ESTUARY MANAGEMENT PLAN

ESTUARY MANAGEMENT STUDY & PLAN

# Saltwater Creek & Lagoon South West Rocks

*Final Report*

*June 2006*

KEMPSEY Shire Council

NSW Government
DEPARTMENT OF NATURAL RESOURCES

WBM

# Saltwater Creek & Lagoon Estuary Management Study and Plan

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| Prepared For: | Kempsey Shire Council |
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| ***Synopsis:*** | This document has been prepared under the provisions of the NSW Estuary Policy and NSW Coastal Policy, and in accordance with the Estuary Management Manual. It outlines a management process that is to be followed in order to achieve long term sustainability of Saltwater Creek and Lagoon with regard to ecological, economic and social values. The Plan is intended to be used by Council to guide future works programs and policy changes. |

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# FOREWORD

## Saltwater Creek and Lagoon Estuary Management Plan

The estuaries of NSW represent a priceless natural resource. Collectively, they are immensely valuable from an ecological, social and economic perspective. NSW has over 130 estuaries that vary in size from small coastal creeks and lagoons to large lakes and rivers. Estuaries contain diverse ecosystems that form the foundation of the coastal food chain. They provide important habitats for a variety of marine and terrestrial plants and animals.

Estuaries have a special place in the lives of most Australians. Over 75% of the NSW population live and work in towns and cities near estuaries. A high proportion of the State's commercial activity occurs near estuaries as they provide an important focus for industry, tourism and recreational activities. This high level of development pressure means that estuaries are subject to a range of direct and indirect impacts due to land use in the catchment, changes to hydrology and tidal processes, and the direct use of the estuary waterway. In recognition of the need for future sustainable use of these threatened resources, the NSW Government is implementing a number of key strategic initiatives, one of which is the Estuary Management Program.

An Estuary Management Plan for Saltwater Creek and Lagoon has been prepared on behalf of Kempsey Shire Council and the Department of Natural Resources (DNR), to fulfil the requirements of the NSW Estuary Management Policy (1992) and the NSW Coastal Policy (1997). The Plan will provide a program of strategic actions to assist government authorities and other stakeholder groups to sustain a healthy estuary through appropriate waterway, foreshore and catchment management. The Plan presents an integrated suite of management strategies, giving due consideration to the complex interactions between many estuarine processes and functions.

It is recognised that many environmental management practices of the past are no longer acceptable, with the community demanding higher levels of ecological conservation and holistic policy-making. This Estuary Management Plan represents a pro-active and forward-thinking approach to the management of Saltwater Creek and Lagoon, and has been developed using the principles of Ecologically Sustainable Development (ESD). In particular, the precautionary principle has been applied when formulating environmental protection strategies, in the absence of detailed scientific studies. Sound, best practice environmental management is at the cornerstone of each strategy, to achieve the long term goal of sustainability.

The Saltwater Creek and Lagoon Estuary Management Plan is designed to provide clear direction regarding responsibilities for actions, which will help achieve long term sustainability. The Plan also provides information on who will be responsible for implementation of these actions and how they can be funded. The Plan is designed to have an initial tenure of 5 years, after which time, conditions can be reassessed and strategies refocussed as appropriate.

# STATEMENT OF ENDORSEMENT

## Saltwater Creek and Lagoon Estuary Management Plan

We the undersigned, representing the key government stakeholders, endorse the content of the Saltwater Creek and Lagoon Estuary Management Plan, and accept responsibility for implementation of the Plan as specified within the document.

Signed,

Mayor,
Kempsey Shire Council .....

Regional Director,
NSW Department of Natural Resources
North Coast Region .....

Regional Director,
NSW Department of Primary Industries
Fisheries Division
North Coast Region .....

Regional Director,
NSW Department of Environment and Conservation
National Parks Division
North Coast Region .....

# EXECUTIVE SUMMARY

Saltwater Creek and Lagoon is a small estuary on the mid north coast of NSW connected to the ocean adjacent to the township of South West Rocks. The estuary is an Intermittently Closed and Open Lake or Lagoon (ICOLL), meaning that the waterway is not permanently connected to the ocean. In fact beach sand keeps the entrance closed for about 70% of the time, resulting in no tidal variability, and water levels that respond to catchment runoff and evaporation.

***Saltwater Lagoon and Creek, and South West Rocks township in the background***

Saltwater Creek and Lagoon are important features of the local landscape. The waterway provides for a combination of passive recreation activities, such as canoeing, bushwalking and fishing, and natural habitat values. The downstream end of Saltwater Creek near the ocean entrance is also used for swimming, and is valued for quiet and safe bathing conditions. South West Rocks is subject to significant seasonal population changes. During the summer holiday period, the area has a high itinerant population, which places stress on the local environment, including Saltwater Lagoon. The ocean entrance of Saltwater Creek and Lagoon is also subject to artificial intervention when water levels reach a height that starts to inundate and impact on surrounding foreshore lands (including the Tourist Park and the Golf Course).

Kempsey Shire Council, in collaboration with the Department of Natural Resources (DNR) has prepared an Estuary Management Plan for Saltwater Creek and Lagoon, under the NSW Government's Estuary Management Program. The aim of the Estuary Management Plan is to ensure ecological sustainability of the ICOLL, whilst balancing the demands on the system by human uses, both within the waterway and around its foreshores. Also, the Plan seeks to achieve an equitable balance between opportunities for future development around the estuary and ensuring that such development does not degrade the natural values that make development in the area attractive. The Plan essentially strives to protect those aspects of the estuary that are valued, whilst redressing those aspects that currently degrade the system.

A combination of scientific investigations and community consultation was adopted in preparing the Plan. First, an Estuary Processes Study (MHL, 2002) was conducted, which investigated and described the physical, chemical and biological processes occurring within the estuary. Consultation was then carried out with the relevant stakeholders of Saltwater Creek as well as local community. The consultation was designed to identify a range of issues that needed to be addressed by future management actions.

Based on a detailed understanding of the environmental processes and the concerns and aspirations of the community and stakeholders, a series of strategies were developed to meet long term objectives for the Saltwater Creek estuary. The strategies, which were assessed and short-listed based on likely costs and effectiveness, cover a range of management issues, including Water Quality, Ecology / Biodiversity, Entrance Management (and flooding), and Future Catchment Development.

Strategies were designed and customised to address 14 separate objectives, each aiming to ensure long term sustainability of the estuary. Many strategies were able to address multiple objectives, meaning that these strategies represent the best opportunities for future conservation and environmental restoration.

The Estuary Management Plan provides a "user manual" for future environmental sustainability of Saltwater Creek and Lagoon, and gives direction for Council and landholders regarding future development constraints and opportunities within the catchment. The Plan provides details of what strategies should be adopted to achieve the greatest benefits to the estuary, whilst also balancing existing and future human demands on the system. For each strategy, sufficient detail is given in the Plan to commence implementation, including costs, responsibilities and timeframes.

The management strategies for Saltwater Creek and Lagoon are presented below, in priority order.

**Table ES-1 – Prioritised Future Management Strategies for Saltwater Creek and Lagoon**

| Reference | Strategy Description | Rank |
|---|---|---|
| | To commence implementation immediately (by end 2007) | |
| A | Prepare and adopt a formal Entrance Management Policy | 1/22 |
| B | Assess water quality to determine appropriate usage | 2/22 |
| C | Review status of existing 1(d) urban investigation lands | 3/22 |
| D | Maintain & enforce existing policies re: land sensitivity | 4/22 |
| E | Prepare stormwater strategy for new development | 5/22 |
| F | Investigate opportunities for wildlife corridors between SEPPs | 6/22 |
| G | Increase enforcement of fishing regulations | 7/22 |
| H | Provide signage at recreation areas regarding risks | 8/22 |
| I* | Artificially open entrance to improve water quality | 9/22 |
| | To commence implementation in the short term (by end 2009) | |
| J* | Periodically allow full hydrological range in wetlands | 10/22 |
| K | Rezone important habitats to 'environmental protection' | 11/22 |
| L | Monitor biological indicators to assess environmental health | 12/22 |
| M | Education of community re: weeds and pests | 13/22 |
| N | Monitoring of water quality to determine health risks | 14/22 |
| O | Audit on-site sewage treatment systems | 15/22 |
| P | Rehabilitate degraded habitats via revegetation, soil stab., etc | 16/22 |
| Q | Review existing EPIs regarding native vegetation removal | 17/22 |
| R | Community education re: land and water sensitivity | 18/22 |
| S | Encourage lot-based on-site stormwater management | 19/22 |
| T | Periodically monitor for hydrocarbon leachate | 20/22 |
| | To commence implementation in the medium term (by end 2011) | |
| U | Retrofit stormwater filtration devices and wetlands | 21/22 |
| V | Assess capacity of sewerage to determine overflows | 22/22 |

* *These strategies addressed primarily through implementation of Strategy A*

# GOVERNMENT AGENCIES AND OTHER ACRONYMS

| | |
|---|---|
| DNR | current Department of Natural Resources |
| DoP | current Department of Planning |
| DoL | current Department of Lands |
| DEC | current Department of Environment and Conservation |
| DPI | current Department of Primary Industries (amalgamation of former Departments of Fisheries, Agriculture, Mineral Resources and State Forests) |
| DEUS | current Department of Energy, Utilities and Sustainability |
| NRCMA | current Northern Rivers Catchment Management Authority |
| DIPNR | former Department of Infrastructure, Planning and Natural Resources – was replaced in September 2005 by the Department of Planning, and Department of Natural Resources. |
| DLWC | former Department of Land and Water Conservation – was replaced in 2003 by DIPNR and DoL. |
| DUAP | former Department of Urban Affair and Planning (also known as PlanningNSW) – was replaced in 2003 by DIPNR |
| NPWS | former National Parks and Wildlife Service – replaced in 2003 by DEC |
| EPA | former Environment Protection Authority – replaced in 2003 by DEC |
| HRC | former Healthy Rivers Commission |

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|---|---|
| AEP | Annual Exceedence Probability |
| AHD | Australian Height Datum |
| ANZECC | Australian and New Zealand Environment Conservation Council |
| APZ | Asset Protection Zone |
| ASS | Acid Sulfate Soil |
| CAMBA | China Australia Migratory Bird Agreement |
| CAP | Catchment Action Plan |
| CBD | Central Business District |
| CEMC | Coast and Estuary Management Committee (Kempsey Shire Council) |
| DA | Development Application |
| DCP | Development Control Plan |
| EPI | Environmental Planning Instrument (e.g., REP, LEP, DCP, SEPP) |
| ESD | Ecologically Sustainable Development |
| GPT | Gross Pollutant Trap |
| ICOLL | Intermittently Closed and Open Lake or Lagoon |
| ICZM | Integrated Coastal Zone Management |
| IWCM | Integrated Water Cycle Management |
| JAMBA | Japan Australia Migratory Bird Agreement |
| KSC | Kempsey Shire Council |
| LEP | Local Environmental Plan |
| LES | Local Environmental Study (precedes a LEP) |
| LGA | Local Government Area |
| MHL | Manly Hydraulics Laboratory (Department of Commerce) |
| ML | Mega Litres (1,000,000 litres, or 1,000$m^3$) |
| PVP | Property Vegetation Plan |
| REP | Regional Environmental Plan |
| RL | Reduced Level |
| SEPP | State Environmental Planning Policy |
| WSUD | Water Sensitive Urban Design |

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# 1 INTRODUCTION AND LEGISLATIVE FRAMEWORK

## 1.1 Locality and Background

Saltwater Creek is located within the Kempsey Local Government Area (LGA). Its catchment covers an area of 8.7 $km^2$ and includes part of the coastal townships of South West Rocks and Arakoon (refer Figure 1-1). Saltwater Creek extends upstream from the ocean for a distance of approximately 3.5 kilometres before reaching Saltwater Lagoon. The lagoon itself is subject to variable water levels, but typically has a surface area of approximately 20 hectares. The creek continues upstream of the lagoon and through the South West Rocks Country Club (Golf Club) before terminating at various outlet of the South West Rocks urban stormwater drainage system.

The predominant landuses of the catchment are light agriculture (rural-residential), recreation (golf course) and urban. The catchment also includes parts of Hat Head National Park. Saltwater Lagoon and most of Saltwater Creek is defined as a SEPP-14 coastal wetland (refer Section 1.4.2.1).

Saltwater Creek and Lagoon is considered to be an intermittently closed and open lake or lagoon (ICOLL). The Creek has an ocean entrance located at the western end of front beach (Trial Bay beach), adjacent to the rocky headland on which the South West Rocks township is located (see Figure 1-1). The entrance is predominantly closed with a sand berm separating the creek from the ocean. Ocean waves and longshore sediment transport along front beach assist in elevating the level of the entrance berm so that the still water level of the creek and lagoon system is typically perched higher than the average level of the ocean (refer Figure 1-2).

## 1.2 The Need for Long Term Management in Saltwater Creek

The NSW coastline is experiencing unprecedented urban expansion. By the year 2031, it is projected that the non-metropolitan coastal zone of NSW will support an additional 430,000 people compared to the 2001 population (DIPNR, 2004). Attractive coastal settlements such as South West Rocks are expected to receive considerable pressure in the near future to accommodate the demand for coastal urban lands. Already, the South West Rocks township has expanded rapidly to the south, with more expansion expected on the fringes of the Saltwater Creek catchment. Council has received rezoning proposals for lands within the Saltwater Creek catchment to intensify and expand existing urban development.

The future of South West Rocks and Saltwater Creek is somewhat typical of many coastal locations where the values of the existing coastal zone environment need to be actively managed in the face of increasing pressure for urban development. Given its existing catchment landuse and its natural sensitivity to inputs, Saltwater Creek and Lagoon is considered to already be at the upper limit for anthropogenic inputs (refer Section 2.4). Further degradation of the environment as a result of additional unsympathetic catchment development is likely to significantly reduce the existing ecological and natural values of the intermittent estuary.


**Figure 1-1 Locality Map of Saltwater Creek and Catchment**

Future management of Saltwater Creek will require consideration of the environmental and natural values of the system, as well as the usage of the system by resident and visiting community members (including commercial uses). Managing the 'summer impacts' of the holidaying public is particularly difficult, given the short-term peaks in recreational demand and external inputs (eg through septic leachate, litter, sewerage surcharges, foreshore trampling etc).

Intermittently open coastal systems such as Saltwater Creek are recognised as being particularly vulnerable to external loadings (HRC, 2002; Boyd *et al*., 1992). The reason for their heightened vulnerability is related to their physical structure, natural depositional characteristics and intermittent nature of their ocean connection (Haines *et al.*, 2006). In recognition of their natural sensitivity, the Healthy Rivers Commission (HRC) conducted an independent inquiry into the management of coastal lakes and lagoons (refer Section 1.4.18). The HRC provided guidance on the future directions for management of these systems based on their existing environmental values and local community aspirations.

**Figure 1-2 Saltwater Creek Entrance Sand Berm (15/3/04)**

For Saltwater Creek specifically, one of the greatest challenges for future management is establishing a regime for management of the entrance that balances the environmental values of minimal intervention with economic losses and inconvenience associated with inundation at high water levels in the system. MHL (2002) identified that the condition of the Saltwater Creek entrance (i.e. whether it is open to the ocean or closed), and the height of the berm if closed, influence a number of important estuarine processes requiring future management (refer Section 2.1).

In summary, a long term management plan is required for Saltwater Creek to ensure that the various demands on the estuary, including ecological, economic and social demands, are management in a balanced and sustainable manner.

## 1.3 Estuary Management Process

The Saltwater Creek Estuary Management Plan has been prepared under the NSW Government's Estuary Management Program. The Program is designed to fulfil the requirements of the NSW Estuary Management Policy 1992 (see Section 1.3.2) and the NSW Coastal Policy 1997 (see Section 1.3.3).

### 1.3.1 NSW Government's Estuary Management Program

In 1992, the NSW State Government introduced an *Estuary Management Policy*, aimed at managing the growing pressures on estuarine ecosystems. The policy is implemented through an Estuary Management Program, which is co-ordinated by the Department of Natural Resources (DNR), in co-operation with local government and the community.

The process of managing an estuary, in accordance with this Policy, is initiated by the establishment of an Estuary Management Committee. In compliance with the policy, Kempsey Shire has an active

Coastal and Estuary Management Committee. This Committee is responsible for the development of an Estuary Processes Study, which outlines all the hydraulic, sedimentation, water quality and ecological processes within the estuary, and the impacts of human activities on these processes.

The Estuary Processes Study provides the necessary understanding of physical and biological processes for the development of an Estuary Management Study. The Management Study identifies the essential features and the current uses of the estuary, and determines the overall objectives required for management of the estuary. The Management Study also identifies options for meeting these objectives, and determines environmental impacts of the proposed options.

From the findings of the Management Study, an Estuary Management Plan is prepared. The Plan describes how the estuary will be managed, gives recommended solutions to management problems, and details a schedule of activities for the implementation of the recommendations. Once the Plan has been accepted by both the community and the relevant Government Authorities, the Plan can be implemented through planning controls, works programs, monitoring programs, and education services. The general estuary management process, as established by the NSW Government, is shown in Figure 1-3.

The procedure of preparing an Estuary Management Plan is documented in the Estuary Management Manual (NSW Government, 1992). The manual broadly described a systems-based approach to estuary management that includes process and condition definition, management planning and implementation, monitoring of outcomes and plan review.

An Estuary Processes Study for Saltwater Creek was completed in November 2002 (MHL, 2002). A summary of the findings of the Processes Study is presented in Section 2.1. This document addresses the next two stages of the Estuary Management Process, being the development of an Estuary Management Study and an Estuary Management Plan.

### 1.3.2 Estuary Management Policy 1992

The NSW Estuary Management Policy is one of a suite of policies under the umbrella NSW State Rivers and Estuaries Policy. The Estuary Management Policy was developed as part of the State Government's recognition of the social and economic importance of estuaries. The specified general goal of the policy is "to achieve an integrated balance responsible and ecologically sustainable use of the State estuaries which form a key component of coastal catchments".

Specific objectives can be summarised as:

- Protection of estuarine habitats and eco-systems in the long term;
- Preparation and implementation of a balanced long term management plan for the sustainable use of each estuary and its catchment;
- Conservation of habitats;
- Conservation of aesthetic values;
- Prevention of further estuary degradation;
- Repair of damage to the estuarine environment; and
- Sustainable use of estuarine resources.

