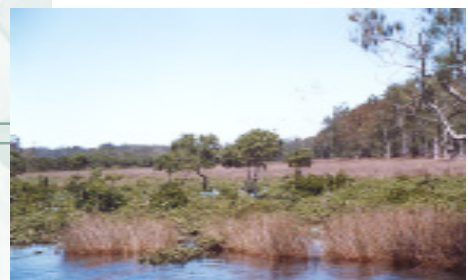


# Narrawallee Inlet

## Natural Resources Management Strategy



June 2002

# NARRAWALLEE INLET

## NATURAL RESOURCES

### MANAGEMENT STRATEGY

As adopted by Shoalhaven City Council  
On June 25<sup>th</sup>, 2002



# FOREWORD

## Why A Natural Resources Management Strategy?

The Narrawallee Inlet and its catchment are important community assets for environmental, economic, recreational and social reasons. Increasing demands for agricultural, residential and recreational opportunities need to be balanced with protection of the very values that people find attractive. . In response to these demands, Shoalhaven City Council and State Government Agencies have prepared this Natural Resources Management Strategy. This strategy has been developed promote the long-term protection of our environment, and to minimise our impacts on the natural resources of the area

This Management Strategy is accessible at libraries, Council offices and on the Shoalhaven City Council website – [www.shoalhaven.nsw.gov.au](http://www.shoalhaven.nsw.gov.au).

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Project supported by:



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# 1 INTRODUCTION

## 1.1 NARRAWALLEE INLET

The Narrawallee Inlet is located in the City of Shoalhaven on the New South Wales south coast, by road approximately 230 km south of Sydney, 60 km south of Nowra and six km north of Ulladulla. The village of Narrawallee forms the northern end of a continuous coastal urban community comprising Mollymook and Ulladulla (see Figure 1.1).

Narrawallee Inlet has four main tributaries – Croobyar, Yackungarrah and Currowar Creeks and Garrads Lagoon. The three creeks rise in the escarpment forests within 30km of the coast and wind through agricultural lands joining the estuary in a floodplain and wetland complex.

Most of the land surrounding the village is bushland, reserved for public recreation, environmental protection or scenic protection.

Narrawallee Inlet's waterways and their catchments are characterised by many environmental, social, commercial and recreational values that make them popular places for a wide variety of activities. However, the pressure of these uses has sometimes resulted in competition for and degradation of the area's natural resources.

## 1.2 AIM

This Narrawallee Inlet Natural Resources Management Strategy provides a comprehensive and integrated set of strategies **to restore, protect and conserve the natural resources of the Narrawallee Inlet its waterways and catchments so as to ensure that their use is ecologically sustainable in the long term.**

The plan has been prepared under the following hierarchy of NSW Government policies.

### 1.2.1 NSW Coastal Policy

The NSW Coastal Policy 1997 is the Government's policy for the co-ordinated planning and management of the NSW coastal zone. It aims to guide the management and planning of the coastal zone by co-ordinating the various policies, programs and standards that apply at both State and local government level including the Estuary Management Policy under which this Estuary Management Plan has been developed.

The goals of the Coastal Policy establish the overall long term outcomes for the policy to be implemented through specific objectives and strategic actions for which responsibility is assigned to government agencies, local councils and the wider community. Estuary management plans are one of the many tools by which the objectives of the Coastal Policy can be met.

### 1.2.2 Total Catchment Management

Total Catchment Management (TCM) is the overlying management approach that involves the coordinated use and management of land, water, vegetation, ecosystems and other resources within a drainage basin. In the Shoalhaven, the Southern Catchment Management Board manages TCM. In 2002, the Board released a draft blueprint for the management of natural resources in the region.

### 1.2.3 NSW Estuary Management Policy

The NSW Estuary Management Policy is one of several component policies under the umbrella NSW State Rivers and Estuaries Policy. The State Government has developed the

