
- Industrial Site
- Oyster Shed
- Purification Plant
- Marina
- Golf Course
- Stormwater Drain
- Rubbish Tip

Not To Scale
Ref No.: 1287/R04/RO2_V1/psc_010.dgn
FIGURE 3.2c
Management Zone B3
Lemon Tree Passage

Legend:
- Marina
- Stormwater Drain
FIGURE 3.3a
Management Zone C1
Mallabula & Tanilba Bay

Legend:
- Caravan Park
- Industrial Site
- Oyster Farm
- Purification Plant
- Marina
- Golf Course
- Stormwater Drain
- Rubbish Tip
- EPA Water Quality Assessment

Shoreline erosion associated with wind waves & runoff from creeks/drains into nearshore zone
Some shoreline erosion, rock protection

Management Zone C1
**FIGURE 3.3c**
Management Zone C3
Waters of Upper Port Stephens

Water Quality affected by rural runoff in wet weather

Oyster leases may present navigation hazards

Long wind fetch in all directions - may be turbid from wind waves resuspending sediment. Water residence time up to 7 days
Unsealed to be connected to new reticulated service

Numerous oyster leases

New alignment bridge to be constructed

High ridgelines predominantly natural vegetation

Historic village with links to AA Company

"Delta" deposition at mouth of Karuah River

Predominantly natural riparian vegetation, high visual amenity

Management Zone C3

Management Zone E

Legend:
- Water Quality Monitoring Point
- STP
- Poultry Farm (Upstream)
- Stormwater Drain
- Rubbish Tip

Water quality affected by rural runoff

Currently unsewered village with history of bypassing septic pumpout systems

Trials & habitat modification to reduce mosquito breeding

Numerous derelict oyster leases, to be removed. Waters often turbid

Highway

Pacific

SEPP 14 Wetlands

Foreshore park & baths

Umwelt (Australia) Pty Limited

NB: Poultry Farms located upstream of Karuah Bridge

FIGURE 3.3d
Management Zone C3 & E
Karuah & North of Karuah River, Yallimbah Creek to Baroomee Point

Not To Scale
Ref No.: 1287/R04/RED2_V1/psc_014.dgn
FIGURE 3.4
Karuah River Catchment

Source Figure 1.2 Report 913
NSW Department of Public Works & Services
FIGURE 3.5a
Management Area E
North Arm Cove

- agricultural catchment landuses
- Management Zone E
- subdivided land, not available for residential development - no services
- need for vigilant erosion and sedimentation control
- potential tourist development
- sewerage village
- absolute waterfront properties, some illegal structures on shoreline
- dereelict oyster leases to be removed
- SEPP 14 Wetlands
- unsewered village

Ref No.: 1287/R04/RD2_V1/psc_043.dgn

Not To Scale
FIGURE 3.5b
Management Zone E
Fame Cove

Catchment area outside National Park is in private ownership

High recreational boating usage - noise, waste management issues

Minor bitou bush infestation of riparian vegetation

National Park
FIGURE 3.6a
Management Zone F1
Corrie Island & Corrie Channel

Not To Scale
Ref No.: 1287/R04/RD2_Vt/psc_027.dgn
FIGURE 3.6b
Management Zone F2
Jimmys Beach & Yacaaba Headland

Not To Scale  Ref No.:1287/R04/RD2_V1/psc_030.dgn

Umwelt (Australia) Pty Limited
FIGURE 3.6c
Management Zone G1
Corlette to Soldiers Point

Legend:
- Water Quality Monitoring Point (Oyster QAP)
- Caravan Park
- STP
- Golf Course
- Stormwater Drain
Figure 3.7
Management Zone G1
Nerong Inlet & Nerong Village

- Waterway highly sensitive to stormwater runoff
- Boating access to National Park
- Natural catchment area, drains to National Park
- High Conservation Value Wetlands
- High quality riparian vegetation throughout Inlet
- Small urban village, virtually enclosed in National Park (No sewage reticulation)

Not To Scale
Ref No.: 1287/R04/RD2_Y1/psc_028.dgn
FIGURE 3.8a
Management Zone H
Lower Myall River in
Myall Lakes National Park
Groundwater inflows are an important part of lake water balance throughout the National Park.

Lake waters are highly sensitive to slight increases in nutrient load.