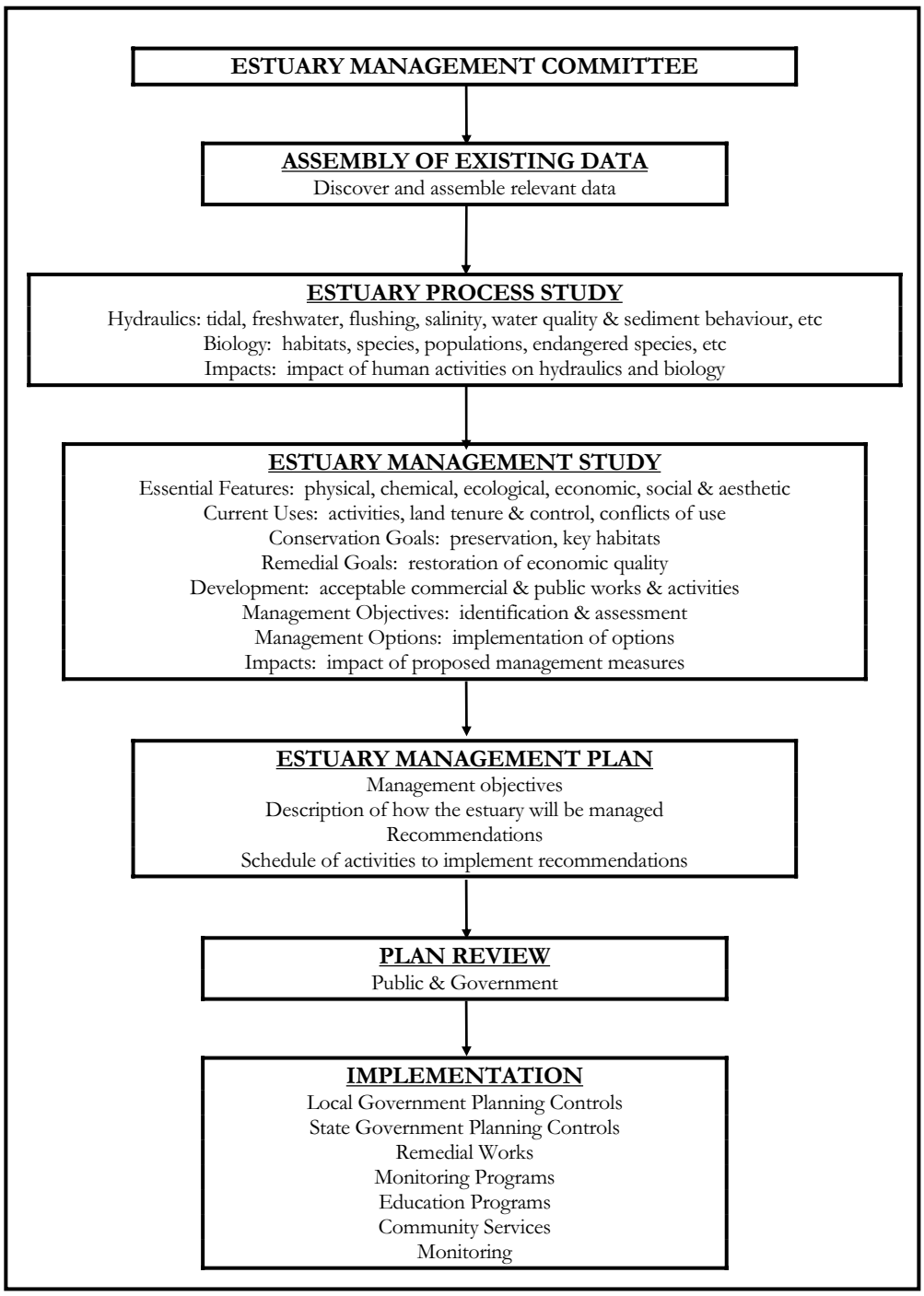



**Figure 1-3 NSW Government's Estuary Management Process**

## 1.3.3 NSW Coastal Policy 1997

The NSW Coastal Policy is the State Government's response to the challenge of achieving a sustainable future for the NSW coastline while balancing environmental, economic, cultural and recreational needs. The policy is based on two fundamental principles: ecologically sustainable development (refer Section 1.3.3.1), and integrated coastal zone management (refer Section 1.3.3.2).

The NSW Coastal Policy 1997 applies to urban and non-urban areas along the NSW Coast, covering land:

- Three nautical miles seaward of the mainland and offshore islands;
- One kilometre landward of the open coast high water mark; and
- One kilometre around all bays and estuaries.

As such, Saltwater Creek and its foreshores fall within the jurisdiction of the Coastal Policy.

The Coastal Policy has nine goals, each underpinned by objectives that are to be achieved by strategic actions. Responsibilities for these actions have been assigned to appropriate agencies, councils and other bodies. DNR is wholly or partly responsible for nearly half of the strategic actions in the Coastal Policy, with many of these involving a partnership with local councils.

The nine goals of the NSW Coastal Policy 1997 are:

1. To protect, rehabilitate and improve the natural environment;
2. To recognise and accommodate natural processes and climate change;
3. To protect and enhance the aesthetic qualities;
4. To protect and conserve cultural heritage;
5. To promote Ecologically Sustainable Development;
6. To provide for ecologically sustainable human settlement;
7. To provide for appropriate public access and use;
8. To provide information to enable effective management; and
9. To provide for integrated planning and management.

With regard to Saltwater Creek, the Policy specifically recommends that detailed management plans for estuaries be prepared and implemented in accordance with the NSW Government's Estuary Management Manual (Strategic Actions d f g h).

#### *1.3.3.1 Ecologically Sustainable Development*

The four principles of Ecologically Sustainable Development (ESD) are:

- *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. This principle is fundamental to adaptive management. Monitoring and prevention are central to the precautionary principle – monitoring to measure progress, and prevention to minimise costs and risks. Decisions can and should be refined as ongoing monitoring and research provides better understanding.
- *Intergenerational equity*: Each generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for future generations. This principle points to institutional and community responsibilities for integrated management, to ensure quality of life is maintained and enhanced.
- *Conservation of biological diversity and ecological integrity*: Measures should be taken to prevent and protect against the extinction or loss of viability 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 and pricing, preventing degradation and damage.

As the NSW Coastal Policy 1997 applies to Saltwater Creek, Council is required to reflect the above principles of ecologically sustainable development in planning and management decisions. The Saltwater Creek Estuary Management Plan will outline a series of actions that are fundamentally aligned with the ESD principles. Therefore, the Plan will provide a framework for implementing these principles as they apply to the estuaries, and their associated catchments.

#### *1.3.3.2 Integrated Coastal Zone Management*

NRMMC (2003) states that "the fundamental goal of Integrated Coastal Zone Management (ICZM) in Australia is to maintain, restore or improve the quality of coastal ecosystems and societies they support. A defining feature of ICZM is that it seeks to address both development and conservation needs within a geographically specific place – a single community, estuary or nation – and within a specified timeframe."

In essence, ICZM is a subset of ESD that relates specifically to the coastal zone. It seeks to protect essential ecological processes and biodiversity, accommodate orderly and balanced resource utilisation, and ensure greater harmony between physical processes and human activities (DNR, in prep.). Within Australia, Coastal Zone Management needs to consider key drivers influencing the sustainable use of the coastal zone, including population growth and demographic shifts; industry trends; protection of the coastal resource base; and climate change (NRMMC, 2003).

## 1.4 Other Government Initiatives for Natural Resource Management

In addition to the NSW Estuary Policy and the NSW Coastal Policy, the Estuary Management Plan for Saltwater Creek and Lagoon is to consider other Government Initiatives that have been developed with the aim of protection and sustainable management of the State's natural coastal resources. In this regard, the Estuary Management Plan is to be a **fully integrated document**, consistent with the goals of broader natural resource management plans.

Other Government initiatives and programs that have been considered and incorporated into the Saltwater Creek and Lagoon Estuary Management Plan are listed below and are described in the following sections of this chapter.

- Environmental Planning and Assessment Act, and associated State Environment Planning Policies (SEPPs);
- North Coast Regional Environmental Plan;
- EPA Stormwater Management Program and Integrated Water Cycle Management;
- Coastal Protection Package;
- Healthy Rivers Commission Independent Inquiry into Coastal Lakes; and
- Catchment Management Blueprint.

### 1.4.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

One of the key pieces of NSW legislation is the Environmental Planning and Assessment Act 1979. This Act provides a system of environmental planning and assessment for NSW. A number of objectives are specified under the act, as follows:

- Appropriate management, development and conservation of natural and artificial resources so as to promote the social and economic welfare of the community and a better environment.
- Facilitation of the orderly and economic use and development of land.
- Ensure appropriate provision and management of communication and utility services.
- Provide land for public purposes.
- Provide for and coordinate community services and facilities.
- Encourage the protection of the environment and facilitate ecologically sustainable development.
- Enable the provision and maintenance of affordable housing.
- Share the responsibility for environmental planning and management between the State and local government.
- Facilitate increased opportunity for public involvement and participation.

### 1.4.2 State Environmental Planning Policies (SEPPs)

These planning policies are instruments under the Environmental Planning and Assessment Act 1979. They deal with issues significant to the state and people of New South Wales.

#### *1.4.2.1 SEPP 14 – Coastal Wetlands*

Preservation and protection of coastal wetlands is the aim of this policy. It is recognised that coastal wetlands serve statewide environmental and economic interests. The policy applies to wetlands in the State identified as needing protection by Department of Planning (DoP). Any development that would involve clearing, construction of levies, draining or filling of wetlands requires consent of the local council and the concurrence of the Director of DoP. Restoration works also require the consent of the local council and the concurrence of the Director. The Department of Environment and Conservation (DEC) must be notified of development proposals within SEPP 14 wetlands.

SEPP 14 wetlands located within the Saltwater Creek catchment cover most of the Creek and Lagoon (refer Figure 1-4).


**Figure 1-4 SEPP 14 Wetlands in the vicinity of Saltwater Creek**

### *1.4.2.2 SEPP 26 – Littoral Rainforests*

This policy was devised to provide a mechanism for the consideration of applications for development that were likely to damage or destroy littoral rainforest areas with a priority to preserve those areas in their natural state. The policy applies to land identified by DoP as containing littoral rainforests.

Once again the consent of the local council and the concurrence of the Director of DoP must be obtained for the purposes of erecting a building, carrying out work, use of the land, subdivision or any work that could disturb, change or alter the landform and/or remove, damage or destroy any native flora or other element of the landscape.

There are no gazetted SEPP 26 littoral rainforest areas within the Saltwater Creek catchment. SEPP 26 only applies to occurrences of littoral rainforest outside national parks. The littoral rainforest within the Saltwater Creek Catchment, as identified in the Saltwater Creek Catchment Flora and Fauna Study (Kendall and Kendall, 2003), is within Hat Head National Park and hence is already afforded a level of protection due to its status as a National Park (refer Figure 1-5).

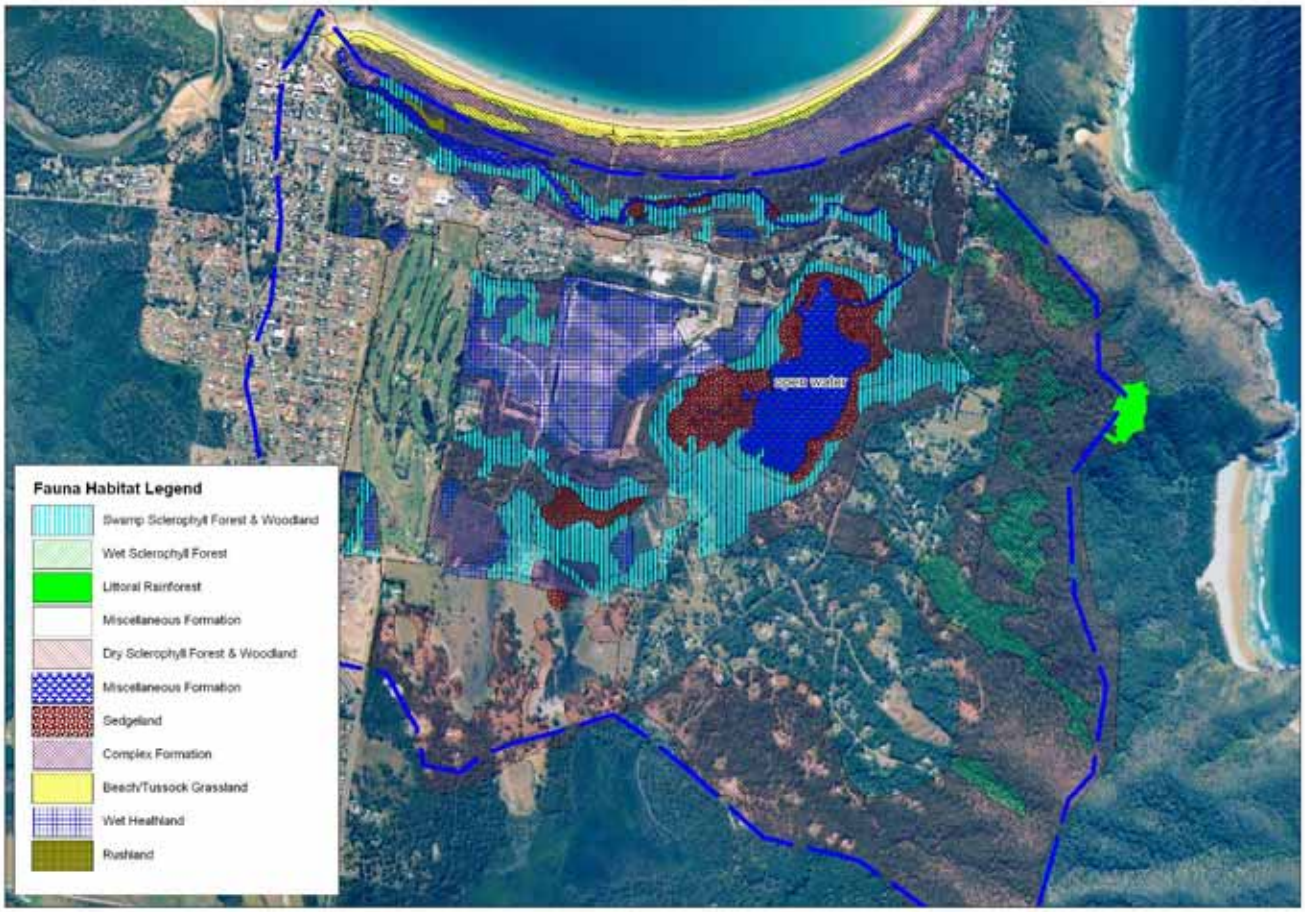



**Figure 1-5 Fauna Habitats in Saltwater Creek Catchment (Kendall and Kendall, 2003)**

### *1.4.2.3 SEPP 35 – Maintenance Dredging of Tidal Waterways*

This policy was developed to facilitate the maintenance dredging of tidal waterways by public authorities provided the works were carried out in a timely, cost effective and environmentally responsible way. The aim of the policy is stated as being to rationalise the planning controls applicable to the carrying out of maintenance dredging of tidal waterways. In this regard public authorities can undertake maintenance dredging without the need to obtain development consent.

Maintenance dredging should not be undertaken until all environmental impacts are identified and assessed. As part of the process the public authority needs to consult with effective bodies including councils and to take into account the views of those consulted.

SEPP-35 has historically been used as a mechanism for Councils to carry out dredging works of tidal entrances in order to improve tidal flushing and to restore or improve navigation. In some instances, SEPP-35 has been used to allow Council's to artificially open coastal lagoons that are closed and have elevated water levels (possibly threatening public or private assets). Legal advice provided to DNR has indicated that opening of ICOLL entrances for the purpose of flood mitigation is an unlawful use of SEPP-35 (Haines, 2004), and supports an earlier determination by DUAP (now Department of Planning) in a Circular of 17 June 1997 that SEPP-35 does not apply to the opening of

ICOLLs (Coastal Council, 1998). It is expected that future amendments to the Water Management Act 2000 will prevent SEPP-35 from being used for this purpose, although the timeframe for this is unknown.

#### 1.4.2.4 SEPP 71 – Coastal Protection

SEPP-71 was first gazetted in November 2002, and applies to the coastal zone of NSW including most of the Saltwater Creek catchment. Recent changes to the Environmental Planning and Assessment Act 1979 and the introduction of a new State Significant SEPP have essentially replaced the provisions outlined in SEPP 71, and as such it is expected the SEPP 71 will be repealed in the near future.

Nonetheless, as originally outlined in SEPP 71, and now documented in the new State Significant SEPP and EP&A Act amendments, the NSW Minister for Planning becomes the consent authority for State significant coastal development. State significant coastal development includes mining, extractive industry, industry, landfill, recreational establishments, marinas, tourist facilities (except bed and breakfast establishments and farm stays) and buildings greater than 13 metres in height above the natural ground level.

It also includes development comprising subdivision of land:

- within a residential zone into more than 25 lots;
- within a rural residential zone into more than five lots; or
- within any zone into any number of lots if effluent is proposed to be disposed of by means of a non-reticulated system.

The policy also defines sensitive coastal locations and generally requires development applications proposed for these areas to be referred to the Director General of Planning for comment. Sensitive coastal locations are generally within 100 metres of tidal waterways, coastal lakes, SEPP-14 wetlands, National Parks and SEPP-26 littoral rainforest.

Master plans, or site-specific Development Control Plans (DCPs), are required to be approved by the Minister before some consents can be granted. Generally a master plan is a document consisting of written information, maps and diagrams that outline proposals for development of land.

#### 1.4.2.5 Other SEPPs

There are a number of other State Environmental Planning Policies (SEPPs) that are applicable to developments within the Saltwater Creek catchment, but are considered not to be of significance regarding the long-term management of the estuarine receiving waters. These SEPPs include:

- SEPP-5: Housing for older people or people with a disability;
- SEPP-6: Number of storeys in a building;
- SEPP-9: Group homes;
- SEPP-11: Traffic generating developments;
- SEPP-46: Protection and Management of Native Vegetation (has now been replaced by the *Native Vegetation Conservation Act, 1997*)

- SEPP-55: Remediation of Land;
- SEPP-64: Advertising and signage; and
- SEPP-65: Design quality for residential flat development.

### 1.4.3 River and Foreshores Improvement Act, 1948

Part 3A of the Rivers and Foreshores Improvement (RFI) Act 1948 provides for the protection of rivers, lakes and other waterbodies within the State. A permit is required for excavation or removal of material within a waterway / watercourse or within 40 metres of a waterway (measured from the top of bank), unless the works are being carried out by a public or local authority.

Permits are issued by the Department of Natural Resources. Works assessed under the EP&A Act 1979 that require a permit under the RFI Act are deemed integrated development. The Department of Natural Resources can revoke or modify a permit, or can direct remediation works if it is considered that the conditions of the permit have been breached.

### 1.4.4 Threatened Species Conservation Act, 1995

The protection of species and ecological communities in New South Wales are administered by the Threatened Species Conservation Act 1995, the National Parks and Wildlife Act 1974 and the Fisheries Management Act 1994.

The Threatened Species Act is responsible for the protection of certain species, populations and ecological communities when they are a particular level of endangerment. These species are known as 'threatened species, populations and ecological communities' and include endangered, critically endangered, and vulnerable species, endangered population, endangered ecological communities and vulnerable ecological communities.

The Threatened Species Conservation Act has established a committee that is responsible for determining species, population, ecological community or threatened process that should be included in Schedules 1, 2 or 3. Consequently, species, populations or ecological communities can be listed by the committee or upon request by the Minister.

### 1.4.5 National Parks and Wildlife Act 1974

The National Parks and Wildlife Act 1974 was responsible for the establishment of the NSW National Parks and Wildlife Services (NPWS), which is now part of the Department of Environment and Conservation.