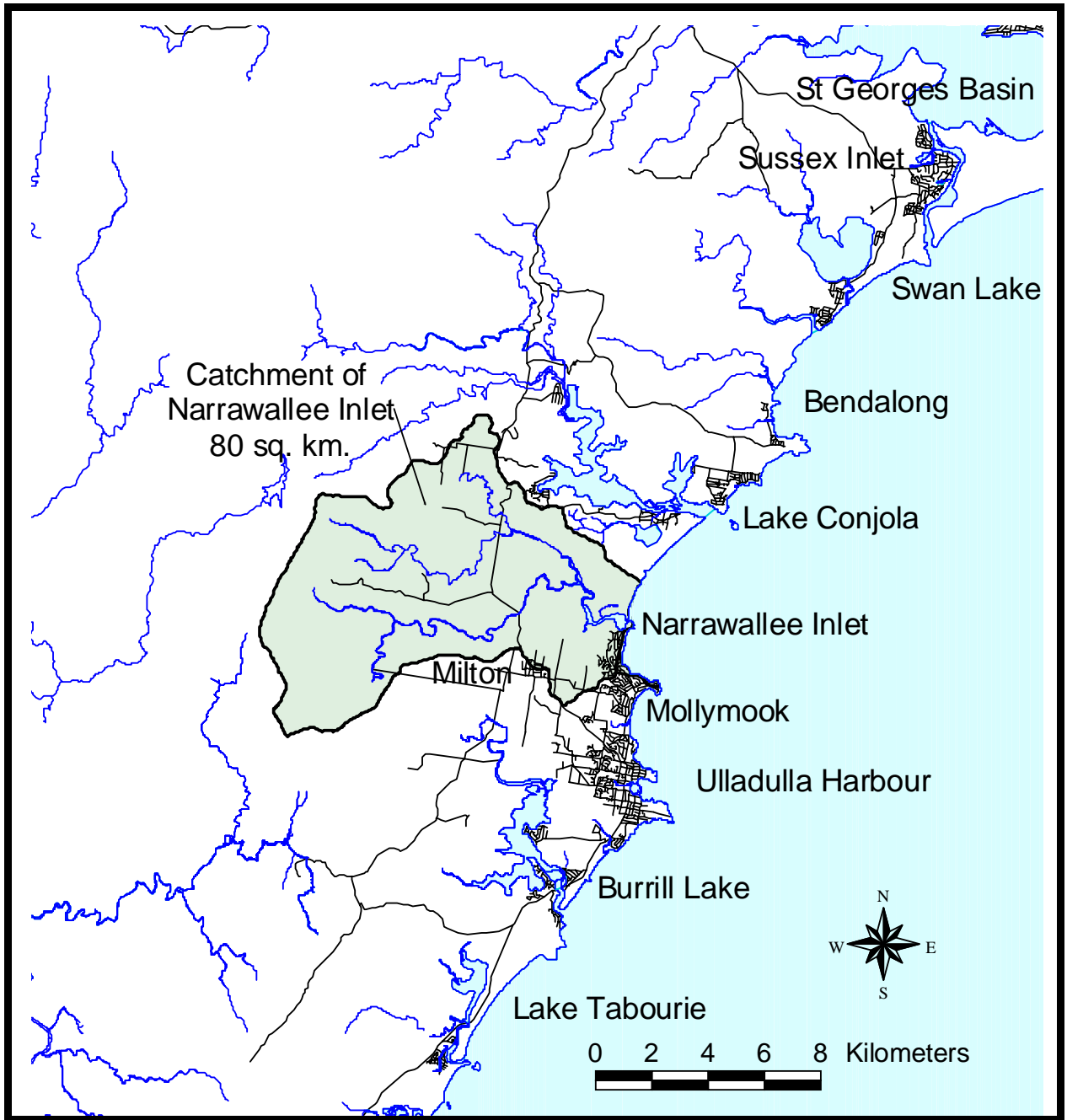


Figure 1.1. Location of Narrawallee Inlet

Estuary Management Policy in recognition of the ecological, social and economic importance of the State's estuaries and in response to concern about the long-term consequences of their accelerating degradation. This policy forms part of a suite of catchment management policies and 'provides for the assessment of all estuarine uses, the resolution of conflicts and the production of a unified and sustainable management plan for each estuary, including remedial works and the redirection of activities, where appropriate' (NSW Government 1992).

The goal of the Government's Estuary Management Policy is to achieve integrated, balanced, responsible and ecologically sustainable use of the State's estuaries, which form a key component of coastal catchments.

### 1.3 PLANNING PROCESS

This draft plan is a result of research, discussions and negotiations involving the Narrawallee Inlet Task Force, State Government Agencies, Shoalhaven Council, various community organisations and individual landowners and residents. The approach has been to examine the full range of issues and concerns affecting the inlet, its waterways and all of the lands in the catchment.

This approach to natural resource management is based on the following:

- The quality of estuaries is largely determined by management of their catchments;
- It is the policy of government to integrate the management of natural resources
- It is important to increase community understanding about how activities in the catchment impact the estuary
- Community input into planning will improve the ways that activities are managed in the catchment

- Estuary and catchment management should identify landcare needs in the catchment.

No specialised technical investigations or research were undertaken during the preparation of this plan. However, a number of issues which require further investigation have been identified as actions arising in the plan.

### 1.4 PLANNING FRAMEWORK

There were a range of policies, plans and strategies that were considered during the preparation of this plan.

These included:

- NSW State Rivers & Estuaries Policy
- NSW Wetlands Management Policy
- NSW Coastal Policy 1997
- Crown Land Foreshore Tenures Policy (non commercial occupations) (1991)

Some of the strategies in this plan may require amendments to Council policies, development controls or consents, permits and/or licences for works to repair existing degradation (eg bank revegetation) and to prevent future damage (eg sediment traps, artificial wetlands). The strategies will be taken into account in future planning for the area.