Management Zone H

Myall Lake - fresh water

Salvinia infestation, Boolambayte Creek. Also rural runoff impacts on water quality in wet weather. Extremely long retention times in lake system.

FIGURE 3.8b
Management Zone H
Myall Lakes - Broadwater and Boolambayte

Not To Scale
Ref No.: 1287/RD2_V1/psc_045.dgn

Umwelt (Australia) Pty Limited
<table>
<thead>
<tr>
<th>Zone</th>
<th>Action</th>
<th>Budget Status</th>
</tr>
</thead>
</table>
| Whole of Estuary    | Explore options for a streamlined planning process for estuary works to include  
  - Water quality monitoring,  
  - Detailed investigations of the feasibility of improving circulation and flushing,  
  - Mooring management,  
  - Environmental awareness program for recreational boating,  
  - Complete pumpout facility for commercial charter vessels |               |
| A                   | Implement catchment controls to reduce sediment load in stormwater draining to estuary  
  Prepare management plan for Nelson Bay Harbour  
  Introduce litter removal plan for Nelson Bay Harbour  
  Monitor water quality in harbour  
  Finalise Coastline Management Plan for Shoal Bay and implement highest priority actions  
  Implement highest priority actions of PSC Stormwater Management Plan, in relation to the estuary (controls on drains to Nelson Bay Harbour, Shoal Bay, Little Beach, Cromartys Road) | Funded (part) |
| B                   | Implement catchment controls to reduce sediment load in stormwater draining to estuary  
  Implement Septic / safe program for all unsewered areas  
  Implement highest priority actions of PSC Stormwater Management Plan, in relation to the estuary (controls on drains to Nelson Bay Harbour, Shoal Bay, Little Beach, Cromartys Road) |               |
| C                   | Implement local erosion control actions at Tareiiba Bay  
  Implement catchment controls to reduce sediment load in stormwater draining to estuary  
  Implement Septic / safe program for all unsewered areas  
  Implement highest priority actions of PSC Stormwater Management Plan, in relation to the estuary (controls on drains to Nelson Bay Harbour, Shoal Bay, Little Beach, Cromartys Road)  
  Audit stormwater system at Williamtown Air Force base |               |
| D                   | Audit dairy farm waste management and prepare management plan  
  Audit chicken farm and user group waste management, and prepare management plan  
  Monitor pumpout volumes in Karuah  
  Implement Septic / safe program for all unsewered areas  
  Prepare Catchment Management Plan |               |
| E                   | Investigate causes of shoreline erosion at Pindimar  
  Investigate options for managing intensity of use in Fame Cove  
  Implement Septic / safe program for all unsewered areas |               |
| F                   | Complete REF and dredge Corne Channel  
  Initiate sediment/channel monitoring  
  Complete review of Jimmys Beach Coastline Management Plan  
  Complete Conservation and Development strategy for Tea Gardens / Hawks Nest | Partly Funded  
  Funded              |
Table 3.3 - Action Plan Summary - Tasks to be Initiated within Two Years (cont)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Action</th>
<th>Budget Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Catchment assessment to identify priority nutrient sources to Myall Lakes, and prepare catchment plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduct community awareness program about the risks of aquatic weeds to Myall Lakes National Park</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Complete Myall Lakes Plan of Management review</td>
<td>Funded</td>
</tr>
<tr>
<td></td>
<td>Catchment assessment to identify priority nutrient sources to Myall Lakes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduct community awareness program about the risks of aquatic weeds and algal blooms to Myall Lakes National Park</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access research information about potential impacts of blue-green algae on oyster production and marketing</td>
<td></td>
</tr>
</tbody>
</table>

In terms of the types of actions proposed for the first two years of implementation of the estuary management plan, the break down is approximately as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address lack of environmental data by establishing baseline status - for ongoing review and improvement, and an integrated and accessible database</td>
<td>25%</td>
</tr>
<tr>
<td>Establish agency/Council and community procedures for ongoing involvement and continual improvement</td>
<td>10%</td>
</tr>
<tr>
<td>Complete preparation of current planning strategies</td>
<td>20%</td>
</tr>
<tr>
<td>Direct actions</td>
<td>25%</td>
</tr>
<tr>
<td>New targeted management plans for high priority issues or high risk issues</td>
<td>20%</td>
</tr>
</tbody>
</table>

This distribution of action types is not accidental, but reflects the special characteristics of the Port Stephens / Myall Lakes estuary and its context area. The short term actions are therefore designed to address the following matters:

- Port Stephens and Myall Lakes is a very large and complex estuary system, about which relatively little baseline environmental data is available. This was highlighted by the Estuary Processes Study and again by recent work on the water quality and health of the Karuah River (MPR 1999). This baseline status information data is an essential component of any environmental management system. The community needs to understand the starting point, so that progress (costs and benefits) can be assessed.