The NPWS is responsible for the administration of national parks and other lands under the National Parks and Wildlife Act and the Wilderness Act. The NPWS are also responsible for the threatened species under the Threatened Species Conservation Act 1995.

The objectives of the National Parks and Wildlife Act 1974 are the:

- Conservation of habitats and ecosystems, biological diversity in the community, landforms of significance, and landscapes and natural features of significance; and

- Conservation of the objects, places or features of cultural values within the landscape, which would include Aboriginal and European heritage and places of historic, architectural or scientific significances.

The objectives of this Act would be achieved by applying the principles of ecologically sustainable development (ESD).

Under the National Parks and Wildlife Act, a management plan needs to be prepared for each national park. The plan needs to address the following issues:

- The conservation of wildlife and its habitat;
- The preservation of the national park and its special features, including historic structures, objects, relics or Aboriginal places;
- The encouragement and regulation of the appropriated use, understanding and enjoyment of the national parks; and
- The preservation of the national park as a water catchment area, and protection against uncontrolled fires and soil erosion.

Within a national park, the Minister is allowed to grant leases to provide accommodation and facilities and licences to carry out trade or business activities, however, leases and licences cannot be granted over land that is within a declared wilderness area.

It is an offence to prospect or mine for mineral in a national park, unless the mining activity is authorised by an Act of Parliament.

### 1.4.6 Fisheries Management Act 1994

The Fisheries Management (FM) Act 1994 is one of the most important state laws in relation to protection of fish and marine vegetation. The Fisheries Management Act is responsible for the protection of freshwater and saltwater fish and invertebrates and marine plants. The Department of Primary Industries (DPI), which now incorporates the former NSW Fisheries department, is responsible for the administration of the FM Act.

The main aim of the Act is to conserve, develop and share the fishery resource of the State for the benefit of present and future generations. Conservation of fish species and habitats, threatened species, population and ecological communities, are dealt with under the Fisheries Management Act 1994. In addition, the Act is to promote ecologically sustainable development, including conservation of biological diversity.

Under the Fisheries Management Act it is considered an offence to harm any listed marine threatened species and damage a marine area declared to be critical habitat.

The Fisheries Management Act applies to all water is the State except for purposes relating to a fishery that is to be managed in accordance with the law of the Commonwealth pursuant to an arrangement under Division 3 of Part 5.

The main provisions of this legislation that relate to Estuary Management works are:

i) Habitat Protection Plans - which allow for the gazettal of management plans for the protection of specific aquatic habitats;

ii) Dredging and Reclamation Plans - which allows for the control and regulation of dredging and reclamation works, which may be harmful to fish and fish habitat. It establishes requirements to obtain a permit from or to consult with NSW Fisheries (now known as the Department of Primary Industries).

iii) Protection of mangroves and certain other marine vegetation, which requires permits to be obtained for the regulation of damage to or removal of certain marine vegetation including seagrass.

Of particular relevance to the Saltwater Creek Estuary Management Plan are provisions within the Act relating to the preparation of Habitat Protection Plans. Fish Habitat Protection Plans describe potential threats to fish habitat and recommend actions to mitigate the effects of potentially damaging activities. There are three habitat protection plans gazetted to date however only two of these plans are relevant to this study. These are outlined briefly below.

Habitat Protection Plan No 1 General

This is an advisory document summarising various protective measures in relation to dredging and reclamation activities, fish passage requirements, and the protection of mangroves, other marine vegetation and snags.

Habitat Protection Plan No. 2 Seagrasses

The Plan deals specifically with the protection of seagrasses across NSW, and discusses activities which impact on seagrasses, including the construction of jetties, wharves, and bridges, dredging and reclamation, and the collection of seagrasses.

### 1.4.7 Policy and Guidelines – Aquatic Habitat Management and Fish Conservation, 1999

This Policy and Guidelines document has been prepared by the then NSW Fisheries to improve the conservation and management of aquatic habitats in NSW. The document provides an overview of the different aquatic habitats found within marine, estuarine and freshwater environments. The document also discussed a range of activities that can potentially impact on these habitats (e.g. dredging, reclamation, waterfront development, flood mitigation works, water pollution), along with guidelines for minimising impacts on aquatic habitats.

A series of general policies for the conservation of fish, marine vegetation and aquatic habitats is provided, and are summarised below:

a. A precautionary approach is required in assessment of impacts on fish and aquatic habitats
b. Aquatic habitats must be protected when the habitat is important to maintain biodiversity or harvestable populations
c. Habitats of protected or threatened species must be afforded special protection
d. Protected Areas and critical fish habitats should be given priority consideration in development of plans in assessing the impacts of developments and in determining applications.

e. Terrestrial areas adjoining habitats should be carefully managed to minimise landuse impacts. Foreshore buffers at least 50m (or 100m adjacent to sensitive areas) should be established and managed for conservation.

f. Pollution of waterways should be avoided by (i) identifying sources, (ii) preventing or minimising discharges, (iii) treatment of discharges, and (iv) using alternative disposal.

g. Maintain free passage for migratory fish, with unlicenced barriers to be removed or fish passage facilities installed.

h. Alien, exotic or introduced species should not be released into any waterway without approval.

i. Where developments or activities are likely to affect fish or habitats, then NSW Fisheries (now, DPI-Fisheries) should be consulted and provided with all necessary information to assess impacts.

j. Environmental compensation needs to be integrated into the planning process, and needs to be provided where significant environmental impact is unavoidable (with new habitat created on a 2:1 basis).

k. Degraded aquatic habitats should be rehabilitated to repair past environmental damage.

l. Environmental monitoring is needed to determine if the assessment of the impacts of a development were accurate. Monitoring needs to be scientifically rigorous. As a general rule, a change of 20% in a biological indicator one year after the impact should be regarded as a major impact and require environmental compensation.

The Policy and Guidelines document provide specific guidance on management of intermittently opening coastal lagoons, such as Saltwater Creek. The guidance with respect to coastal lagoons is focussed on entrance management. In essence, the Policy and Guidelines advocates minimum interference of entrances, and will not support artificial opening unless there is a threat to public health or safety. The document recommends using Estuary Management Plans to determine and define appropriate entrance manipulation guidelines. A number of specific guidelines are also provided, including:

- Guard against illegal entrance opening by erection and maintenance of appropriate signs
- Using factual data, not speculation or perception, as a basis for opening a lagoon entrance
- Interim entrance management strategies should be formulated for problematic lagoons
- Opening should be carried out during a falling tide to maximise potential for achieving maximum scouring and thus establishing a longer lasting entrance channel
- Artificial manipulations should be lessened in the future by adopting catchment management practices, transferring flood-prone land to public ownership, preventing development of flood-prone land, relocating susceptible infrastructure and increasing community awareness.

### 1.4.8 Protection of the Environment Operation Act 1997

The Protection of the Environment Operations (PEO) Act regulates water pollution, air pollution and noise pollution in New South Wales. The Act enables the Environment Protection Authority, an agency within the DEC, to issue pollution license and notices, to take legal action to enforce the law and to create a range of pollution offences and penalties. The Act also enables members of the public to take legal action to enforce laws.

Under the PEO Act it is considered and offence to pollute water without an environmental protection licence. Water pollution is the placement of any matter in a position where pollution enters or is likely to enter the water. There are a number of activities that require licence, which are detailed in Schedule 1 of the Act, including dredging works and extractive industry, although these activities must remove more than 30,000 $m^3$ per year to trigger the Act.

Pollution of a waterway is allowed if an environmental protection license is held, however, there are conditions of a licence.

### 1.4.9 Catchment Management Authorities Act 2003

The purpose of the Catchment Management Authorities Act 2003 is to establish catchment management authorities that would carry out certain natural resource management functions in their regions. There are thirteen catchment management authorities in New South Wales. Saltwater Creek falls in the Northern Rivers catchment area. The Act repeals the Catchment Management Act 1989 and amends various other Acts.

The objectives of the Act are:

- To provide natural resource planning on a catchment level;
- To ensure that the decisions about natural resources take into account appropriate catchment issues;
- To ensure that catchment level decisions take into account state standards and involve the Natural Resource Commission in catchment planning;
- To make use of the communities' knowledge and expertise and to involved them in decision making;
- To ensure proper management of natural resources from the social, economic and environmental issues; and
- To provide financial assistance and incentives to landholders in connection with natural resource management.

Under the Act each catchment authority is required to prepare a draft Catchment Action Plan (CAP) as soon as possible after the commencement of this Act and submit it for approval by the Minister.

Details of the Catchment Action Plan, and the Catchment 'Blueprint' on which is has been based, are provided further in Section 1.4.19.

### 1.4.10 Natural Resource Management Act 2003

The Natural Resource Management Act 2003 is responsible for the creation of the Natural Resources Commission. The objectives of the Act are:

- To establish a sound scientific basis for the informed management of natural resources in regards to the social, economic and environment interests of the State;
- To enable the adoption of State-wide standards and targets for natural resource management issues; and

- To advise in the circumstance where broad-scale clearing is regarded to be an improvement or maintenance of environmental outcomes for the purpose of the Native Vegetation Act 2003.

The Natural Resource Commission consists of a full time Commissioner and Assistant Commissioner. The role of the Commission is to provide the government with independent advice on natural resource management, in addition to recommending state-wide targets for natural resource management, approval of catchment action plans, and commenting on the effectiveness of these plans. The commission would also undertake natural resource management assessments, and would control investigations and inquires into natural resource management issues and research of the issues.

### 1.4.11 Coastal Protection Act 1979

The Coastal Protection Act 1979 was amended in 1998 and extended the coastal zone to include estuaries, coastal lakes and lagoons, islands and rivers in recognition of the strong connection between estuaries and the open coast. The coastal zone is delineated on maps approved by the Minister for Planning and Natural Resources.

The Coastal Protection Act 1979 provides general supervision of the use, occupation and development of the coastal zone. This includes a requirement for public authorities to gain agreement from the Minister for Infrastructure, Planning and Natural Resources before any development is carried out or consent is given for the use, occupation or development of the coastal zone. It also provides for general supervision of development within the coastal zone that is not otherwise subject to the provisions of an environmental planning instrument (other than a State Environmental Planning Policy).

The Act requires that the Minister promotes ecologically sustainable development. The Minister may reject development or use of occupation of the coastal zone, that is inconsistent with the principles of ecologically sustainable development, or that may adversely affect the behaviour or be adversely affected by the behaviour of the sea or an arm of the sea or any bay, inlet, lagoon, lake, body of water, river, stream or watercourse.

### 1.4.12 Local Government Act 1993

The Local Government Act 1993 creates local governments and grants them the power to perform their functions, which involve management, development, protection, restoration, enhancement and conservation of the environment for the local government area. The functions of the local government are to be performed in a manner that are consistent with and promote the principles of ecologically sustainable development.

The Local Government (Ecologically Sustainable Development) Act 1997 amends this Act, so that the guiding operational principles are ecologically sustainable development and sustainable use of resources.

### 1.4.13 Crown Lands Act 1989

The Crown Lands Act 1989 provides for the administration and management of Crown land, which includes most beaches, coastal reserves, nearshore waters and estuaries, including some section of Saltwater Creek, including the entrance.

The Crown Lands Act 1989 requires a land assessment to be undertaken prior to the reservation, dedication, exchange, vesting or sale of Crown land, or the granting of easements, leases or licences in respect of such land. The process for land assessment is specified by the Act and the *Crown Lands Regulation 2000*. It requires the physical characteristics of the land to be identified, the land's capabilities to be assessed and suitable uses identified. A draft land assessment is publicly exhibited for 28 days for comment. The exhibited draft may indicate a preferred use or uses.

### 1.4.14 Environment Protection and Biodiversity Conservation (Cth) Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the main Commonwealth Law responsible for the protection of flora and fauna. The EPBC Act commenced on 16 July 2000 and replaced the Environmental Protection (Impact of Proposals) Act 1974 (Cth), the Act which formerly set out requirements for environmental assessment in Federal law.

This Act applies to:

- Flora and fauna within areas controlled or owner by the Commonwealth;
- Flora or fauna that may be harmed by the actions of the Commonwealth agency; and
- Actions that may have a significant effect on species on the national threatened species list.

The EPBC Act has increased the number of activities that will be subject to environmental assessment and approval by the Commonwealth government, and has given a more important role and broader powers to the Federal Minister for the Environment (the 'Minister'). Under the EPBC Act, it is necessary to obtain an approval from the Minister to carry out a 'controlled action', which is an activity that is likely to have a significant effect on the environment, or likely to have a significant effect on a "matter of national environmental significance".

The act provides protection to species and ecological communities by:

- Creating a process for the listing of protected species and ecological communities;
- Requiring the assessment and approval of proposals that are likely to have a significant impact upon threatened species, and ecological community or a migratory species; and
- Requiring permits for actions in a Commonwealth area that involve the killing, injury or taking of a listed threatened species or ecological community.

The EPBC Act provides protection for threatened species, migratory species that are listed under the JAMBA Convention, the CAMBA Convention or Bonn Convention, and listed marine species as detailed by the Department of Environment and Heritage.

The EPBC Act provides protection to Ramsar wetland from actions that would result in significant impact on the wetlands. However, an action that may have significant impact on the ecological

character of a declared Ramsar wetland might take place outside the boundaries of the wetland. A declared Ramsar wetland is an area that has been designated under Article 2 of the Ramsar Convention or declared by the Minister for the Environment to be a declared Ramsar wetland in accordance with section 16 the Act.

The EPBC Act was amended in 2003 to include protection of National Heritage. This amendment involved, including 'national heritage' as new matter of national environment significance, and the establishment of a national heritage list.

### 1.4.15 North Coast Regional Environmental Plan 1988

The North Coast Regional Environmental Plan 1988 (NCREP) is an overarching planning document that has been prepared by the now Department of Planning (DoP). It details a range of matters that Council's, including Kempsey Shire Council, must consider when preparing draft Local Environmental Plans (LEPs) and when considering development applications (DAs). NCREP must be consistent with all relevant SEPPs, as discussed in Section 1.4.2.

Several Clauses within the NCREP address specific considerations relating to developments near waterways or environmental important or culturally significant areas, including for example Clauses 15, 29A, 32B, 33, 36A, 36B, 36C, 36D, 36E, 36F, 76 and 81.

In the future it is intended that the non-statutory Mid North Coast Regional Planning Strategy will replace the existing NCREP.

### 1.4.16 Stormwater Management Planning

In April 1998 the NSW Environment Protection Authority (EPA) issued a direction under Section 12 of the Protection of the Environment Administration Act requiring councils to prepare stormwater management plans. The primary purpose of preparing urban stormwater management plans was to improve the health and quality of the State's urban waterways.

The stormwater management plans were to address environmental issues including stormwater quality, river flow, riparian vegetation and aquatic habitat management. A stormwater management plan was not intended to be a flood or drainage management plan. This program relates to the State Government's water reforms in that water quality and river flow objectives were to be established. These were expected to be the long term objectives of the stormwater management plans.

The Kempsey Shire Urban Stormwater Management Plan 2000 – 2005 was prepared by Council in response to the EPA requirements. The Plan identifies stormwater issues, values, objectives, pressures, and responses strategies for the urban areas within Kempsey Shire, including South West Rocks.

Issues for stormwater management within the Saltwater Creek catchment include transfer of stormwater problems to downstream environments, with visual evidence of nutrients (algal growth) and siltation, pressure from community to reduce perceived flooding risk, high aesthetic and property value appeal of the natural watercourses, risk of pathogenic pollutants transferred to waterways used for recreation, and existing environments including subtropical rainforest, wetland and aquatic habitats affected by stormwater drainage.

In response to these issues, the Stormwater Management Plan recommended a host of strategies including encouragement of healthy flowing aquatic ecosystems that include mosquito predators, minimisation of concrete lined channels, monitoring of nutrients and weeds, involving the community in effective on-site sewage treatment options, and provision of end of pipe treatments for litter, along with reduction of litter and pollutants in the catchments, via additional bins, street sweeping, dog control and an audit of all sewers and sewerage systems to ensure no leaks. These recommended strategies were accompanied by a series of specific and shire-wide actions for implementation by Council.

### 1.4.17 Kempsey Integrated Water Cycle Management Strategy

The Kempsey Integrated Water Cycle Management Strategy (IWCMS) has been prepared by Kempsey Shire Council, in conjunction with the Department of Energy, Utilities and Sustainability (DEUS) to aid in the identification and development of management strategies for urban water cycle planning. IWCMS involves consideration of stormwater, sewage and water supply from a holistic and integrated perspective, incorporating whole-of-catchment processes and other planning and water management initiatives.

The Kempsey IWCM Study involved a detailed audit of the existing water systems in Kempsey to identify those areas where the system is not performing as well as it could in relation to water resources management. Specific issues were defined from the audit, which were then assessed in terms of driving causes and inter-relationships with other issues. A potential list of management tools and actions was prepared which were aimed at addressing these water management issues.

With regard to South West Rocks and the Saltwater Creek catchment, the IWCMS found that recycled effluent, treated to a high standard, be considered to supplement non-potable water supply usages, such as garden watering, laundry and toilet flushing in new residential development. It also recommended recycled effluent be used for municipal uses such as on the local golf course and sporting fields.

### 1.4.18 Independent Inquiry into Coastal Lakes

The NSW Healthy Rivers Commission (HRC) finalised an Independent Inquiry into NSW Coastal Lakes in 2002 (HRC, 2002). While this Inquiry focussed on typically larger lakes and lagoons along the entire NSW coastline, the HRC advised that the approach adopted is applicable to all estuaries, particularly the smaller coastal creeks that have intermittently opening entrance. Saltwater Creek was mentioned by the HRC as one of several additional estuaries where the adopted approach may be applied.

According to the HRC, NSW coastal lakes provide valuable ecological, social and economic benefits to local and wider communities, yet pressures placed on them by increasing development within their catchments and around their foreshores, have resulted in their degradation. Unfortunately there is no agreed management system that pays sufficient regard to the inherent limitations of coastal lakes. Therefore, in order to achieve 'healthier lakes', a fundamental change in the way decisions are made is recommended by HRC.

A Coastal Lakes Assessment and Management Strategy has been presented by the HRC as an effective response to the challenges for managing coastal lakes. This Strategy comprises:

- A management framework for major classes of coastal lakes;
- Preparation of Sustainability Assessments to determine capabilities and limitations of each coastal lake;
- Arrangements to implement key elements of the strategy (eg implementation responsibilities); and
- A range of supporting initiatives.

The Management Framework is essentially a guide for making critical decisions for each major class of coastal lake. Each coastal lake is classified into one of four classes, and for each class, the framework provides guidance as to:

- The underlying intention of management decisions;
- The scope of the Sustainability Assessment;
- The intended outcomes;
- The types of actions possible; and
- A selection of management 'tools' for implementing actions.

The four classes of coastal lakes are:

**Comprehensive Protection**: where the restoration and preservation of all natural ecosystems is paramount. These lakes generally have pristine or near pristine catchments, with little modification to the waterbody, and a high conservation value.