Actions carried out as a result of this plan will have to comply with legislation and statutory instruments such as:

- *Local Government Act 1993* (Shoalhaven City Council)
- *Environmental Planning & Assessment Act 1979* (Dept Planning)
- *State Environmental Planning Policy No. 14 - Coastal Wetlands* (Dept Planning)
- *State Environmental Planning Policy No. 35 - Maintenance Dredging* (Dept Planning)
- *Local Environmental Plan 1985*, (SCC)

- *Crown Lands Act 1989* (Dept Land and Water Conservation)
- *Rivers and Foreshores Improvement Act 1948* (DLWC)
- *Soil Conservation Act 1938* (DLWC)
- *Coastal Protection Act 1979* (DLWC)
- *Native Vegetation Conservation Act 1998* (DLWC)
- *Maritime Services Act 1935* (Waterways Authority)
- *Fisheries Management Act 1994* (NSW Fisheries)
- *Protection of the Environment Operations Act 1997* (EPA)
- *National Parks & Wildlife Act 1974* (NSW NPWS)
- *Threatened Species Conservation Act 1995* (NSW NPWS).

The information and actions in the plan will be used by Council to develop its Strategic Business Plan that forms part of its internal Management Plan required under the Local Government Act. Many outcomes of the strategies and actions in the Plan will be reported in the State of the Environment Report.

### **1.5 ASSISTANCE**

Shoalhaven City Council and the Commonwealth Government (Natural Heritage Trust, National Landcare and Coast and Clean Seas) provided financial assistance for the preparation of this plan.

In addition, technical assistance has been provided by:

- Department of Land & Water Conservation (DLWC)
- Southern Catchment Management Board
- Environment Protection Authority, NSW (EPA)
- Waterways Authority
- NSW Fisheries
- NSW National Parks & Wildlife Service (NPWS)

- Environment Australia and the National Oceans Office

### **1.6 CONSULTATION**

The Narrawallee Inlet Task Force was established in 1996 and re-established in 2000 as an advisory committee to Shoalhaven City Council. It provides a forum for resolving conflicting demands on Narrawallee Inlet's waterways and advises on long-term management strategies.

Committee members are drawn from the local community, together with Council and State Government representatives. The Task Force was established to perform the role of an Estuary Management Committee in accordance with the Estuary Management Policy. Task force members have contributed greatly to the preparation of this plan.

In addition to informal discussions held with many other people that have an interest in Narrawallee Inlet, the broader community has had the opportunities to contribute to the preparation of this plan.

A questionnaire was distributed to gauge the Narrawallee Inlet community's opinions on values and issues, as well as to provide information on their use of the natural resources of the catchment. Approximately six hundred were distributed in November 2000 by letterbox drop at to all residential areas in Narrawallee and Milton and by mail to all ratepayers with a rural postal address.

One hundred and forty six responses were received before Christmas 2000. Results are summarised on pages 15 to 18 and 44.

This plan is the next phase of formal consultation during the preparation of the Natural Resources Management Strategy for Narrawallee Inlet.

## **2 NARRAWALLEE INLET, ITS TRIBUTARIES AND CATCHMENT**

### **2.1 LOCATION AND CHARACTER**

The Narrawallee Inlet is a narrow water body approx 4km long that is permanently open to the sea.

An estuarine wetland and coastal forest association surround the inlet and township. Three major tributaries to the inlet, Croobyar, Yackungarra and Currowar Creeks, cross these wetlands into an alluvial floodplain after crossing the rich agricultural soils of the Milton Monzonite.

Narrawallee is a residential area almost fully developed. It is a popular recreational site for both locals and visitors. Though there are few specific tourist accommodation or facilities, many houses are holiday residences. The area receives many day visitors and the population of the area increases significantly in holiday periods.

The catchment of the inlet includes the Narrawallee suburb, part of the town of Milton, large areas of agricultural soils, native forest recently included in the Morton National Park, native forest in private ownership and significant areas of rural residential development.

### **2.2 THE COAST AND ESTUARY**

The Narrawallee Inlet enters the sea immediately north of Narrawallee Headland; a 3 ha vegetated outcrop rising 26m above the surrounding area. An aquatic reserve has been proposed for this rock platform and sub tidal zone. To the south, Narrawallee Beach extends 1.2 km towards Bannisters Point. To the north, Buckley's Beach extends 5km north towards the Lake Conjola entrance

The inlet is a mature estuarine complex open to the sea. It has an apparently very stable entrance.

A large sand shoal is located on the southern shore, and the channel runs permanently along the northern side. A shallow channel extends along the southern side of this shoal.

Storms can send large waves into the inlet, and deposit large volumes of marine sand. Floods and tides would rework and redistribute this sand within the inlet, shoal and beach systems.

The inlet is a place where marine and terrestrial processes interact to produce a particularly sensitive and complex coastal environment.

This sea level rise six thousand years ago triggered the shoreward transport of huge volumes of sand that accumulated as beaches, many of which blocked off bays and river mouths. The Narrawallee inlet is the result of one such drowned river valley.

The action of tides, storms and floods has resulted in the infilling of most of the Narrawallee Inlet, predominantly with marine sands.

The wetland complex and the low-lying farmland represent an infilled drowned valley system that developed to this stage prior to human involvement. Since European settlement, a variety of works including weirs, walls, infilling and channels have reduced the extent of the estuary to that which exists today.

The estuary in Croobyar Creek ends in a weir that restricts saltwater intrusion into the low lying farmland, as well as providing a source of fresh water for dairying and grazing purposes.