- On the basis of the information that is available, the estuary is generally in very good condition, although there are some indications that catchment and waterway usage are having a discernible impact on water quality and community satisfaction with lifestyle. In this sense, there are relatively few urgent remediation actions (direct actions). The management plan will focus on minimizing future needs for urgent remediation, which is almost always very expensive and costs are often difficult to allocate in a fair and equitable manner.

- The geographical location of Port Stephens and Myall Lakes means that the area faces unprecedented growth pressure over the next ten years. Rapid growth has occurred in the Port Stephens LGA for several years, but improvements in transport times to the northern shore of the estuary from the Sydney metropolitan area can be expected to create further development pressure there. In this context, the local community faces major decisions about the environmental quality and lifestyle that it wants to sustain into the future. Careful planning for the management of social and economic growth is essential. A relatively high proportion of actions suggested for the first two years of plan...
implementation (approximately 40%) are therefore directed at putting in place effective planning strategies and actions to safeguard community and environmental values.

- The program of works identified in the estuary management plan will not be realised unless there is government and community commitment to its implementation, and a policy and administrative framework that facilitates whole of community participation in the process. Several of the actions suggested for high priority implementation are directed at getting this framework of shared responsibility and commitment right for this estuary. These require the ongoing involvement of State and local decision makers and appointment of a co-ordinator to ensure the smooth organisation of actions.

It is acknowledged that some of the options suggested will require careful policy analysis by State and local government. Effective implementation of estuary management plans as a key element of sustainable management of the coastline is still pretty much in its infancy. It is critical, however, that these policy discussions take place.

Community responses to the exhibition of the draft Estuary Management Study included comment about the appropriateness and priority of certain actions. These responses (see Reference Document 3) included:

- Effluent holding tanks should be fitted to all vessels in Port Stephens and Myall Lakes that are greater than 6 metres in length, and consideration should also be given to holding tanks for smaller vessels.
- The floating pumpout facility in Myall Lakes should be continued.
- Urgent attention is needed for a range of sewage issues in the Myall Lakes catchment including Nerong and Bombah Point.
- Employ additional waterway regulatory staff in peak periods to enhance compliance (eg regarding speed limits in the Myall River).
- Power boats should be able to operate in Myall Lakes in a controlled manner.
- Potential for power boats generally to have detrimental impacts (noise, waves, water quality (2 stroke motors), seagrass damage, bank damage, access to isolated areas) needs careful management.
- Public access to waterways and bushland should be maintained.
- Study is needed to identify nutrient sources in the Upper Myall.
- Inspections of slipways, marinas and other boat repair facilities.
APPENDIX 1

Survey Questions for Recreational Boating
Good morning/afternoon. My name is ___________________ from Umwelt Australia and we are conducting a survey of users of boating ramps within the Port Stephens Council area. The main aim of the survey is to determine current use, issues and the main users of the ramps and surrounding waters. Can you spare a few minutes to answer some questions regarding recreational boating. All information provided is treated with the strictest of confidence and you are not required to answer any question you do not wish to.

1. Where do you live?
   01 □ Port Stephens (specify postcode) 09 □ Victoria
   02 □ Great Lakes (specify postcode) 10 □ Queensland
   03 □ Newcastle (specify postcode) 11 □ South Australia
   04 □ Lake Macquarie (specify postcode) 12 □ Northern Territory
   05 □ Maitland (specify postcode) 13 □ Western Australia
   06 □ Cessnock (specify postcode) 14 □ Tasmania
   07 □ Sydney (specify postcode) 15 □ Other (please specify)
   08 □ NSW (other than the above)

2. How often do you participate in boating on this waterway?
   01 □ Daily 06 □ At least every three months
   02 □ Weekends 07 □ Less than yearly
   03 □ Weekly 08 □ At least yearly
   04 □ Fortnightly 09 □ First visit
   05 □ Monthly 10 □ I don’t know