**Significant Protection**: where focus should be placed on restoring and preserving critical natural ecosystem processes. These lakes generally have largely unmodified to somewhat modified catchments and slightly affected waterbodies. The recognised conservation value of these lakes can be moderate to high.

**Healthy Modified Condition**: where key and/or highly valued ecosystem processes are to be rehabilitated and retained. These lakes generally have modified catchment and waterbody conditions, but can still retain some recognised conservation value.

**Targeted Repair**: where a preferred lake condition is sought through rehabilitation. These lakes generally have highly modified catchments, with significant impacts on the waterbodies. There is generally little recognised conservation value of these lakes.

The HRC has classified 90 individual NSW coastal lakes into these four categories, based on a review of several broad factors, including:

- Natural sensitivity to human activities;
- Existing condition of the catchment and lake waterbody; and
- Recognised natural and resource conservation values.

It is envisaged that sustainability assessments for each lake would confirm the lake's classification.

Saltwater Lagoon is specifically categorised by the HRC into the 'Healthy Modified Condition' class. This categorisation was likely based on liaison with relevant authorities rather than any specific detailed environmental assessment. Outcomes of the Estuary Processes Study and other environmental assessments (refer Section 2) would therefore provide a more accurate basis for classification of Saltwater Lagoon.

HRC recommends Sustainability Assessments for each coastal lake to determine the capability and limitations of individual lakes and their catchments to support different types of human activities, and consider such assessments as pivotal to the overall management strategy. Sustainability Assessments would be carried out at three levels, viz: statewide, lake specific, and site specific. The statewide assessment is essentially covered by the HRC Independent Inquiry, which places all coastal lakes into one of the four classes described above.

The lake-specific sustainability assessments would be based on more detailed information about individual coastal lakes, and would build on existing information, such as Estuary Processes Studies and soil maps, wherever possible. Lake-specific assessments would be based on:

- Key ecosystem processes and thresholds;
- Catchment processes;
- Environmental and ecosystem values;
- Indigenous values;
- Sustainable resource usage;
- Resident values;
- Public health implications; and
- Existing and possible future mechanisms for implementing strategies

The nature and scope of the sustainability assessments would be influenced by the management orientation (or class) of the lake. For example, assessments for Comprehensive Protection lakes would focus on identifying actions required for restoring and preserving natural processes, whereas assessments for Targeted Repair lakes may be focused on mitigating adverse effects, such as algal blooms.

Site specific sustainability assessments would be carried out by proponents of development proposals, and would confirm or fine-tune the assessments at the lake specific level. The format and required scope of sustainability assessments is not yet known, however, it is likely that much of the information contained within an Estuary Processes Study and an Estuary Management Study / Plan would be relevant. It is expected that future requirements for sustainability assessments could be incorporated into the updated version of the Coastal Zone Management Manual, which is proposed to replace the existing Estuary Management Manual (see Section 1.3.1).

#### *1.4.18.1 Response to HRC Independent Inquiry by NSW Government*

In response to the HRC Independent Inquiry, the NSW Government has prepared a Statement of Intent (NSW Government, 2003). This statement indicates that the government has committed resources and funds to carry out a series of pilot Sustainability Assessment and Management Plans

for a small group of priority coastal lakes, comprising Cudgen, Myall, Wollumboola, Burrill, Narrawallee, Coila, Merimbula and Back Lakes. Also, the government has agreed to a number of supporting initiatives, including:

- Assessing risks associated with sea level rise and change in storm events;
- Reserve the beds of coastal lakes classified as Comprehensive Protection as part of nearby or adjacent national parks, or declaring the lakes as Marine Parks or Aquatic Reserves;
- Declaring adjacent Crown Land with outstanding conservation value as reserves;
- Revise estuary and coastal management manuals;
- Explore possibilities for nominating a group of South Coast lakes for World Heritage Listing;
- Reinforce efforts to contain the spread of the noxious aquatic weed *Caulerpa taxifolia*;
- Investigate possibilities for managing undeveloped private land with outstanding conservation value.

## 1.4.19 Northern Rivers Catchment Management Authority

### *1.4.19.1 Mid North Coast Catchment Blueprint*

The Mid North Coast Catchment Blueprint was prepared by the Mid North Coast Catchment Management Board (MNCCMB) in 2002. The Mid North Coast Catchment area encompasses the catchments of the Nambucca, Macleay, Hastings and Camden Haven Rivers within the Mid North Coast and Southern New England Tablelands regions of New South Wales. The blueprint provides a framework for natural resource management of the Mid North Coast Catchment Management Region. The blueprint sets targets and priorities for environmental action and investment in the southern region over the next 10 years. The MNCCMB is made up of representatives of primary producers, natural resource users, environmental groups, government and indigenous people.

The Blueprint consists of:

- **First order objectives**: which provide a statement of the community's values about the desired state and functioning of the region's natural resources;
- **Catchment targets**: which indicate what needs to be achieved across the landscape to meet the first order objectives. They are specific, measurable, achievable, relevant and time-bound. These measurable targets will provide a means of evaluating the effectiveness of the Blueprints and their management actions;
- **Management targets**: which state what has to be done to achieve the catchment targets. Again, they are specific, measurable, achievable, relevant and time-bound;
- **Management actions**: which specify who is responsible for what by when, in order to meet the catchment and management targets.

The Mid North Coast Catchment Blueprint focuses on Landuse and Planning, Stream Health, Acid Sulphate Soils, Vegetation and Biodiversity. Each of these broad issues contain specific catchment and management targets.

The first order objectives for the Mid North Coast Catchment Blueprint include:

> "Healthy aquatic systems, with water quality and quantity meeting the needs of the environment and the community".

The catchment target for Land Use and Planning is:

> "By 2012 mechanisms in place for effective land use planning and management addressing human settlement, sustainable development, heritage and rural production issues in a natural resource management context."

The specific management target for which Saltwater Creek is recognised as a priority catchment states that:

> "By 2012 plans in place for management of the coastal zone in each of the three main coastal government areas".

### 1.4.19.2 Catchment Action Plan

In early 2004, the Catchment Management Boards of NSW were replaced with new Catchment Management Authorities, with delegation under the Catchment Management Act. The former Mid North Coast Catchment Management Board was incorporated in the Northern Rivers Catchment Management Authority (NRCMA). The first task of the NRCMA was to prepare a Catchment Action Plan (CAP) to outline how catchment management will be carried out within the NRCMA jurisdictional boundaries.

The NRCMA is responsible for:

- Preparing a Catchment Action Plan (CAP) and associated investment strategies that integrate and enhance the Catchment Blueprints (see discussion above) and the regional vegetation management plans,
- Managing incentive programs to implement the CAP,
- Providing all landholders with access to data and relevant information to prepare Property Vegetation Plans (PVPs),
- Allocating funds to support the development of PVPs - including incentives,
- Providing education and training on natural resource management, especially in vegetation management, and
- Developing transparent procedures for handling local disputes related to implementing the Catchment Action Plans.

The CMA Boards will be responsible for the creation and implementation of catchment action plans, associated investment strategies and corporate governance.

A draft Catchment Action Plan for the Northern Rivers CMA was completed in December 2005. Management Target C2 relates to estuaries and coastal lakes, and states "By 2016, maintain and improve the condition of estuaries and coastal lakes through: completion of management plans (e.g. Estuary Management Plans, Coastal Zone Management Plans) for all estuaries (65% complete by 2009), and Sustainability Assessment and Management Plans for all coastal lakes (65% complete by

2009); and implementation of all priority NRM activities within those plans (65% complete by 2009)".

Saltwater Creek and Lagoon has been named within the CAP, and has been identified as having a 'high' risk to the natural ecosystem in the short to medium term by landuse pressures. The CAP therefore calls for 65% completion of all NRM activities identified within this Estuary Management Plan by the year 2009, and 100% completion of NRM activities by 2016. Funding would be available through the NRCMA for implementation of the NRM activities outlined in the EMP in order to meet Management Target C2.

## 1.5 Existing Council Planning Framework

### 1.5.1 Kempsey LEP 1987

In addition to the State Government Plans and Policies, the Saltwater Creek and Lagoon Estuary Management Plan needs to be consistent with, and fit into, the existing Kempsey Shire Council planning framework. The Council planning framework is based around a central Local Environment Plan (Kempsey LEP, 1987) and a number of supporting Development Control Plans (DCPs). The Kempsey LEP is consistent with the NCREP and defines landuse zones, which prescribes permissible developments throughout the LGA. The LEP also details a range of specific controls relating to development matters, such as subdivisions, height restrictions, clearing and offsets.

The actual waterway of Saltwater Creek and Lagoon transects several landuse types (see Figure 1-6) including:

- 6(a): Open Space A – Public Lands
- 8(a): National Parks Nature Reserve
- 2(c): Residential C – Housing and holiday accommodation within central South West Rocks

DCPs have been prepared to guide specific types of development, or developments in specific areas within the Local Government Area (LGA). Generally, DCPs have been prepared to conserve particular values and attributes of the village and its natural environment.

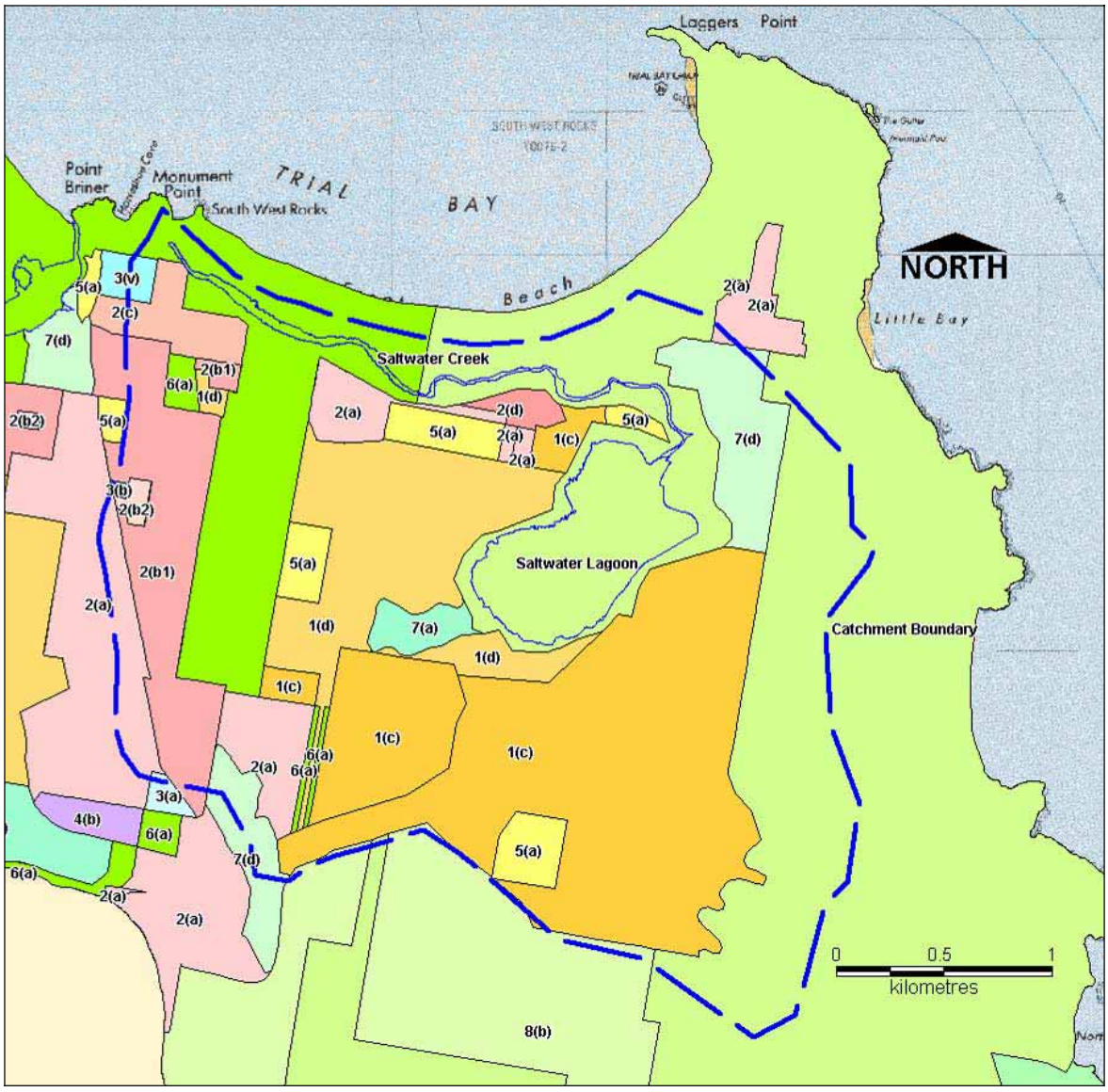
### 1.5.2 Development Control Plans

Development Control Plans (DCPs) are non-statutory policies that provide specific Council requirements regarding various aspects of development within the LGA.

Development Control Plans that are applicable to Saltwater Creek and its catchment include:

- DCP 2 - Arakoon Road, South West Rocks: includes matters relating to subdivision of rural residential areas at Arakoon.
- DCP 10 - Provision for Open Space for South West Rocks: Identifies open space requirements for South West Rocks and district. Requires review as based on 1986 Census data.
- DCP 22 - Local Housing Strategy (Urban Areas) 2001: Identifies performance objectives and development standards related to residential development in the Shire's urban areas.

- DCP 24 – Access and Mobility: Identifies Council's requirements for disabled access to public and commercial buildings. Relevant to mixed residential / commercial development in the CBD.
- DCP 27 - Acid Sulfate Soils: Specifies measures to be considered when developing on lands containing potentially acid sulfate soils.
- DCP 29 – Bed and Breakfast Accommodation: Specifies Council's parking, health and fire safety requirements for B&Bs.




**1(c) Rural (Small Holdings)**
**1(d) Rural (Investigation)**
**2(a) Residential A**
**2(b1) Residential B1**
**2(b2) Residential B2**
**2(c) Residential C**
**2(d) Residential (Tourist facility)**
**3(a) Business (General) A**
**3(b) Business (Neighbourhood) B**
**3(v) Business (Village) V**
**4(b) Light Industrial B**
**5(a) Special Uses A**
**6(a) Open Space A**
**7(a) Wetlands Protection**
**7(d) Scenic Protection**
**8(a) National Parks Nature Reserve**
**8(b) Proposed National Parks Extension**

**Figure 1-6 Landuse Zonings around Saltwater Creek (Kempsey LEP 1987)**

- DCP 30 - Exempt and Complying Development: Incorporates developments that may be carried out without development consent and developments that can be approved as Complying Development by satisfying a predetermined set of development standards. This DCP is largely overridden by SEPP-71 – Coastal Protection within the coastal zone (refer Section 1.4.2.4).
- DCP 31 – Energy Smart Homes: Incorporates the principles of ESD by requiring dwellings to be designed to meet Sustainable Energy Development Authority standards.
- DCP 32 - Onsite Sewage Management Strategy: Outlines the requirements of Council for installing and operating an on-site sewage management system in rural and rural-residential areas.
- DCP 34 - South West Rocks Town Centre: Incorporates development standards for implementation of the South West Rocks Town Centre Master Plan, including relevant requirements of DCP 22.
- DCP 36 – Engineering Guidelines for Subdivision and Development: Specifies Council's minimum requirements for subdivision design and construction.

### 1.5.3 Other Council Planning Policies and Instruments

There are also a number of other strategic planning documents relevant to South West Rocks which Council must have regard to, including:

- South West Rocks Structure Plan 1995: Previously used to guide strategic planning, including rezoning for a range of developments by identifying broad development constraints. This document is no longer accepted by DoP, as it is out of date and lacking sufficient detail for current development consideration. The document is currently undergoing review by Council.
- Kempsey Residential Land Release Strategy: Includes supply and demand balance sheets for the Shire's towns and villages based on availability of infrastructure, population trends and broad development constraints. The strategy identifies future sequencing of urban release areas and is a requirement of the NCREP 1988. This document is also under review by Council.
- South West Rocks Town Centre Master Plan: Identifies key land and streetscape elements and acts as a blueprint for town centre improvement works.
- Kempsey Rural Land Release Strategy: Details Council's strategy for the release of land from rural residential subdivisions. This document is also under review by Council.

## 1.6 Concurrent Planning Initiatives around Saltwater Creek and Lagoon

Two Local Environmental Studies (LES) are currently being carried out by Council for lands in the vicinity of Saltwater Creek and Lagoon. The first LES is for Lot 1 DP 445196, Phillip Drive, South West Rocks (former oil terminal site), and outlines potential constraints and opportunities for residential development on this site. The second LES is for land to the immediate west of Saltwater Lagoon, between Phillip Drive and Belle O'Connor Street, South West Rocks. Again, this LES has been prepared to identify constraints and opportunities for future residential development on the study site. Both LES's are currently in draft format. The two LES documents will be used to change zonings within the LEP, if considered appropriate.

The Estuary Management Plan is to be used as background reference by the two LES's prior to finalisation and any changes to the LEP, particularly in respect to future conservation and preservation of the Saltwater Creek and Lagoon waterway environment. The EMP therefore represents an important step in the future landuse planning of South West Rocks.

## 1.7 Structure of this Report

The Estuary Management Plan, presented in this document, provides a series of strategic management actions that, if implemented, will result in the long-term sustainability of Saltwater Creek and Lagoon with regard to ecological, economic and social values. In addition to the management actions, the Plan describes the process that was adopted in developing and prioritising the various actions and strategies. This process is summarised in Figure 1-7. The various steps in this process are detailed in this Estuary Management Study and Plan document.