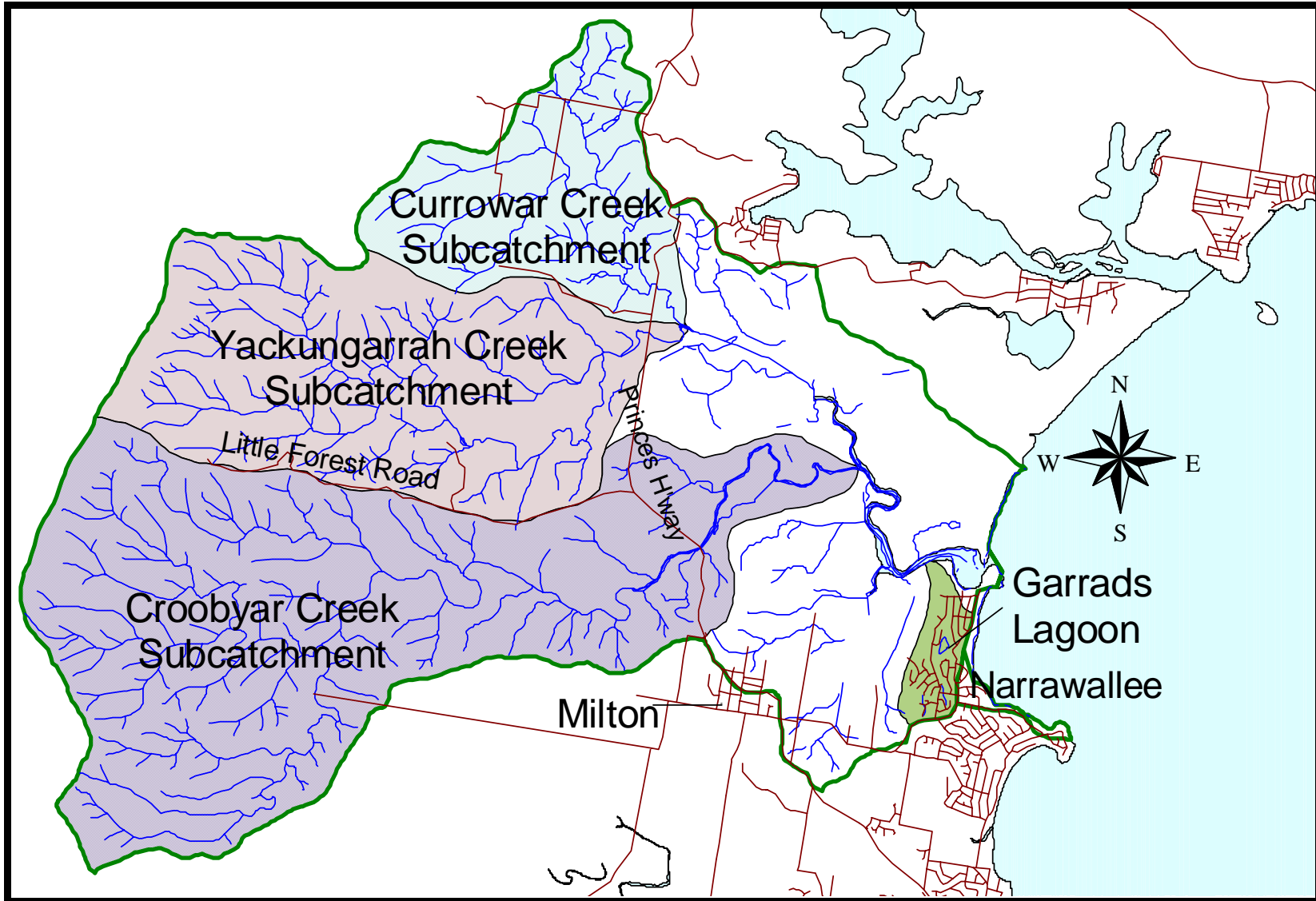


Figure 2.1. Narrawallee Inlet and its Catchments

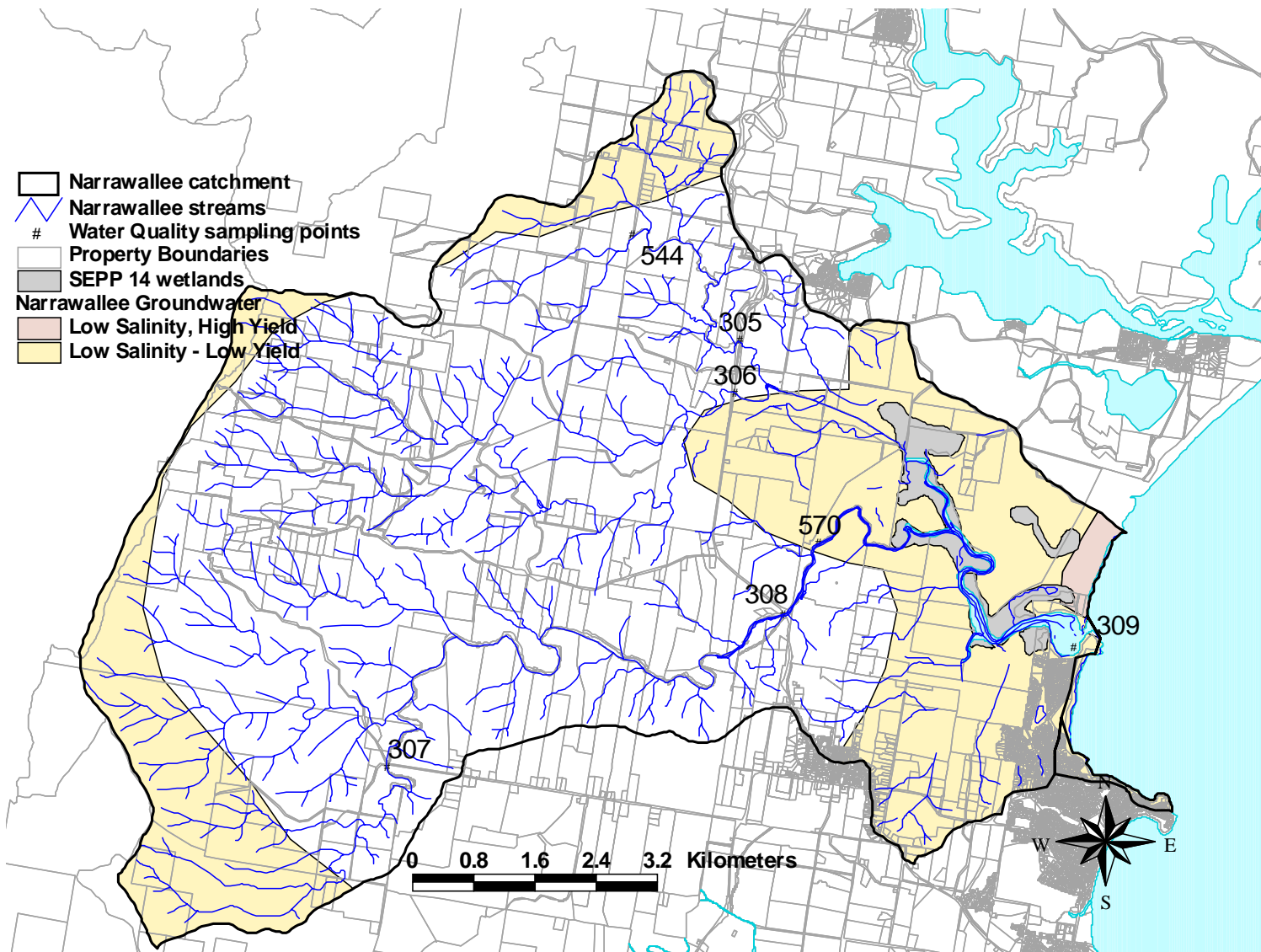


Figure 2.2. Freshwater and Aquatic Features

Water quality testing at the entrance consistently shows excellent water quality as a result of the tidal exchange.

The bed of the inlet is Crown Land and is subject to the Crown Lands Act 1989. The Department of Land and Water Conservation have not assessed the submerged and intertidal areas of the inlet.

### **2.3 SURFACE WATER**

Croobyar, Yackungarra and Currowar Creeks all rise in the sandstone escarpment area in the west of the catchment. In this area, the creeks exhibit a characteristic pool and riffle habit.

Croobyar Creek then flows through the Monzonite country where the character of the creek changes. There are few pools in this area, and the creek has tended to dry out completely during dry times. The previous Water Resources Commission installed a number of weirs along its length, in order to supply water to farms for stock and domestic uses. There are no fish ladders on any of these weirs. These weirs still provide some function in providing water for stock.

Yackungarra and Currowar Creeks flow directly from the sandstones onto the alluvial soils. Across the alluvial floodplain, the creeks flow slowly with little fall in elevation. On Boolgatta Flat, there are visible relic meanders and channels. Towards the inlet, a constructed drainage channel has replaced the entire original stream.

The creeks finally flow through an alluvial plain of agricultural lands and fresh and salt water wetland complexes before entering the inlet.

SCC monitoring has revealed a poor water quality in the lower reaches of Croobyar, Yackungarra and Currowar Creeks during the past 10 years at the sampling locations. This has largely

been due to high inputs of bacteria, sediment and nutrients, particularly after rainfall events

Yackungarra Creek was reported as having the lowest water quality result for any Shoalhaven waterway in the 1997/98 State of the Environment Report (SCC 1998), indicating the impact of agricultural and rural residential uses.

During the 2000/01 monitoring period the Narrawallee Inlet catchment continued to have poor water quality, according to the water quality index used in the State of the Environment Reporting. Testing revealed high numbers of faecal coliforms in the upper catchment, and low oxygen levels, which are indicative of high organic loading from surface runoff. Possible sources of these pollutants are discussed in section 6.3

These results must be kept in context. The main monitoring site was shifted from near the entrance to Croobyar Creek upstream of the tidal weir because the testing results in the inlet were consistently excellent. Council has chosen to report on the water quality from areas that are largely cleared and zoned for agriculture and which receives no tidal flushing. These sampling sites provide an indication of the inputs to the system from the main land uses within the catchment.

### **2.4 GEOLOGY & SOILS**

The Narrawallee Catchment consists of three geological components.