3. What type of boat/vessel are you using today?
   01 □ Runabout - up to 7.5m 08 □ Power Catamaran 12m - 15m
   02 □ Jet Ski 09 □ Fishing Trawler
   03 □ Canoe 10 □ Monohull Power Boat 12.5m - 20m
   04 □ Windsurfer 11 □ Charter Vessel
   05 □ Speed Boat < 12.5m 12 □ Sport/Game Fishing Vessel
   06 □ Yacht - trailer sailer 13 □ Tall Ship/Paddlewheel Replica
   07 □ Sail Catamaran/Dinghy 14 □ Other (specify)
4. **What area(s) of the waterways do you usually use?** *(Tick as many that apply)*

<table>
<thead>
<tr>
<th>Number</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Nelson Bay</td>
</tr>
<tr>
<td>02</td>
<td>Salamander Bay</td>
</tr>
<tr>
<td>03</td>
<td>Shoal Bay</td>
</tr>
<tr>
<td>04</td>
<td>Tilligerry Creek</td>
</tr>
<tr>
<td>05</td>
<td>North Arm Cove</td>
</tr>
<tr>
<td>06</td>
<td>Big Swan Bay</td>
</tr>
<tr>
<td>07</td>
<td>Little Swan Bay</td>
</tr>
<tr>
<td>08</td>
<td>Cromarty’s Bay</td>
</tr>
<tr>
<td>09</td>
<td>Myall Lakes</td>
</tr>
<tr>
<td>10</td>
<td>Myall River</td>
</tr>
<tr>
<td>11</td>
<td>Pacific Ocean</td>
</tr>
<tr>
<td>12</td>
<td>Fame Cove</td>
</tr>
<tr>
<td>13</td>
<td>Karuah River</td>
</tr>
<tr>
<td>14</td>
<td>Other (specify)</td>
</tr>
</tbody>
</table>

5. **Why do you choose this/these specific areas?** *(Tick as many that apply)*

<table>
<thead>
<tr>
<th>Number</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Calm Waters</td>
</tr>
<tr>
<td>02</td>
<td>Sightseeing</td>
</tr>
<tr>
<td>03</td>
<td>Diving</td>
</tr>
<tr>
<td>04</td>
<td>Snorkelling</td>
</tr>
<tr>
<td>05</td>
<td>Dolphin Watching</td>
</tr>
<tr>
<td>06</td>
<td>Whale Watching</td>
</tr>
<tr>
<td>07</td>
<td>Swimming</td>
</tr>
<tr>
<td>08</td>
<td>Fishing</td>
</tr>
<tr>
<td>09</td>
<td>Water Skiing</td>
</tr>
<tr>
<td>10</td>
<td>Never been before</td>
</tr>
<tr>
<td>11</td>
<td>I don’t know</td>
</tr>
<tr>
<td>12</td>
<td>Other (specify)</td>
</tr>
</tbody>
</table>

6. **Why do you choose to launch your boat at this ramp?**

- ...

7. **What do you see as the main constraints of using the boat ramp?** *(Tick as many that apply)*

<table>
<thead>
<tr>
<th>Number</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>No Constraints</td>
</tr>
<tr>
<td>02</td>
<td>No/Lack Car Parking</td>
</tr>
<tr>
<td>03</td>
<td>No Toilets</td>
</tr>
<tr>
<td>04</td>
<td>No Lighting</td>
</tr>
<tr>
<td>05</td>
<td>No Water Supply</td>
</tr>
<tr>
<td>06</td>
<td>Inadequate Signage</td>
</tr>
<tr>
<td>07</td>
<td>Overcrowding</td>
</tr>
<tr>
<td>08</td>
<td>No pump-out facilities</td>
</tr>
<tr>
<td>09</td>
<td>No boarding pontoon/jetty</td>
</tr>
<tr>
<td>10</td>
<td>Competition with other users</td>
</tr>
<tr>
<td>11</td>
<td>Waiting Times</td>
</tr>
<tr>
<td>12</td>
<td>Exposure to wind/swell conditions</td>
</tr>
<tr>
<td>13</td>
<td>Environmental Damage</td>
</tr>
<tr>
<td>14</td>
<td>Pollution</td>
</tr>
<tr>
<td>15</td>
<td>Ramp Access</td>
</tr>
<tr>
<td>16</td>
<td>Other (specify)</td>
</tr>
<tr>
<td>17</td>
<td>I don’t know</td>
</tr>
</tbody>
</table>