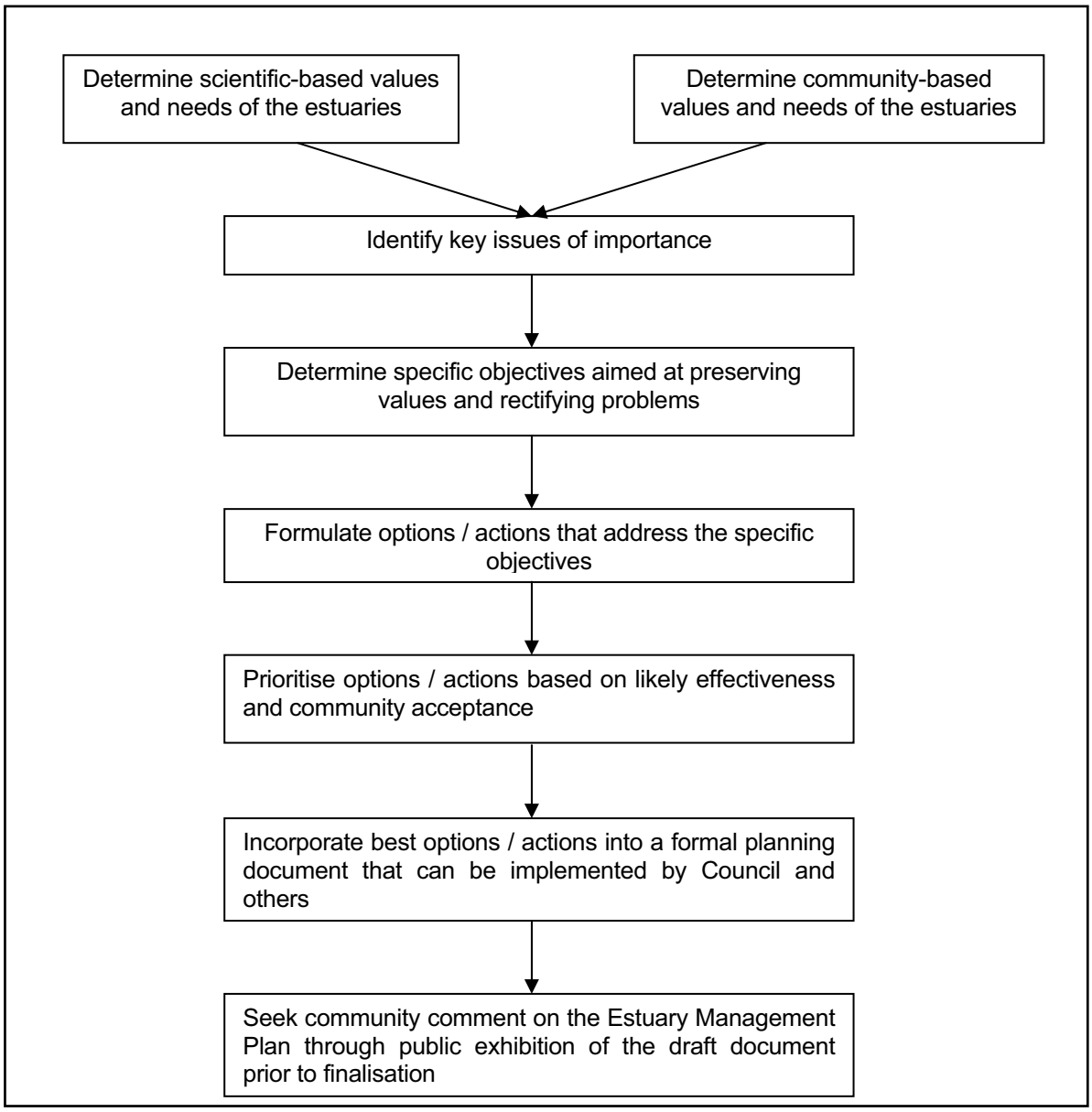



**Figure 1-7 Process of developing Management Strategies for the EMP**

Presented below is a basic outline of the contents of each chapter of this document, as they relate to the process described in Figure 1-7.

Chapter 2 presents a **Summary of Estuary Processes**. This includes all of the fundamental physical, chemical and biological processes that currently occur within the estuaries, and how these processes need to be considered and managed in the future.

Chapter 3 summarised the **Outcomes of Consultation Activities** carried out with the stakeholders and the local community of Saltwater Creek and South West Rocks.

Chapter 4 summarises the **Values and Uses** of the estuary, and also details the **Key Management Issues** that need to be addressed in order to maintain a healthy and sustainable estuarine environment in the future.

Chapter 5 defines specific **Management Objectives** that need to be addressed. The objectives are based on information relating to each of the Key Management Issues.

Chapter 6 provides a list of **Possible Management Options** that could be employed to address the management objectives. These options are then evaluated using a multi-criteria assessment, along with input from the Committee to give prioritisation of the management options.

Chapter 7 contains the **Estuary Management Plan**. This is a stand-alone section of the document that can be extracted and distributed to everyone involved in the implementation of the Plan. It provides details of prioritised management strategies for Saltwater Creek, who is responsible for implementation of the various strategies, and relevant timeframes for implementation.

Chapter 8 lists relevant **references** for the study.

Additional information is also provided in Appendices to this document, where necessary.

# 2 SUMMARY OF THE ESTUARY PROCESSES STUDY AND OTHER RELEVANT BACKGROUND DOCUMENTS

A number of documents describing various environmental processes of Saltwater Creek and Lagoon have been prepared in recent years. This chapter provides a summary of the important aspects of these documents, as they relates to the requirements for future management of Saltwater Creek and Lagoon.

## 2.1 Saltwater Creek Estuary Processes Study (MHL, 2002)

The Saltwater Creek Estuary Processes Study was completed by Manly Hydraulics Laboratory in November 2002 (MHL, 2002). An overview of the Saltwater Creek and Lagoon environment, as documented in the Estuary Processes Study, is presented below. Full copies of the Estuary Processes Study report (MHL, 2002) are available from Council offices and libraries, and in pdf format via Council's Macleay Data Register (http://macleay.kempsey.nsw.gov.au/).

Catchment inputs

1. Urban runoff flows into the lagoon through the golf course drain, and into the creek via stormwater pipes. Like most urban waterways, Saltwater Creek becomes quite degraded following rainfall events.
2. The estuarine system essentially retains everything that is discharged to it (including all sediment, nutrients, and other pollutants). Development within the catchment has resulted in an increase in sediment and nutrient deposited within the lagoon, and has caused a net shallowing of the system.

Water quality

3. Acid sulfate soils (ASS) are located around the lagoon. Water quality has been measured with occasional low pH, and fish have been seen with red spot disease, both of which indicate problems with runoff from ASS.
4. Even when the entrance is open, there is limited flushing and mixing within the creek, and especially within the lagoon (as ocean water only moves in and out of the lower section of the creek). When the entrance is closed, Saltwater Creek can become stratified, which means that the surface waters are different to the bottom waters (the bottom waters normally have poorer water quality with low oxygen levels).
5. Low oxygen levels recorded in the creek and lagoon are the result of the natural breakdown (decay) of organics (eg seagrass, leaves, branches, algae).
6. Phosphorus concentrations in Saltwater Creek and Lagoon, are generally between 10 and 300 µg/L, with most recordings exceeding the ANZECC guideline of 30 µg/L. Oxidised nitrogen concentrations are generally between 60 and 1000 µg/L, which is considerably higher than ANZECC guideline values. Excessive nutrients in the system results in 'eutrophication' (which is indicated by excessive algae growth).
7. There is a significant risk of pathogens entering Saltwater Creek through the urban stormwater system, with measured faecal coliforms within the creek occasionally exceeding guidelines for both primary and secondary contact. The creek is unlikely to be suitable for swimming when the

entrance is closed, particularly following rainfall, due to potentially elevated bacteria and hydrocarbons concentrations.

8. When the creek is closed for extended periods of time, the water becomes tannin stained due to leaching from surrounding tea trees (Melaleucas). The natural staining of the water affects the aesthetics and odour of the creek, giving the perception of poor water quality, and causing a decline in recreational usage.

Ecology

9. The creek and especially the lagoon provide valuable habitat for aquatic and terrestrial fauna and flora, especially birds.
10. The entrance condition of Saltwater Creek is likely to influence many of the aquatic ecological processes, including spawning, recruitment and dispersal of biota.
11. Fish kills have occurred both before and after entrance openings. Kills would likely be related to low oxygen levels (anoxia), as a result of decomposing organics following rainfall (and influx of organics into the system from the catchment).
12. Human-induced changes to the Saltwater Creek system (including mechanical opening of the entrance berm) are likely to have modified the distribution and dominance of species utilizing the waterway and its surrounds.

Flooding

13. There is extensive flooding of low-lying areas around the lagoon and creek fringes when the entrance is closed and when water levels in the system are high (following rainfall events).
14. The height of the sand berm responsible for temporarily closing the creek entrance plays an important role in controlling flooding during rainfall/runoff events. Based on the berm height of the beach immediately east of the entrance, the height of the Saltwater Creek entrance berm could reach 3m AHD if not artificially opened (p70), which would have significant impacts on low lying lands surrounding Saltwater Lagoon, including the Golf Course.

## 2.2 Additional Flora and Fauna Studies

In 2003, Kendall and Kendall Pty Ltd examined the flora and fauna communities and species within Saltwater Creek Catchment, concentrating on the relationship between the water regime and communities and species present. The Saltwater Creek Catchment Flora and Fauna Study (Kendall & Kendall, 2003) established several factors that the Saltwater Creek species diversity is dependant on. Fluctuations in water levels are known to result in the greatest level of floristic diversity. Wetland species are sensitive to water level fluctuation although the sensitivity of a species may vary between life stages, seasons and species. The inundation patterns may affect seed dispersal, germination and establishment of vegetation.

Many wetland species are sensitive to nutrient levels, particularly wet heath. An increase in nutrients associated with urban development is likely to cause a reduction in biodiversity and increase the occurrence of weed species. A variety of weed species already occurs in the catchment and poses a threat to native vegetation.

Wetlands generally require high water table levels with the exception of wet heath being dependant on periodic high water tables associated with high soil fertility. Thus the natural opening and closing of the berm is a requirement of many species present in the Saltwater Creek catchment. Figure 2-1 illustrates the different types of wetlands around Saltwater Creek and Lagoon, and the hydrologic dependencies of each.

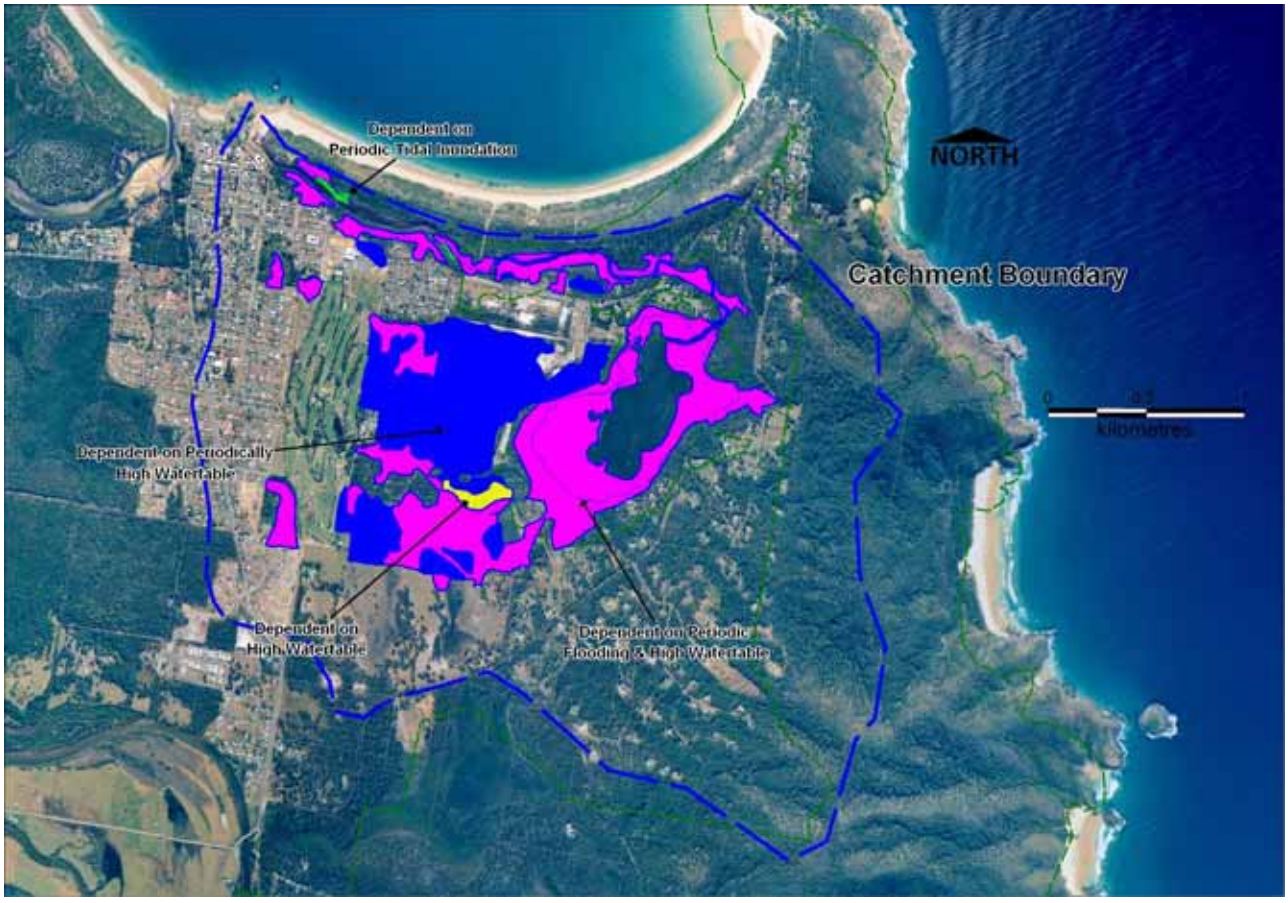



**Figure 2-1 Wetland dependencies (Source: Kendall & Kendall, 2003)**

The vegetation communities within the catchment have been fully mapped and are shown in Figure 2-2, while the relative sensitivity of the different types of vegetation is shown in Figure 2-3.

It should be noted that since the vegetation mapping undertaken by Kendall and Kendall in 2003, much of the heath sedge located to the immediate north west of Saltwater Lagoon has now been significantly disturbed with the intention of future residential development.

Of the fauna habitats documented by Kendall and Kendall (2003), five are considered susceptible to changes in the hydrological regime resulting from opening the berm. Several species of fauna protected under the Threatened Species Conservation Act would be affected by the degradation of the susceptible habitats.

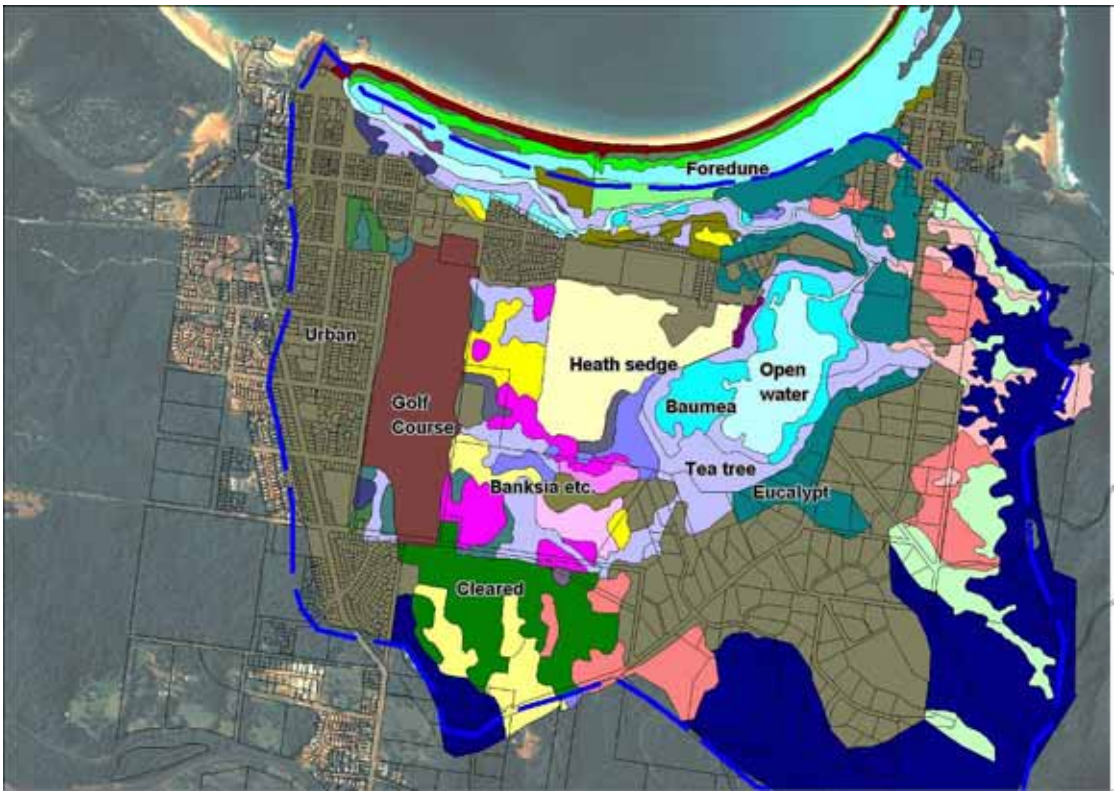
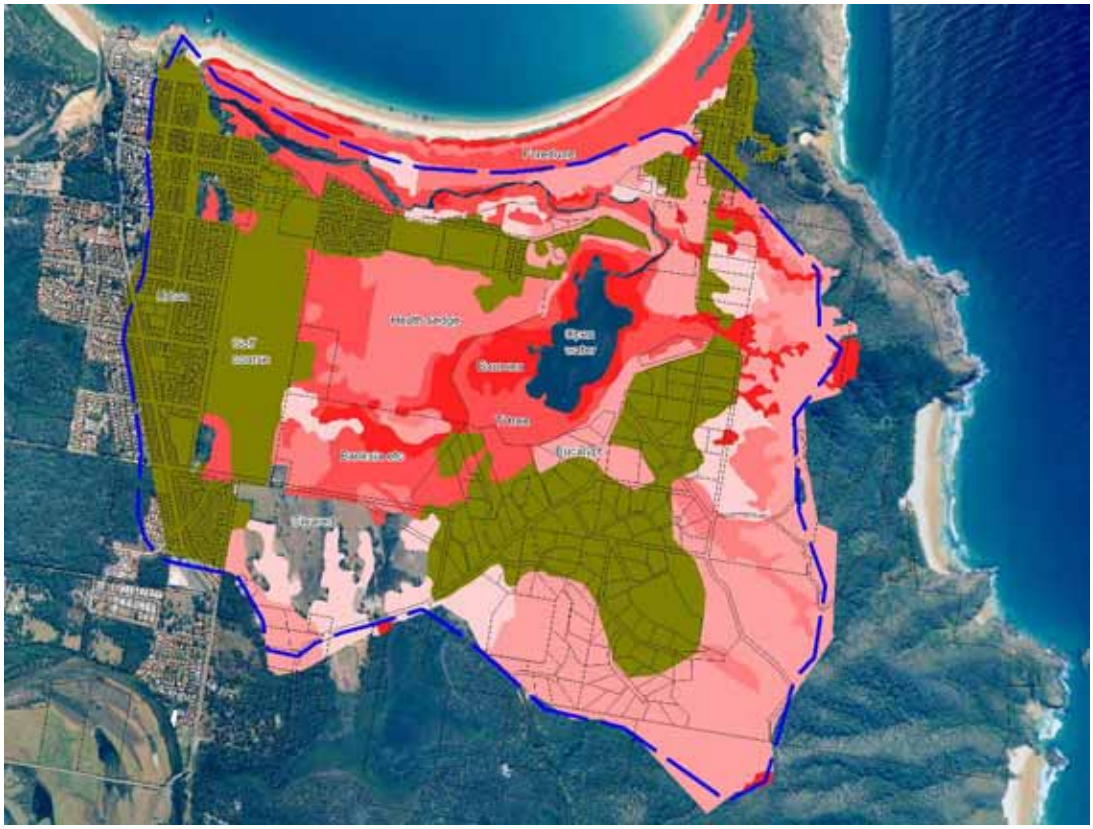



**Figure 2-2 Vegetation communities within the Saltwater Creek catchment**



*Note: Darker red indicates greater sensitivity, khaki indicates disturbed land*

**Figure 2-3 Relative Sensitivity of Vegetation Communities**

Opening the berm would also partially drain the lagoon, reducing its value to fauna foraging, shelter and nesting. In addition, the lagoon is valued as a fauna refuge during droughts. Artificially opening the berm would tend to increase the salinity and tidal influences in Saltwater Creek and Lagoon, modifying the habitat values.