The farming lands consist of soils derived from the Milton Monzonite, a volcanic laccolith that intruded into sedimentary layers approximately 255-260 million years ago. The Monzonite is chemically related to the Gerringong Volcanics to the north and the Mount Dromedary intrusion in the south. The rock shows large crystals of plagioclase in a groundmass of ferro-

magnesium minerals. The Milton Monzonite extends for an area approximately 8km in diameter, which includes the bulk of the rich soils of the Milton farming district. The soils are derived directly from the breakdown of the Monzonite. Only the higher points in the district show outcrops. A scree slope of monzonite-derived rocks covers a number of steeper sites, where remains of sub-tropical rainforest persist. (Taken from Thompson and Mitchell 1999)

The areas surrounding the Monzonite are conglomerates, siltstones and sandstones of the Conjola Formation, laid down in the Permian period. These typically have only a shallow soil cover, with a build up of alluvial soils along the watercourses. They are support dry sclerophyll eucalypt forests.

The flat lands adjoining the estuary and the lower reaches of the creeks are alluvial soils, developed as a floodplain and in estuarine conditions over the past 5000 years. Extensive wetlands have been drained over the past 150 years, leaving highly productive soils. Regular flooding and drainage limit their use.

Some of these alluvial soils are underlain with layers of acid sulfate material that may cause serious environmental problems if they are disturbed or drained. Acid sulfate soils when exposed to oxygen produce sulfuric acid that can pollute the creeks and estuary and severely degrade the aquatic ecosystem. Severe development restrictions apply to these lands.

## 2.5 GROUNDWATER

Groundwater resources exist in the sandstones and beach sands along the eastern edge of the catchment. This provides a high yield of low salinity water with high iron content. No assessment of water quality has been done.

## 2.6 NARRAWALLEE INLET HABITATS

**Estuarine Ecosystem** The Narrawallee Inlet represents a clean and largely unchanged estuarine ecosystem involving sea grass beds and an apparent abundance of aquatic species. It shows only minor modification of habitat with few water quality problems. The banks are largely stable with only a few instances of undercutting or headcutting. According to West et al (1985), the estuary contains

- 378 Ha of mangroves
- 14 Ha of seagrass (*Zostera* spp)
- 91 Ha of saltmarsh

**Freshwater ecosystem.** Clearing, on the other hand, has changed the freshwater system. Much of the riparian vegetation has been removed on the agricultural lands. The creek banks are largely unfenced and are grazed by cattle. Weirs restrict the movement of species up Croobyar Creek. No detailed assessment has been done of the freshwater ecology.

### **Freshwater and estuarine wetlands.**

The estuarine wetlands in both the Narrawallee Creek Nature Reserve and on private lands are in a near natural state. 196 ha are protected under SEPP 14. Most of the wetlands and adjoining buffer areas are zoned for environment protection. The estuary has well vegetated foreshore for most of its length, of grey and river mangroves, swamp oaks and bangalay communities.

### **Coastal Eucalypt/Banksia forest along dune system**

This provides a magnificent backdrop to the beach and to the township, making the beach feel very remote from the urban area. There has been major damage to the dunes from ocean storms, most recently in the 1970s. There has been some damage to trees along the foreshore, in an attempt to obtain views by some residents. The dune

system in the nature reserve has well-developed parallel dunes with old growth forests. In the past, this provided a good source of Blackbutt timber.

### **Eucalypt and Turpentine Forests**

Remnant eucalypt forests with good fauna populations separate the Narrawallee urban area from the wetlands and farmland to the west. These provide a natural backdrop to both Narrawallee and Milton urban areas. These forests have an important visual role from both Milton and Narrawallee.

**Forest Red Gum Forests** The bulk of the Milton farming lands were originally covered by forest red gum, which now survives intact in only a small number of locations. There are scattered copses of old trees on various farms throughout the catchment, for example on either side of the highway on Boolgatta Flat.

**Subtropical Rainforest** Moist and dry subtropical rainforest pockets occur at and around the Yatteyattah Nature Reserve, as well as on the steeper slopes around Milton and in some escarpment gullies. This rainforest type is described as inadequately preserved on the south coast (Robinson and Boefeldt 1997). Some assessment of these remnants has been done and they appear to be stable.

### **Escarpment eucalypt forests,**

Significant eucalypt forests comprising bloodwood, peppermint and stringybark occur in both the National Park and rural areas in the western portion of the catchment.

## **2.7 ABORIGINAL HERITAGE**

The Narrawallee Inlet catchment is located within the lands of the Wandandian speaking people and Budawang/Murramarang tribes of the Dhurga language group. The Ulladulla

Local Aboriginal Land Council covers the area.

The catchment has not been extensively surveyed for Aboriginal sites. The Narrawallee and Conjola silica deposits were an important source of stone for tools and were traded a considerable distance along the coast and inland. There are a small number of known middens or Aboriginal sites along the foreshore and in the Narrawallee and Yatteyattah Nature Reserves.

## **2.8 EUROPEAN HERITAGE**

Evidence remains of the silica mining operation. Ore was taken by rail across the entrance for export from Bannisters Point. Remains of this structure still exist in the sand spit and are often revealed after storms.