8. **What safety concerns do you have with using the ramps?** *(Tick as many that apply)*

<table>
<thead>
<tr>
<th>Number</th>
<th>Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Concerns</td>
</tr>
<tr>
<td>2</td>
<td>Access to Ramp</td>
</tr>
<tr>
<td>3</td>
<td>Poor Boarding/unloading</td>
</tr>
<tr>
<td>4</td>
<td>Tidal Currents</td>
</tr>
<tr>
<td>5</td>
<td>No protection from wind/swell conditions</td>
</tr>
<tr>
<td>6</td>
<td>Shallow water depths</td>
</tr>
<tr>
<td>7</td>
<td>Poor Condition of Ramp</td>
</tr>
<tr>
<td>8</td>
<td>Other (specify)</td>
</tr>
<tr>
<td>9</td>
<td>I don’t know</td>
</tr>
</tbody>
</table>
9. What do you feel are the environmental impacts of boating, if any? (Tick as many that apply)

01 □ No Impacts
02 □ Unburnt Exhaust Gas
03 □ Litter
04 □ Fuel Spills
05 □ Inappropriate disposal of sewage/sullage
06 □ Inappropriate disposal of bilge/ballast water
07 □ Maintenance practices
08 □ Disturbance to fishstocks
09 □ Disturbance to birdlife
10 □ Damage to seagrass beds
11 □ Other (specify)

10. Does your boat/vessel have a holding tank for effluent?

1 □ No 2 □ Yes

11. What facilities/actions would you like to see to the boat ramps and surrounds? (Tick as many that apply)

01 □ More Car/Trailer Parking
02 □ Toilets/Shower
03 □ Lighting
04 □ Water Supply
05 □ Safety Signs
06 □ Fish Cleaning Area
07 □ Boarding Jetty
08 □ Separation of Boating Activities
09 □ Pump-out Facilities
10 □ Picnic/BBQ Areas
11 □ Fuel Available
12 □ I don’t know
13 □ Other (specify)

Thank participant for their time and contribution to the study.

Date: 
Time: 
Weather: 
Ramp Location: 
Interviewer:
APPENDIX 2

Statement of Joint Intent Used by South Coast Estuary Plans
STATEMENT OF JOINT INTENT

ST GEORGES BASIN ESTUARY MANAGEMENT PLAN

In recognition of the need to ensure that the use and development of St Georges Basin is ecologically sustainable in the long term, a St Georges Basin Estuary Management Plan has been developed by Shoalhaven City Council in partnership with State Government agencies and the local community. The plan has been publicly exhibited and has now been adopted as a plan of Council under the Local Government Act, 1993.

This Statement of Joint Intent requires Council, the agencies and the community to work together to implement the strategies set out in the management plan. The strategies cover a range of measures including planning and development controls, works to repair and prevent environmental damage, education and awareness campaigns, monitoring and further research. Responsibilities have been assigned for implementation of each strategy in the plan to either Council, one of the agencies or the community.

By signing this Statement of Joint Intent, it is agreed that:

• the strategies set out in the plan are appropriate to St Georges Basin and
• they will be implemented by Council and the nominated agencies in partnership with the community in a coordinated and responsible manner recognising the constraints imposed by financial and human resourcing of the respective organisations.

The timeframes given in the plan are meant as a guideline to assist in the prioritisation of Council and agency workplans. Progress of plan implementation will be reviewed on an annual basis and a new timeframe developed if required.

GENERAL MANAGER
SHOALHAVEN CITY COUNCIL

REGIONAL DIRECTOR
DEPARTMENT OF LAND & WATER CONSERVATION

DIRECTOR OF FISHERIES
NSW FISHERIES

REGIONAL MANAGER
NATIONAL PARKS & WILDLIFE SERVICE

REGIONAL MANAGER
ENVIRONMENT PROTECTION AUTHORITY

REGIONAL MANAGER
STATE FORESTS

REGIONAL MANAGER
WATERWAYS AUTHORITY

REGIONAL MANAGER
DEPARTMENT OF URBAN AFFAIRS & PLANNING

DATED 14 JULY 1998