Recommendations of Kendall & Kendall (2003) include reducing nutrient contamination, management of wet heath associations and control of weeds. Also, the report suggests that for the long-term survival of the wetland habitats, the wetland and watertable dependant associations outside the SEPP 14 and national parks be maintained in natural state as a buffer. Buffers around wetlands should be considered in a vertical perspective rather than a horizontal or spatial sense. A vertical buffer of 1 to 1.5 metres above the upper reaches of the wetland communities identified as dependent on periodic flooding and high watertable (as shown in Figure 2-1) is likely to accommodate the majority of temporal and seasonal fluctuations in wetland boundaries. Ground survey carried out concurrent with the Kendall and Kendall (2003) study shows that the upper reaches of the wetland communities that are dependent on periodic flooding and high water table correspond to a ground level of approximately RL 1.5 – 2.0m AHD. Consequently, a vertical buffer to approximately RL 3.0m AHD would be sufficient to accommodate the natural functioning of the Saltwater wetlands. This buffer does not take into consideration any future variation of water levels associated with climate change (eg sea-level rise).

With regard to entrance management, Kendall & Kendall (2003) indicate that a reduction in the natural fluctuation of water levels throughout the wetland communities (by artificially opening the entrance when levels are lower than their natural peak water levels) is likely to significantly alter the floristic composition of the wetlands and reduce the overall biodiversity of the wetland communities.

## 2.3 Saltwater Creek Flood Study

In 2004, WBM carried out a flood study of Saltwater Creek and Lagoon at South West Rocks. The study was commissioned by Kempsey Shire Council in response to recent requests for development near low-lying and the need to understand the relationship between entrance berm heights and flooding issues upstream. Council considered that an improved level of understanding regarding flooding was required before it could consider any further development in the vicinity of the waterway.

The flood model utilised the combined 1D / 2D TUFLOW finite difference flood modelling package. High resolution two-dimensional elements were used for the Saltwater lagoon waterbody and adjacent floodplains, while low resolution one-dimensional elements were used for the linear section of Saltwater Creek joining the lagoon to the ocean. Two-dimensional elements were also used at the creek entrance to simulate breakout of the entrance sand berm. Modelling incorporated fully dynamic and integrated hydrologic inputs from a RAFTS-XP model of the 8.7km$^2$ catchment.

The objective of the flood modelling was to examine and define flood behaviour within Saltwater Creek (and Lagoon) in response to different rainfall and runoff conditions, and to different sand berm erosion conditions at the creek mouth. A range of design flood events were considered, including the 1%, 2%, and 20% Annual Exceedance Probability (AEP) events[1], as well as the Probable Maximum

[1] The 1% AEP event, for example, has a 1% chance of occurring in any year.

Flood (PMF)[2]. A range of entrance sand berm conditions were also considered, including a berm with crest elevations of 2.0, 2.5 and 3.0 m AHD. In all simulations, overtopping of the entrance sand berm resulted in subsequent erosion of the berm, as the sand is transported away by high velocity laminar flows (similar to flow over a weir). The hydraulics and sand transport components of the model are fully integrated, which means that as the entrance sand berm erodes, the hydraulics in the waterway respond immediately in the model.

Typically the accuracy of flood models are confirmed through a calibration process using known flood behaviour (eg levels) for specific historical flood events. Unfortunately no such information was available for Saltwater Creek, and therefore a formal calibration was not completed. Instead, a validation of the models was carried out by performing sensitivity tests on the model to determine its response to small changes to key design parameters. Sensitivity was carried out on the entrance sand berm conditions of the model, as well as the model roughness (or bed friction). Model roughness was found to be relatively insensitive to the final results, however, the entrance sand berm conditions were found to be critical in predicting flood levels within the creek and lagoon system. Consequently, a range of entrance sand berm conditions were reported for design purposes to illustrate the importance of this feature on predicted flood behaviour.

Figure 2-4 shows longitudinal profiles of maximum water level in Saltwater Creek, from the ocean entrance (at 0m chainage: left hand side of plot) to the golf course (at 6000m chainage: right hand side of plot). The profiles show peak water levels for the four design events (viz: PMF, 1%, 5%, 20% AEP) and for three different entrance conditions (viz: 2.0, 2.5 and 3.0m AHD – 1% AEP runs only). As seen in these profiles, the peak water levels within the creek, particularly downstream of Phillip Drive bridge, are predominantly controlled by the level of the sand berm. Peak levels downstream of the bridge almost exclusively occur immediately following overtopping of the entrance sand berm and prior to significant scour (breakout) of the berm.

The 1% AEP (1 in 100yr) design event was simulated for 3 entrance berm conditions (2m, 2.5m and 3m AHD) and showed that the Phillip Drive bridge has a significant impact on flood levels within the lagoon and further upstream. Resulting flood levels for the 1% AEP event upstream of Phillip Drive were similar irrespective of the entrance berm condition, due to the flow constriction associated with the Phillip Drive bridge. Backwater behind the Phillip Drive bridge extends well upstream of the lagoon and into the golf course for the 1% AEP (1 in 100 year) design flood conditions.

For the smaller flood events, the Phillip Drive bridge has less of an impact. It is expected for 5% AEP (1 in 20 year) and 20% AEP (1 in 5 year) events, berm heights of greater than 2.5m AHD would essentially 'drown out' the influence of the bridge, meaning that flooding within the lagoon for these circumstances would be controlled by the berm crest.

Consequently, it can be concluded that for infrequent flood event (eg 1% AEP), flood levels upstream of Phillip Drive bridge are controlled by a combination of entrance berm heights and the bridge constriction, whereas downstream of the bridge, flood levels are controlled by the entrance (and the conveyance capacity of the creek to a much lesser extent). For more frequent events, however, Phillip Drive has sufficient flood conveyance capacity, meaning that flood levels both upstream and downstream of the bridge are controlled by entrance berm conditions.

[2] Probable Maximum Flood is based on the hypothetical maximum possible rainfall

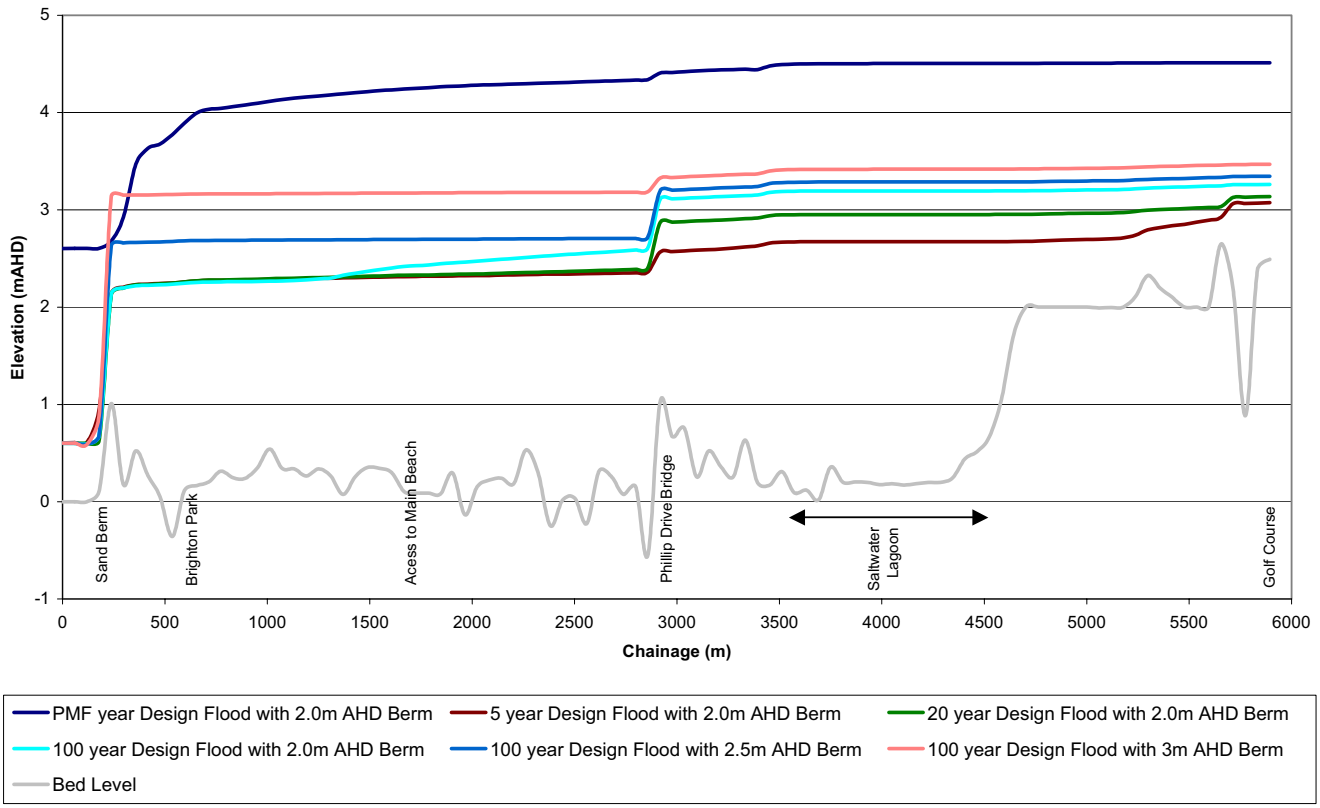



**Figure 2-4 Longitudinal profiles of maximum water level reached for design flood events and different entrance berm conditions**

**(note: maximum water level reached does not occur at the same time throughout the waterway, i.e. the profiles do not represent a single instant in time)**

## 2.4 Oil Terminal Sites on Phillip Drive

Between 1961 and 1992, Caltex and Shell operated terminals for storing and distributing gasoline and diesel at Trial Bay. The fuels were received from ship through a marine pipeline from the bay and stored in above ground tanks on land at Phillip Drive between Saltwater Creek and Saltwater Lagoon. Following closure of the sites, it was found that the sandy soils at the terminal sites had been impacted with petroleum hydrocarbons, and a dissolved hydrocarbon plume was present in the groundwater down-gradient of the site (flowing northwards towards Saltwater Creek).

Remediation of soils on the terminal sites commenced following decommissioning. It is understood that the Shell terminal has been remediated to the satisfaction of the Department of Environment and Conservation (former EPA), however, there is a lack of information in relation to potentially remaining contamination at the former Caltex terminal. Groundwater remediation, both beneath the sites and beneath residential properties to the north of the sites, has been time consuming, and has involved multi-level sparging (to introduce oxygen for bioremediation and volatilisation of dissolved hydrocarbons in the groundwater), a venting system to capture vapours, and installation of a calcium peroxide array on the terminal site to slowly release oxygen in the groundwater, again to increase dissolved oxygen levels and accelerate bioremediation. Throughout the remediation program, monitoring of dissolved hydrocarbon levels was undertaken via 50 wells distributed across the

groundwater plume at different depths within the overlying sand, within the coffee rock, and below the coffee rock in the deeper sand aquifer (although no monitoring bores have been placed immediately adjacent to Saltwater Creek due to difficulties of access for drilling).

In a letter to Council, Shell has indicated that on-going natural attenuation processes may be effective in further reducing hydrocarbon concentrations in groundwater, and that TPH, BTEX and lead have not been detected above the Limit of Reporting (LOR) in any surface samples taken from Saltwater Creek since January 1999, however, Caltex has recently provided data to DEC (EPA) showing minor petroleum hydrocarbon contamination in Saltwater Creek (in respect to xylenes, ethylbenzene and naphthalene) (letter to DIPNR by Alex Purvis, DEC, 31 March 2005). This contamination may be the result of contaminated groundwater discharge and/or previous leakage of petroleum from the former transportation pipeline across the waterway (A. Purvis, 31 March 2005).

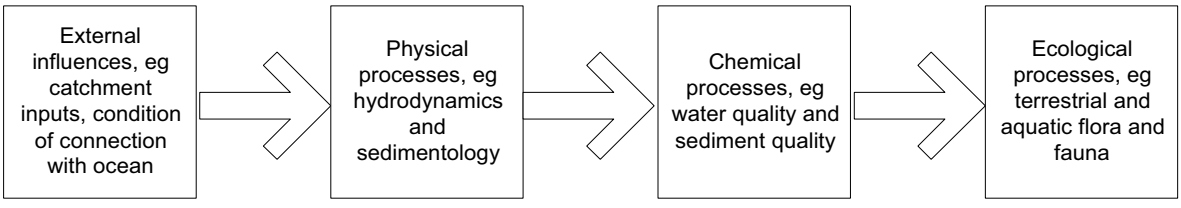
Contaminated groundwater north of the former Caltex terminal presents a potential risk of harm to residents and other users of groundwater. Management of the groundwater in areas surrounding the former oil terminals is currently subject to a Section 149(5) notice and guided by a specific management plan ("Institutional Controls"), which includes the provision for Caltex to provide point of use treatment. DEC intend to formalise and regulate the management of the groundwater contamination under the auspices of the *Contaminated Land Management Act 1997*.

## 2.5 Overview of Estuary Processes Interactions

The physical, chemical and biological processes of estuarine environments, such as Saltwater Creek, are highly inter-related. The relationship between the processes can be considered in the context of a pyramid, with primary processes at the top, having 'filtering down' impacts on lower order processes.

The processes interaction pyramid for ICOLLs such as Saltwater Creek is shown in Figure 2-5. At the top of the interaction pyramid are the primary processes influencing external contributions to the system: Catchment Inputs and Entrance Conditions. These two factors, more than any other, tend to control the condition of the estuary and the habitats that it supports.

In simple terms, the external processes influence the physical hydraulic processes, which in turn influence the chemical responses, which in turn, define the ecological structure of the system (see below).




Based on the above structure, the overall result of changes to first order processes (i.e. inputs to the system) is a change to the ecological structure and communities supported by the estuary. Changes also manifest in other processes, such as hydrodynamics, sediments and water quality, in response to

the change in inputs, however, these can be considered as intermediate links between the inputs and the resultant natural ecology.

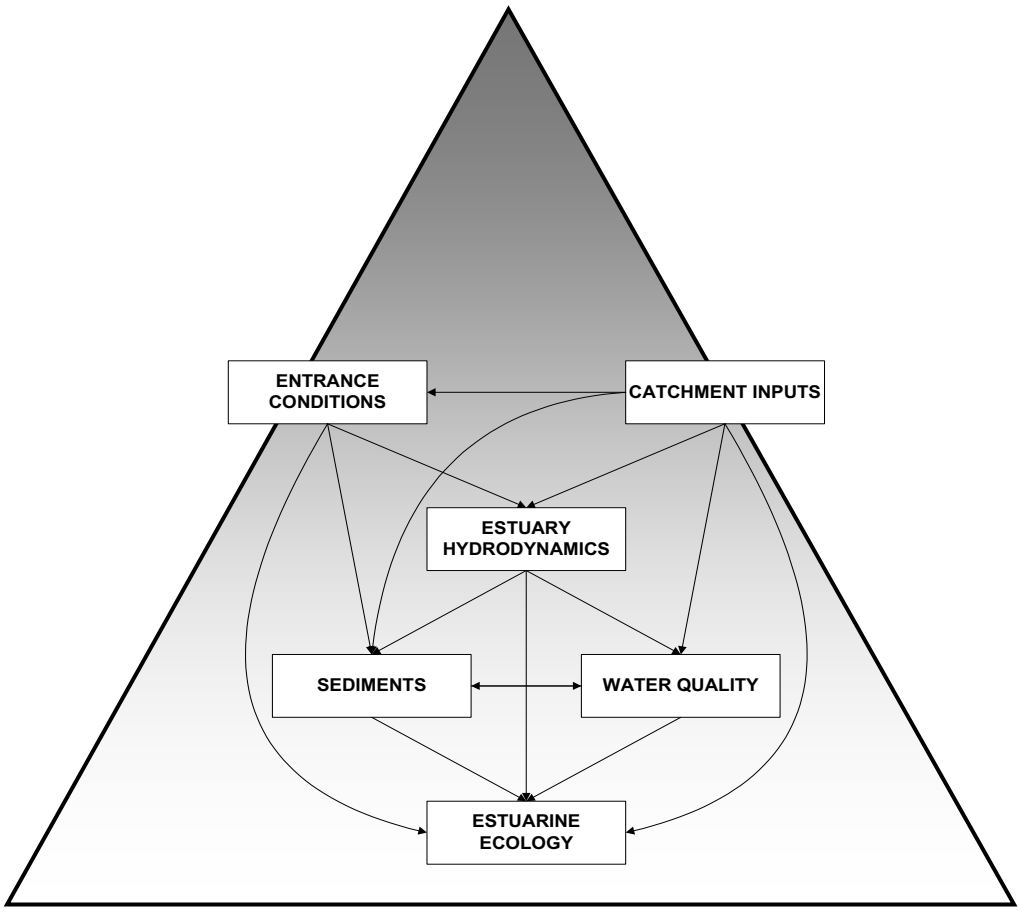



**Figure 2-5 Interactions between Estuarine Processes (based on WBM, 2002)**

## 2.5.1 Entrance Conditions of Saltwater Creek

As clearly identified in MHL (2002), the condition of the Saltwater Creek entrance has a major influence of the condition of the estuary. When the entrance is closed, there is no tidal flushing of the estuary, and virtually 100% of inputs are retained within the system. This includes sediments (leading to sedimentation and shallowing), nutrients (leading to eutrophication) and even volumetric runoff from the catchments (leading to inundation of fringing low-lying lands). A closed entrance also influences the mobility of aquatic fauna between the estuary and the ocean.

Fish kills have also occurred, both immediately prior to an entrance opening event, and immediately after entrance breakout. In both cases, the fish kill is likely to be related to a sudden depletion of oxygen from the water due to the breakdown of organic matter. In the case of a fish kill prior to breakout, it is likely that episodic rainfall and catchment runoff increased water levels in the system which inundated previously dry sections of the wetland fringe. The inundation would have liberated loose organic material on the ground, would then start to decompose within the water. In the case of a fish kill after breakout, the sudden drop in water levels may expose macrophytes and macroalgae to

the atmosphere, which were previously submerged within the creek and lagoon system. Exposure to the atmosphere would kill the plants, with the detrital material forming an oxygen demand on the water.

Historically, the entrance of Saltwater Creek has been artificially opened to mitigate the impacts of inundation on surrounding private lands and assets. However, there is increasing recognition of the need to maintain natural variability of water levels in ICOLLs in order to maintain fringing ecological communities that are dependent on periodic inundation (HRC, 2002; Haines, 2004). A careful balance between the needs of the estuarine and wetland ecology and the detrimental impacts on inundation on private lands needs to be found in order to progress with future management of Saltwater Creek.