Milton and the agricultural lands of Boolgatta Flat retain much evidence of the original dairying industry and early European settlement. Milton has a significant number of historic buildings and structures. The pastoral landscapes around Milton identify the original patterns of land subdivision from the 19<sup>th</sup> century.

## **2.9 RESOURCE USE**

### **2.9.1 Waterways**

Narrawallee Beach is very popular for swimming and surfing. More recently, commercial sea kayaking and the use of personal water craft (PWCs) have become popular in the ocean waters adjacent to the village. The use of PWCs may conflict with other passive recreational activities within the enclosed area of the inlet.

The estuary is used for fishing, swimming, canoeing and boating. The upper reaches are less frequently used, and represent a very quiet, natural narrow waterway of great beauty. The foreshore reserve is very important for walking and picnics.

Some recreational fishing and bait collection occurs in the Inlet. The limited commercial fishing in the Inlet is due to be phased out by the end of 2002.

A public boat ramp is located on the southern side of the inlet, although boat access is limited to the top of the tidal range.

In general, waterway usage increases greatly during the summer months and holiday periods. Narrawallee Inlet is a popular tourist destination for families. Tourist accommodation is restricted to the letting of holiday houses and weekenders. However, the area, in particular the surfing beach, is intensively used by both residents and visitors staying in the Mollymook and Ulladulla areas. The peak tourist seasons are over the summer holiday period and at Easter.

### 2.9.2 Surface Water

Croobyar, Yackungarra and Currowar Creeks are used for rural water supply for stock and domestic uses. The extent or number of users is not known. At least two irrigation licences occur on Croobyar Creek.

### 2.9.3 Groundwater

High yield, low salinity groundwater reserves occur in the dune system in the Narrawallee Creek Nature Reserve. Low yield, low salinity groundwater is found in within 3-4km of the coast and under the wetland system. Narrawallee is serviced by a reticulated water supply, (treated Shoalhaven River water). Groundwater is used for watering of gardens in the Narrawallee suburb.

### 2.9.4 Land Use

Land use in the Narrawallee Inlet area is subject to the Shoalhaven Local Environmental Plan (LEP) 1985, as amended. The area south of the estuary and Croobyar Creek was

included in the Milton Ulladulla Structure Plan, leading to the release of the Milton Ulladulla Strategy in 1996. Amendments to the draft LEP currently on exhibition implement changes arising from this Structure Plan. These amendments;

- rezone lands on the western fringe of Narrawallee for residential uses and for environmental protection;
- expand the scenic protection zoning along the inlet; and
- identify the corridor for the highway diversion to the west of Milton.

The land area for the land use zones is shown in Table 2-1. Figure 2-3 shows the land use zoning as at October 2001.

**Table 2.1** Zoning categories and land areas as at October 2001.

Zone	Description of zone	Area in ha	% Area
1A	Agricultural Production Zone	2279	27%
1A (LEP 127)	Agricultural Production Zone proposed for rural lifestyle use and deferred	503	6%
1B	Rural Zone-Arterial and Main Road Protection	506	6%
1C	Rural Lifestyle Zone	377	5%
1D	General Rural Zone	1448	17%
1G	Rural Flood Liable Zone	75	1%
2	Various Residential Zones	135	2%
3	Various Business Zones	3	0%
5	Various Special Use Zones	8	0%
6	Various Open Space – Recreation Zones	71	1%
7A	Environment Protection Ecology Zone	173	2%
7D	Environment Protection Scenic Zone	506	6%
7E	Environment	183	2%

	Protection Escarpment Zone		
7F	Environment Protection Coastal Zone	3	0%
8	National Park including previous State Forests	2093	25%

A large area of land in the catchment is agriculture, including dairying, grazing, horticulture and other uses. This agriculture is predominantly located on the Milton Monzonite and on the alluvial floodplain. The number of dairies has declined from 3 to 2, although production on individual farms is intensifying. Appropriate infrastructure (bulk milk handling, abattoir and sale yards) exists in the area to maintain this agriculture.

The general rural zone comprises a mixture of grazing, forestry and native vegetation on steeper land in the sandstone country. Some residential development exists along Little Forest Road.

Three Rural Lifestyle Zones exist, along Little Forest Road, Pointers Road and Garrads Lane. Four additional areas were proposed as rural lifestyle zones in the Rural Plan amendments but remain deferred. The future of any development in these deferred areas is undecided. The Structure Plan estimated that one lot per five hectares would be sustainable in these areas, although recent subdivision approvals have yielded a significantly higher number of lots.

Narrawallee and Milton urban areas are mostly zoned residential 2A1, with a lower density residential zone the eastern edge of Milton. Most privately owned land that is zoned for residential development has been developed. The Structure Plan specifies that both townships should not expand beyond their current zoned

areas, and that a sharp boundary be maintained between the urban and rural areas. Overall, the potential for expansion of both Narrawallee and Milton under current planning controls is quite limited.

The 1996 Settlement and Population Statistics for Narrawallee Inlet are shown in Table 2-2.