In many respects, the condition of the entrance simply defines the ability of an ICOLL to accommodate catchment inputs. Systems with mostly closed entrances have little buffering capacity for catchment inputs, whereas systems that are mostly open are more likely to accommodate inputs without detrimental impacts on resident estuarine processes (Haines *et al*., 2006). Specific data regarding the proportion of time the entrance is open and closed is not available. However, personal observations made by local residents suggest that the entrance is mostly closed. MHL (2002) assumed the entrance was closed for 8 months per year when calculating a water balance for the estuary (although based on anecdotal reports, it is likely that the entrance is more closed than this assumption by MHL).

### 2.5.2 Catchment Inputs to Saltwater Creek

As outlined above, the inputs to an estuary become more critical when the connection between the estuary and the ocean is closed for the majority of the time. However, as calculated by MHL (2002), even when the entrance is open, few catchment inputs to Saltwater Creek and Lagoon are evacuated from the system. Therefore, catchment inputs appears to be equally important, if not even more important, to the overall health and structure of the estuarine communities of Saltwater Creek and Lagoon, than the entrance conditions.

Based on the measured nutrient concentrations and extent of algal growth within the estuary, it is considered that the Saltwater Creek and Lagoon system is already at or exceeding its natural capacity to accept catchment loads. Further increases in the amount of nutrients and other pollutants discharged to the system may result in catastrophic changes to estuarine ecology, which may be very difficult (if not impossible) to reverse. Over-development of some ICOLL catchments, particularly around Sydney, has resulted in highly degraded estuarine systems possessing little ecological value (eg Manly Lagoon, Curl Curl Lagoon, Terrigal Lagoon). The challenge for this Estuary Management Plan will be to ensure that the existing values of the estuary are not compromised further, without unduly preventing expansion of the South West Rocks township in the future.

### 2.5.3 Human Impacts on the Estuary

With respect to Figure 2-5, human interference with the natural inter-related processes of Saltwater Creek and Lagoon tend to be at the highest level, that is, Entrance Conditions and Catchment Inputs. This means that human activities are responsible for subsequent modifications to all estuarine processes, culminating in a change to the overall ecological community structure of the estuary.

In terms of entrance conditions, humans have been responsible for premature entrance breakouts. These artificial breakout truncate the natural water level regime of the system, preventing inundation to that part of the wetland fringe that only receives periodic inundation. The consequence is "terrestrialisation" of the wetland fringe, with dryland species tending to outcompete wetland species at the wetland interface.

In terms of catchment inputs, broadscale development of the catchment, either for rural, rural-residential, or urban development, has significantly increased the runoff of pollutants and contaminants from the catchment to the estuary. Using the catchment runoff loading rates presented in MHL (2002), development of the catchment has increased nitrogen loads to the estuary by 3.5 times, and phosphorus loads by 10 times, compared to pre-European (fully timbered) conditions.

In addition to surface runoff, human impacts extend to contamination of the soils and groundwater through the former oil terminal sites on Phillip Drive. As discussed in Section 2.4, groundwater remains contaminated north of the Caltex terminal, with some minor hydrocarbon contamination recorded in Saltwater Creek (most likely as a result of groundwater discharges). MHL (2002) did not document the degree of contamination of the terminals or groundwater, or discuss the potential impacts on the environmental condition of the estuary.

### 2.5.4 Management Recommendations based on the Physical, Chemical and Biological Processes of Saltwater Creek and Lagoon

Based on the scientific information presented in this Chapter, there are a number of key issues that need to be addressed in order to ensure that Saltwater Creek remains a healthy and ecologically viable estuary for future generations. These issues include:

- Maintenance of a hydraulic (water level) regime that corresponds with the extents of fringing wetlands around the estuary, and the need to minimise the risks and costs to private landholders associated with inundation when water levels are high;
- No further increase, and preferable a future decrease, in the amount of pollutant inputs (sediments, nutrients, organic matter) from the catchment to Saltwater Creek and Lagoon;
- Conflict between recreational use of the creek (particularly at the downstream end) and pollutants entering the waterway from the stormwater (especially pathogens and bacteria); and
- Conservation of existing high value habitats around the waterway and within the catchment, and protection of these habitats through establishment of appropriate buffers to urban development.

# 3 COMMUNITY AND STAKEHOLDER CONSULTATION

## 3.1 Scope of Consultation Undertaken

Consultation with the community and local stakeholders commenced during the preparation of the Estuary Processes Study (MHL, 2002). Further consultation was carried out during the course of this Estuary Management Study, and included:

- Distribution of letters to key stakeholders and community groups outlining the scope of the works and requesting feedback regarding the existing estuary values and issues requiring future management;
- Distribution of a questionnaire in the local newspaper (Macleay Argus) regarding the study, and again requesting information on estuary values and management issues;
- Follow-up conversations and on-site (face to face) meetings with several community members and stakeholders;
- Workshops with the Estuary Management Committee and with the wider community regarding the issues requiring management and potential options to address them;
- Public exhibition of the draft Saltwater Creek and Lagoon Estuary Management Study and Plan document;
- Public meeting during the public exhibition period to present the draft report to the wider community.

Appendix A contains a copy of the information published in the local newspaper, and a summary of the formal responses received from the initial round of consultation.

## 3.2 Issues raised through formal community and stakeholder input

Outlined below are the main issues that were identified through consultation with community and stakeholder representatives. The following comments do not necessarily reflect true and accurate records regarding the estuary, nor do they necessarily reflect the opinion of the study team responsible for preparing this Estuary Management Plan.

**NSW Department of Infrastructure, Planning and Natural Resources (now DNR)**

- Appropriate setback distances and development controls would need to be determined between future urban development and the Saltwater Creek and Lagoon system. The current policy of 50m setbacks from National Park Boundaries and High Conservation Areas appears inadequate particularly given the nature of the Lagoon to expand or contract dependent on the conditions.
- Regarding Stormwater Management, clear strategies and controls for both existing and future developments are required to maintain or improve the health and functioning of Saltwater Creek and Lagoon.
- A water quality monitoring program is required for more effective management of the system, especially in the Lagoon and areas of high public recreation in the Creek. This program should

include monitoring near the former oil terminal sites. Data produced from monitoring stations should be managed to ensure the data is reliable and routinely analysed.

**NSW Fisheries - now Department of Primary Industries (DPI)**

- Minimum entrance manipulation is a high priority. There are concerns over the detrimental effect on Saltwater Lagoon from unauthorised openings, development on low lands and poor quality storm water runoff.
- NSW Fisheries would support strategies designed to mimic natural processes while maintaining the ecological health and biodiversity in the estuary and lagoon.

**Environmental Protection Authority (EPA) – now Department of Environment and Conservation (DEC)**

- Many issues regarding water quality, flows and estuarine health should be reviewed, particularly, the stormwater discharge into the Creek and whether this discharge was adequately treated. Stormwater treatment and source controls mechanisms should be considered for the potential to improve water quality and alter runoff volume.
- The cause of fish kills within the estuary should be investigated. Effects on the ecological integrity of artificially opening the mouth of Saltwater Creek should be examined.
- The adequacy of the sewerage system should be examined, particularly in the face of increasing development in the Saltwater Creek catchment. Appropriate modifications should be made if the system is inadequate.
- The possible contamination from former oil terminal site is also a concern.

**National Parks and Wildlife Division, Department of Environment and Conservation**

- Weed infestation – prevention, management, funding and education.
- Fire management – where national park adjoins urban areas, it is common for the park to become a sacrificial area for hazard reduction activities. Fire management is required on a whole-of-landscape basis, so land management and property owners are responsible for fire prevention activities.
- Rubbish dumping in bushland areas and rubbish entering the catchment through stormwater system.
- Maintaining vegetation diversity, biodiversity, threatened species protection and overall conservation.

**Residents and Community Members**

- Urban development in the catchment is an issue as it results in an increase in impervious surfaces and thus an increase in the volume of runoff. This issue is linked with the decline in water quality over recent years. Vegetation clearing, often for the purpose of urban development, is an issue due to the fragmentation of wildlife habitat that results.
- Prior use of the area for oil terminals may have left the groundwater contaminated with lead and hydrocarbons.

- Excessive fires around the foreshore have burnt large areas and remaining unburnt areas are too small for sufficient recovery and regeneration.
- Allowing the Creek to operate as a natural system is preferred over the artificial opening of the Creek entrance when water is regarded as too high or stagnant (repeated several times by different residents).
- Flooding is an important issue as the local vegetation relies on this natural process. The Creek and Lagoon area have important ecological values due to the uniqueness of the area compared to other estuaries in the region.
- Water quality is a concern, particularly the effects on the natural ecological system.
- Other issues including stormwater management, siltation and sedimentation.
- Negative effects of recreation, such as the catching of under size fish and the inconsistency in signage with regards to allowing dogs in the vicinity of the National Park.
- Management of the area should involve minimal interference except in areas requiring remediation for issues such as contamination, invasive weeds and predation by cats and dogs.
- Domestic dogs should be clearly prohibited from areas of high habitat value.
- Rezoning of oil terminal land for residential use.
- Possible leaching of septic tanks, particularly those used around the immediate lagoon fringes (Lagoon View ??), especially due peak holiday periods when systems are overloaded.
- The system is no longer a natural system due to 'huge' stormwater pipes discharging into the creek and the entrance manipulation.
- When water levels are high, there is inundation of the golf course ($16^{th}$ hole), however, when this occurs the golf course is virtually unplayable.
- Water from the new residential development behind the golf course flows out onto the course, with a silt curtain needing to be constructed to control the amount of sediment washoff.
- Vegetation along drainage lines act as a filter and require conservation. This vegetation also provides aesthetic values and wildlife corridors.
- For all future development, 'best practice' stormwater systems should be adopted.
- Protection of the landscape is required that screens out urban development. Fire sensitive vegetation should be replanted.
- Much of the area would be suitable for inclusion in National Park.
- Wildflowers have disappeared from newly developed housing areas.
- Planting new vegetation would be appropriate to replace vegetation that is cleared and otherwise lost due to residential developments and roadways. Vegetation corridors on drainage lines and appropriate landscaping are suggested.
- No further rezoning of rural land to urban should occur as this will degrade the environment, and the community would support a ban on all future urbanisation of the area.

- Maintenance of ecological processes and the control of potentially threatening development are required. Past planning and development has been ad hoc, often resulting in expensive remedial work or environmental degradation. Zoning is required to protect the local ecology.
- Is it better to ban all development, or to allow some development that can be demonstrated to not have adverse impacts on the creek? Planning first is better than dealing with consequences later, so strong recommendations based on science and experience are required for the Estuary Management Plan.

## 3.3 Outcomes of Community and Stakeholder Workshops

An Estuary Management Committee workshop regarding Saltwater Creek was held on 14 October 2004, while a second workshop involving invited members of the community, was held on 1 November 2004. Community members invited to the second workshop where those who responded to previous inquiries regarding future management of Saltwater Creek, along with known local community groups such as Friends of South West Rocks.

Prior to the workshops, an Issues and Options Paper was distributed to participants to ensure that everyone had a solid understanding of the project and the context in which they were being consulted.

During the workshops, the participants were lead through the Issues and Options Paper, which outlined identified management issues, suggested Management Objectives, and a range of potential options aimed at addressing the issues and meeting the objectives. Participants were encouraged, and provided, additional items for discussion and inclusion in the final documents. Participants of the Estuary Management Committee workshop were also involved in ranking the Management Objectives (see Section 5.6 for detailed outcomes).

## 3.4 Outcomes of Public Exhibition of the draft Estuary Management Study and Plan

The draft Saltwater Creek Estuary Management Study and Plan was placed on public exhibition for four weeks in April 2006. At the beginning of this exhibition period, a public meeting was held to openly discuss the elements of the draft Plan and to seek initial feedback from the community.

Thirteen written submissions were received by Council regarding the draft Saltwater Creek and Lagoon Estuary Management Plan. While some submissions fully endorsed the Plan, many others rejected one or more of the strategies recommended in the Plan. Subsequent to the public meeting, another meeting was held between Council, DNR, WBM and members of the public that were dissatisfied with the draft Plan. This meeting resolved all issues associated with the draft document through the agreement to modify certain aspects of some strategies. The final Estuary Management Plan presented herein incorporates all of the changes that were endorsed by the community, and ratified by Council and state government agencies (including DNR, DPI-Fisheries, and DEC – National Parks).

# 4 ESTUARY VALUES, USES AND ISSUES OF CONCERN

## 4.1 Estuary Values

The values of the estuary, as identified through consideration of the scientific literature, consultation with the Coast and Estuary Management Committee (CEMC), and consultation with the wider community and stakeholder groups, have been defined as follows:

**Passive recreation -** including bushwalking, fishing, birdwatching, and canoeing.

**Open space -** the creek and lagoon provides an important aesthetics value based on it natural heritage aspects.

**Ecological -** the area provides an important wildlife habitat, with the area containing high biodiversity. The lagoon is an important nursery and breeding area for aquatic species, and forms part of a valued regional corridor along the mid north coast, as well as a local corridor between the marine and terrestrial environments.

**Natural filter -** the extensive bushland and reedland surrounding Saltwater Creek and Lagoon provides an effective buffer between the urban area of South West Rocks, and the local estuary / marine environments. However, the natural filtering capacity of the estuary fringes can be easily exceeded.

**Heritage** – anecdotal report (from community member response) of discussions with a local Dunghutti elder indicate that Saltwater Creek and Lagoon is sacred and of high cultural significance. Although no formal response to a request for input into this study was received from the Kempsey Local Aboriginal Lands Council, on-going consultation with local Aboriginal communities, including the Dunghutti Elders Council Aboriginal Corporation and the Figtree Aboriginal community of South West Rocks should be carried out to ensure indigenous issues are addressed as part of this Estuary Management Plan. A detailed archaeological assessment of land to the immediate west of Saltwater Lagoon was carried out as part of the South West Rocks LES (Connell Wagner, draft 2004).

## 4.2 Uses of the Estuary

The uses of the estuary are somewhat limited given its small size and limited access. The uses of Saltwater Creek and Lagoon were identified through consultation with the CEMC and local community and stakeholder representatives, as follows:

**Recreation** – As South West Rocks is a major tourist destination, Saltwater Creek and Lagoon is subject to variable recreational use, including canoeing, birdwatching, fishing, cycling, bushwalking, swimming, and views appreciation. However, tourists are not the only users of the estuary, with the local community also using the estuary for the remaining non-holiday periods of the year.

**Commercial** – Commercial uses of the estuary are somewhat limited to the commercial enterprises that fringe the lagoon, and rely on the natural attributes of the area to attract patrons. The Trial Bay Tourist Park would be the main commercial beneficiary of the estuary, however, to some extent, all tourist-related developments within the South West Rocks area are benefited by a healthy and

attractive estuary. Canoe hire is also carried out on Saltwater Lagoon, which is licenced by the Parks and Wildlife Division of DEC.

With regard to fishing, commercial activities are not prohibited from the estuary, but given the small size of the system, commercial fishing is unlikely to be a significant usage of the estuary. Nonetheless, Saltwater Creek and Lagoon is considered important to local commercial fishers (including eel fishers), as expressed in recent correspondence to DPI (Fisheries) regarding improved boating access to the estuary.

## 4.3 General Issues of Concern

The following list of issues relevant to Saltwater Creek has been developed by the Saltwater Creek & Lagoon Working Group, and the Coastal and Estuary Management Committee:

- Management of the entrance sand berm;
- Potential for floods as a result of the entrance closure;
- Inundation of lands surrounding Saltwater Creek (including Golf Course);
- Litter entering via stormwater runoff from nearby South West Rocks;
- Protection of ecological function such as the fish breeding;
- Potential use of Saltwater Creek as a stormwater detention basin;
- Future development planned within the catchment;
- Maintaining long term health and functioning;
- Potential Acid Sulphate Soils;
- Access and safety for recreational activities; and
- Remediation of oil tank sites.

In addition to the above, pertinent issues associated with Saltwater Creek were derived from the Estuary Processes Study (MHL, 2002) and the supplementary Saltwater Creek Flora and Fauna Study (Kendall and Kendall, 2003) as follows:

- Resource pressures due to influx of tourists during holiday season;
- Pollutant loads from the catchment, especially during wet weather;
- Species diversity;
- Salinity impacts from berm management;
- Prevention of further weed infestation;
- Importance of creek as fauna refuge during droughts; and
- Protection of regionally vulnerable wet heath.

Some of the key management issues are discussed in further detail below.

## 4.4 Specific Issues Requiring Attention

The issues that are considered to be most important, and thus require management in the future are presented below, under broad topic headings of water quality, ecology/biodiversity, entrance management (and flooding) and future catchment development.

### 4.4.1 Water Quality

#### *4.4.1.1 Issue A: Stormwater Inputs*

Existing urban stormwater inputs to the creek and lagoon system result in impacts on the ecological function of the estuary and the recreational uses of the system. Existing stormwater inputs would deliver litter, pathogens / bacteria, nutrients, sediments, petro-chemical and heavy metals to the estuary. Gross Pollutant Traps (GPTs) have been installed in some locations to remove litter, but are ineffective in removing harmful bacteria and dissolved pollutants such as nutrients and metals. It is considered that the system is already exceeding its natural capacity to assimilate catchment loads, as evidenced by algae, occasional fish kills, and loss of fringing vegetation.

#### *4.4.1.2 Issue B: Recreation in a closed system*

There are possible conflicts between the existing water quality and the recreational uses of the estuary, especially when the entrance is closed. When closed, 100% of the inputs to the system are retained within the system. Stormwater inputs in the lower estuary potentially compromise the recreational value of the estuary, as the inputs may contain bacteria that are harmful to swimmers. Tannin stained water within the estuary sometimes results in an incorrect perception of poor water quality. It is reported that the protected waters of the lower estuary are used by bathers, particularly young children.

#### *4.4.1.3 Issue C: Former Oil Terminals*

There is a potential impact on water quality and groundwater by the disused oil terminals and from soil / groundwater contamination. The land formerly used by Shell and Caltex for oil and petrol storage has been contaminated, and has undergone some remediation in recent years (particularly in respect to the Shell site). Groundwater in the vicinity of this land and to the north under existing residential lots is also contaminated, and as a result, there is a potential for petro-chemical contamination of the creek and lagoon. This may be exacerbated when water levels in the creek are low and there is a greater hydraulic gradient between the groundwater and the surface water of the creek. Minor contamination of Saltwater Creek by petroleum hydrocarbons has been recorded (likely the result of contaminated groundwater discharges).

#### *4.4.1.4 Issue D: On-site sewage systems*

There are potential impacts on the estuary associated with leachate from unsewered (utilizing on-site systems) non-urban areas. There are currently 58 registered on-site sewage management systems (OSMS) within a 1 kilometre buffer of Saltwater Lagoon, with 21 recently assessed as non-complying and require remedial work to gain approval by Council (mostly located to the immediate

south and south-east of the lagoon). Other unregistered OSMS may also be located within the area, which have not been assessed for compliance.

Inadequate OSMS can potentially have adverse impacts on public health and the environment through contamination of groundwater and surface waters. Contamination can include bacteria, viruses, parasites and other wastewater organisms, while elevated nutrients can lead to algal blooms and eutrophication of receiving waters.

#### *4.4.1.5 Issue E: Potential Acid Sulfate Soils*

Drainage of potentially Acid Sulfate Soils (ASS) from around the lagoon may affect pH of surface waters. Although actual signs of acidic runoff are limited, drainage of lands around the lagoon has the potential to oxidize ASS, and affect the water quality of the estuarine environment.

### 4.4.2 Ecology / Biodiversity

#### *4.4.2.1 Issue F: Ecological Values*

The estuarine system holds significant intrinsic value to the local ecological communities. The area has a range of habitat types, and as such has high biodiversity. These features are recognized by the community, who would like to see the system better protected from existing and future development, which can potentially degrade its existing ecological values.

#### *4.4.2.2 Issue G: Vegetated Buffer around Estuary*

Fringing vegetation around the estuary should act as a buffer, or filter, between existing development and valuable estuarine habitats, as well as a contraction and expansion area for the wetted perimeter of the lagoon. Given that the system is already considered to be reaching (or even surpassing) the natural capacity to accept and assimilate catchment loads, any further loss of vegetation from around the estuary would reduce the buffering potential, and hence would result in a direct degradation of the system. Therefore, there is a need to protect the existing vegetation.

#### *4.4.2.3 Issue H: Fire and Weed Management*

Effective fire management and weed management in surrounding rural residential lands is required. Inappropriate land management practices in neighbouring properties have the potential to degrade the estuarine environment as weeds and fire can spread rapidly from the private lands. Weed infestation can have devastating effects on native vegetation, wildlife, water quality and in some cases, human health.

### 4.4.3 Entrance Management (and Flooding)

#### *4.4.3.1 Issue I: Flooding of Private Lands*

Elevated water levels in the lagoon and creek result in inundation of surrounding private lands and assets. These include parts of the caravan park, the golf course, the stormwater system, and some paths / cycletracks. Water levels in the system rise when rainfall in the catchment coincides with a

closed entrance condition. Water levels start to cause concerns when they exceed levels of about RL 2 – 2.2m AHD.

#### 4.4.3.2 Issue J: Artificial Entrance Openings

There may be environmental implications associated with artificially opening the entrance at levels lower than natural breakout levels. The vegetation surrounding the creek and lagoon is dependent on periodic wetting and drying. Also, changes to the lagoon hydrology are likely to result in changes to groundwater hydraulics, which can have follow-on implications for acid sulfate soils and land contamination. The reduced volume of the lagoon could also potentially reduce the capacity of the system to assimilate catchment pollutants.

#### 4.4.3.3 Issue K: Water levels and recreation

Elevated water levels may limit the recreational amenity of the lagoon, as some foreshore areas used for recreation would be inundated. Conversely, at high water levels, the lagoon becomes more accessible for watercraft, and thus can be considered to be beneficial for some recreational activities.

#### 4.4.3.4 Issue L: Illegal opening of entrance

Illegal opening of the entrance by unauthorized persons has occurred in the past, and is likely to continue in the future unless an entrance management policy can be developed that is agreeable to all stakeholders and affected landholders around the estuary.

#### 4.4.3.5 Issue M: Surfboat Access

There is an occasional need for access by surfboats and vehicles across the creek entrance when the entrance is open. In the past, the entrance has needed to be closed, artificially, to enable access from the surf club onto front beach for surf carnivals.

### 4.4.4 Future Catchment Development

#### 4.4.4.1 Issue N: Future Development Impacts

As outlined in Section 2.5, the ecological condition of Saltwater Lagoon has suffered as a result on past land development given its natural sensitivity. Further catchment development likely to have a significant impact on the estuarine ecosystem. Future development therefore needs to be controlled (or if necessary, prevented) to ensure that future activities do not exacerbate an already stressed environment beyond its natural tolerance levels. Additional pollutant loads to Saltwater Lagoon may result in a dramatic ecological shift, to a system dominated by algae and eutrophication. To avoid this situation, any increase in pollutant / nutrient loads to the estuary is therefore unacceptable. This would include increases to runoff volumes, pollutant loads, vegetation loss and social pressures on the existing environment. Controls on future development should be applicable to intensification within existing zonings (such as the tourism-zoned land between Saltwater Creek and Phillip Drive) as well as development associated with rezoning of land within the Saltwater Creek and Lagoon catchment (such as all 1(d) land, the oil terminal site and rural land to the south of the lagoon).

# 5 OBJECTIVES FOR FUTURE MANAGEMENT

A set of well-targeted management objectives has been formulated based on protection of the values and uses of the estuary and remediation of specific issues/problems facing the estuary, as presented in the previous chapter.

The objectives essentially aim to rectify the problems facing the estuary, whilst preserving and enhancing the estuary's inherent values. Fourteen (14) separate objectives have been formulated covering the topics of water quality, ecology/biodiversity, entrance management (and flooding) and future catchment development, as per the specific issues in Section 4.4.

## 5.1 Water Quality Objectives

### ***Objective (1)*** *Reduce the existing urban stormwater pollutant loads entering Saltwater Creek and Lagoon*

Addressing **Issue A** (see Section 4.4.1.1), this objective is aimed at reducing the existing inputs to the estuary via the urban stormwater system. Input loads from the stormwater would include sediments (particularly in areas that are being developed, such as in the south-west of the catchment), nutrients (nitrogen and phosphorus), pathogens / bacteria (from illegal sewer connections to the stormwater, exfiltration from the sewerage system, and direct faecal inputs to the catchment, eg dogs and other pets) and litter (particularly in the CBD area of South West Rocks).

### ***Objective (2)*** *Ensure that the water quality of Saltwater Creek and Lagoon is compatible with the recreational uses of the estuary*

Addressing **Issue B** (see Section 4.4.1.2), this objective aims to ensure that the water quality of Saltwater Creek and Lagoon does not compromise the existing recreational uses of the waterway. The main activity that would potentially be compromised is swimming, and this mostly occurs at the downstream end of the creek, adjacent to public open space / parkland. A major stormwater drain discharges into Saltwater Creek at this location. While this drain contains an in-line GPT, bacteria and pathogens considered potentially harmful to humans are not filtered from the stormwater by the GPT.

The potential impacts of stormwater and other inputs on human health during recreational activities undertaken within the waterway are exacerbated when the entrance is closed. Under these conditions, there is no opportunity for tides to assist with dilution or dispersal of pollutant inputs, meaning that areas close to stormwater outlets would be particularly susceptible to poor water quality.

Water quality can also be *perceived* as poor by users when the water becomes tannin-stained. Therefore, it is important that water quality monitoring be carried out to distinguish between perceived and actual risks associated with water quality conditions throughout the waterway.

### ***Objective (3)*** *Ensure that the contamination of the former oil terminal sites does not degrade the existing or future estuarine environment of Saltwater Creek and Lagoon*

Addressing **Issue C** (see Section 4.4.1.3), this objective aims to protect the waters of Saltwater Creek and Lagoon from contamination associated with the former use of nearby land for petro-chemical storage. Remediation of most of the land on which the storage tanks were located has been carried out, however, the impacts of the contamination extended to the groundwater, which has subsequently moved off-site towards Saltwater Creek. Remediation of the groundwater was also carried out in the 1990s, with oxidation of the groundwater being induced by chemical dosing and sparging in an attempt to promote bioremediation of the groundwater. Nonetheless, groundwater is still considered to be contaminated, particularly to the north of the former terminal sites.

Discharge of possibly contaminated water from the groundwater into the creek would be highest when the water levels in the creek are at a low level (ie there is a maximum head difference between the groundwater levels and the surface water levels in the creek).

### ***Objective (4)*** *Reduce the impact of on-site sewage treatment systems on the surface water quality of Saltwater Creek and Lagoon*

Addressing **Issue D** (refer Section 4.4.1.4), this objective focuses on minimizing the potential discharge of leachate from on-site sewage management and septic systems to Saltwater Creek and Lagoon. Critical to the success of achieving this objective will be a thorough audit of all registered and unregistered on-site and septic systems within the catchment, to determine their operational efficiency and potential for release of pollutants (bacterial and nutrients) to the estuary, either through groundwater flows or direct surface runoff (especially during periods of heavy rainfall and saturated soil conditions). Registered systems have already been audited, with 21 out of 58 found to be non-complying to safety standards.

### ***Objective (5)*** *Prevent the generation of acidic runoff resulting from activities carried out on potentially acid sulfate soils surrounding Saltwater Creek and Lagoon*

Addressing **Issue E** (refer Section 4.4.1.5), the generation of acidic runoff from potentially acid sulfate soils around the creek and lagoon can be minimised by ensuring that the soils remain in a saturated condition. This can be achieved by maintaining high groundwater levels and/or maintaining high surface water levels in the lagoon and creek.

Oxidation of potentially acid sulfate soils could be a long-term outcome of continued entrance intervention, whereby the entrance berm is artificially opened at levels much lower than the normal upper range of water levels in the system.

## 5.2 Ecology / Biodiversity Objectives

***Objective (6)*** *Prevent any further loss or damage to the habitats around the lagoon that are valued by the local ecological communities, including the vegetation that provides an important buffer between the estuary and existing development, and enhance existing habitats through targeted restoration and rehabilitation*

Addressing **Issues F and G** (refer Sections 4.4.2.1 and 4.4.2.2), this objective aims to secure all existing vegetation between the estuary and existing urban and rural development. The vegetation is considered important from a habitat perspective, and provides a suite of habitat types that are utilised by a range of species. The vegetation is also critically important at filtering and buffering the inputs from the existing catchment development before being discharged to the estuary. Given that the estuary is already at capacity with regard to external inputs, any reduction in the extent of existing filtering / buffering vegetation is likely to result in degradation of the aquatic estuarine environment.

***Objective (7)*** *Ensure fire and weeds are managed appropriately on private properties surrounding Saltwater Creek and Lagoon*

Addressing Issue H (refer Section 4.4.2.3), this objective is aimed at urban and rural-residential landholders within the catchment to ensure that poor land management practices do not have flow-on effects to public and Council lands that form the bulk of existing buffering vegetation around Saltwater Creek and Lagoon.

## 5.3 Entrance Management (and Flooding) Objectives

***Objective (8)*** *Ensure that water levels in Saltwater Creek and Lagoon do not compromise the functioning of existing assets around the estuary*

In addressing **Issue I** (refer Section 4.4.3.1), this objective aims to minimise the impacts of high water levels on private properties and assets. Some of the lands around Saltwater Creek and Lagoon are very low, reflecting the recent (last 6000 years) alluvial nature of the local geomorphology.

Historically, private lands have been gazetted with little or no understanding of natural water level fluctuations in the estuarine system. Consequently, at the upper range of water levels, inundation of some private lands occurs. This is most obvious within the Country Club, where the 16$^{th}$ fairway becomes inundated, and at the Trial Bay Tourist Park when water levels in the Creek and Lagoon exceed approximately RL 2m AHD. It is also noted that a low-lying area on National Park land adjacent to the Tourist Park used for tent camping by Park operators is susceptible to inundation when lagoon levels exceed approximately RL 1.6m AHD (based on ground survey provided by Tourist Park operators).

***Objective (9)*** *Ensure that any artificial manipulation of the Saltwater Creek entrance does not adversely affect the value or health of the estuarine environment of Saltwater Creek and Lagoon and mimics, as much as possible, the natural wetting and drying regimes required by fringing wetlands*

Addressing **Issue J** (refer Section 4.4.3.2), this objective will ensure that the environmental implications of managing the entrance for flood control are duly considered. The wetland and estuarine environment within and fringing Saltwater Creek and Lagoon has become established based on the long-term hydraulic behaviour of the system. If this behaviour is to change, then the environment will respond. Therefore, future entrance management will need to consider flood control within the context of preventing any long term detrimental impacts on the local wetlands and estuarine environment.

***Objective (10)*** *Ensure that water levels in the estuary do not unduly compromise the recreational opportunities offered by the Saltwater Creek / South West Rocks area*

Addressing **Issue K** (refer Section 4.4.3.3), Objective 10 will ensure that the recreational values of Saltwater Creek and Lagoon are also considered in light of long-term water level and entrance management. The recreational opportunities afforded by Saltwater Creek and Lagoon are considered to be important assets for the local South West Rocks tourism industry.

***Objective (11)*** *Ensure that all entrance works are carried out by authorized persons or their representatives only*

Addressing **Issue L** (refer Section 4.4.3.4), this objective will ensure that any artificial opening of the Saltwater Creek entrance will be conducted by authorised personnel only. In the past the entrance has been illegally opened by unauthorised members of the community. Unauthorised openings are only likely to occur when there is inconsistency or ambiguity regarding the roles and responsibilities associated with entrance management.

***Objective (12)*** *Allow for selective temporary access across creek entrance during particular circumstances when the creek is open*

Addressing **Issue M** (refer Section 4.4.3.5), this objective aims to provide a mechanism for temporarily modifying the entrance condition of Saltwater Creek to allow for access between front beach and the Surf Life Saving Club. It is expected that such requirements would occur only very occasionally, as for the majority of time, the entrance of the creek is already closed (refer Section 2.5.1).

## 5.4 Future Catchment Development Objectives

***Objective (13)*** *Ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon*

Addressing **Issue N** (refer Section 4.4.4.1), this objective aims to ensure that future development has no net detrimental impact on the existing condition of the estuary. This includes no loadings to the estuary (volumes and pollutants) above existing conditions, and no loss of important buffering / filtering vegetation between existing urban development and the waterway environment.

***Objective (14)*** *Ensure that all future development controls consider the environmental sensitivity of Saltwater Lagoon and Creek*

Also addressing **Issue N** (refer Section 4.4.4.1), Objective 14 seeks to recognise the environmental significance and sensitivity of Saltwater Creek and Lagoon with respect to future development controls, including any controls placed on future urban development approved within the catchment. It is expected that these controls would focus on the value of vegetation within and around the estuarine environment, and supplementing this with revegetation throughout the catchment, especially along drainage lines, which would be used to improve the natural filtering capacity to the creek and lagoon system.

## 5.5 Summary of Objectives

***Water Quality***

***Objective (1)*** *Reduce the urban stormwater pollutant loads entering Saltwater Creek and Lagoon*

***Objective (2)*** *Ensure that the water quality of Saltwater Creek and Lagoon is compatible with the recreational uses of the estuary*

***Objective (3)*** *Ensure that the contamination of the former oil terminal site does not degrade the existing or future estuarine environment of Saltwater Creek and Lagoon*

***Objective (4)*** *Reduce the impact of on-site sewage treatment systems on the surface water quality of Saltwater Creek and Lagoon*

***Objective (5)*** *Prevent the generation of acidic runoff resulting from activities carried out on potentially acid sulfate soils surrounding Saltwater Creek and Lagoon*

***Ecology / Biodiversity***

***Objective (6)*** *Prevent any further loss or damage to the habitats around the lagoon that are valued by the local ecological communities, including the vegetation that provides an important buffer between*

*the estuary and existing development, and enhance existing habitats through targeted restoration and rehabilitation*

***Objective (7)*** *Ensure fire and weeds are managed appropriately on private properties surrounding Saltwater Creek and Lagoon*

***Entrance Management (and flooding)***

***Objective (8)*** *Ensure that water levels in Saltwater Creek and Lagoon do not compromise the functioning of existing assets around the estuary*

***Objective (9)*** *Ensure that any artificial manipulation of the Saltwater Creek entrance does not adversely affect the value or health of the estuarine environment of Saltwater Creek and Lagoon*

***Objective (10)*** *Ensure that water levels in the estuary do not unduly compromise the recreational opportunities offered by the Saltwater Creek / South West Rocks area*

***Objective (11)*** *Ensure that all entrance works are carried out by authorized persons or their representatives only*

***Objective (12)*** *Allow for selective temporary access across creek entrance during particular circumstances when the creek is open*

***Future Catchment Development***

***Objective (13)*** *Ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon*

***Objective (14)*** *Ensure that all future development controls consider the environmental sensitivity of Saltwater Lagoon and Creek*

## 5.6 Ranking of Objectives

The objectives of the Estuary Management Plan, as described above, have been ranked in order to assist with prioritisation of future management strategies. In essence, strategies that address the most important issues / objectives, will be implemented first so that maximum benefit to the estuary can be achieved within the timeframe of this Plan (i.e. approximately 5 years before a complete review).

The objectives have been ranked in consultation with the Coast and Estuary Management Committee through the workshop process (as described in Section 3.1). Each committee member was asked to score each objective between 1 and 5 (1 representing a low priority and 5 representing a high priority). The responses from the committee members were collated and the scores for each individual objective averaged.

The overall ranking of the specific objectives is presented in Table 5-1, in order of priority.

**Table 5-1 Prioritised list of Management Objectives**

| Rank | Objective No. | Objective description | Issues addressed | Relative Score 1 = low, 5 = high |
|---|---|---|---|---|
| **1** | 13 | *Ensure that all future development does not place any additional stress on the existing natural environment of Saltwater Creek and Lagoon* | N | 4.6 |
| **2** | 14 | *Ensure that all future development controls consider the environmental sensitivity of Saltwater Lagoon and Creek* | N | 4.6 |
| **3** | 1 | *Reduce the existing urban stormwater pollutant loads entering Saltwater Creek and Lagoon* | A | 4.4 |
| **4** | 6 | *Prevent any further loss or damage to the habitats around the lagoon that are valued by the local ecological communities, including the vegetation that provides an important buffer between the estuary and existing development, and enhance existing habitats through targeted restoration and rehabilitation* | F, G | 4.3 |
| **5** | 9 | *Ensure that any artificial manipulation of the Saltwater Creek entrance does not adversely affect the value or health of the estuarine environment of Saltwater Creek and Lagoon* | J | 3.8 |
| **6** | 2 | *Ensure that the water quality of Saltwater Creek and Lagoon is compatible with the recreational uses of the estuary* | B | 3.5 |
| **7** | 3 | *Ensure that the contamination of the former oil terminal site does not degrade the existing or future estuarine environment of Saltwater Creek and Lagoon* | C | 3.4 |
| **8** | 4 | *Reduce the impact of on-site sewage treatment systems on the surface water quality of Saltwater Creek and Lagoon* | D | 3.4 |
| **9** | 11 | *Ensure that all entrance works are carried out by authorized persons or their representatives only* | L | 3.3 |
| **10** | 12 | *Allow for selective temporary access across creek entrance during particular circumstances when the creek is open* | M | 2.7 |
| **11** | 5 | *Prevent the generation of acidic runoff resulting from activities carried out on potentially acid sulfate soils surrounding Saltwater Creek and Lagoon* | E | 2.5 |
| **12** | 8 | *Ensure that water levels in Saltwater Creek and Lagoon do not compromise the functioning of existing assets around the estuary* | I | 2.4 |
| **13** | 7 | *Ensure fire and weeds are managed appropriately on private properties surrounding Saltwater Creek and Lagoon* | H | 2.0 |
| **14** | 10 | *Ensure that water levels in the estuary do not unduly compromise the recreational opportunities offered by the Saltwater Creek / South West Rocks area* | K | 2.0 |