**Table 2.2** 1996 Settlement Population Statistics.

Town/Area	Population 1996	Population growth, 1991-96
Milton	1030	1.0%
Narrawallee	892	4.4%
Rural	n/a	4.6%

Most of the foreshore land is zoned for environmental protection (both ecology and scenic protection), flood prone land or National Park.

A significant area of the catchment is National Park. This includes the escarpment forests of the Morton National Park, the rainforests of the Yatteyattah Nature Reserve and the coastal and estuarine wetlands in the Narrawallee Creek Nature Reserve. Plans of management are underway for the Yatteyattah Nature Reserve (on exhibition) and the Narrawallee Creek Nature Reserve (in preparation). Residents and visitors use these areas as a recreational resource (especially for walking and nature observation).

The Milton Monzonite represents a significant reserve of hard rock for possible use in road building and in construction. The Department of Mineral Resources has identified the Little Forest Monzonite Deposit as a potential extractive resource. There are various other hard rock sites that are unlikely to be exploited.

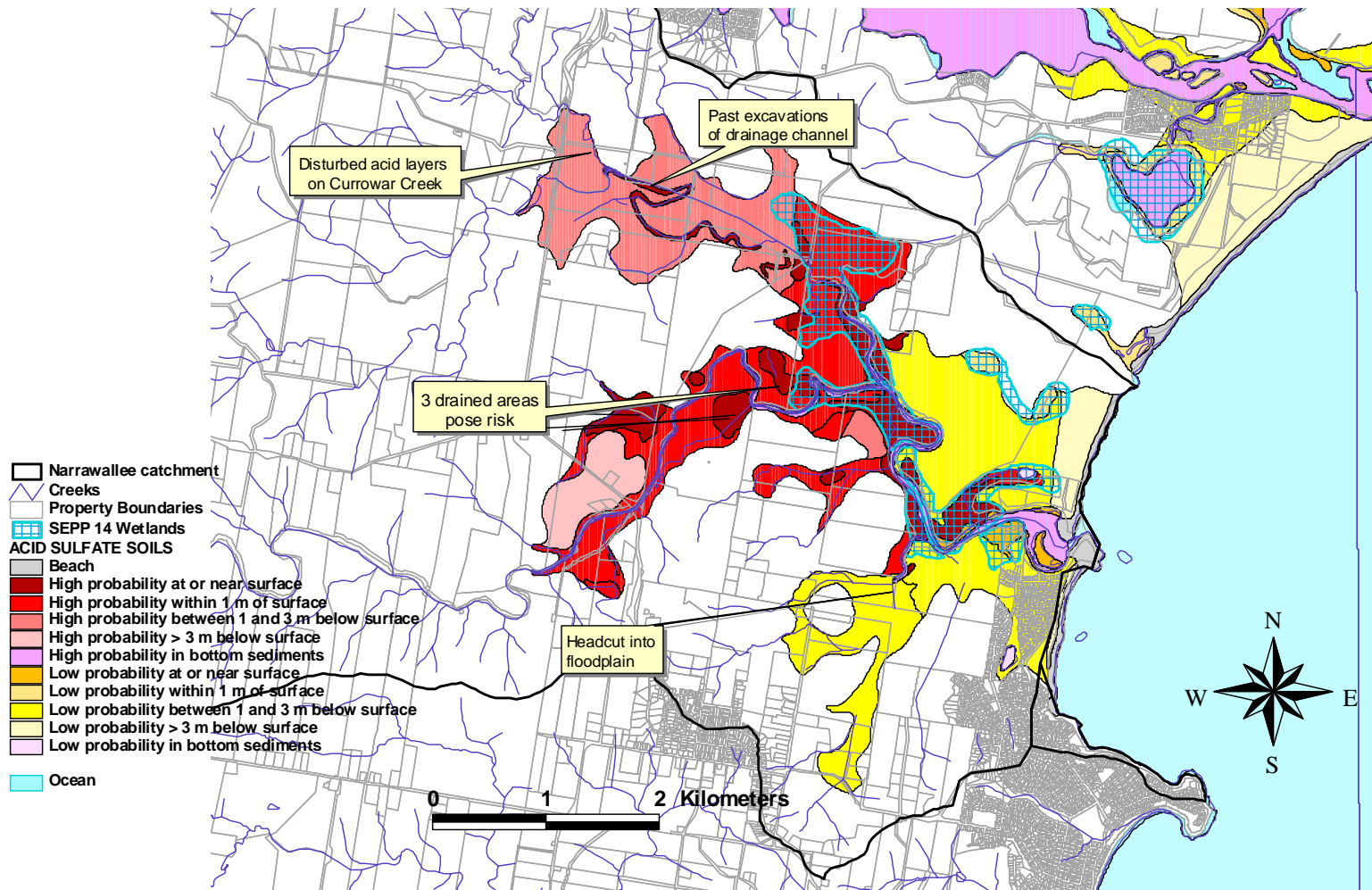


Figure 2.3. Acid Sulfate Soils

Narrawallee Inlet Natural Resources  
Management Strategy



### 3 KEY ISSUES

The equitable management of a resource requires identification of the key ecological, social and economic values that people with an interest in the area consider important and wish to see preserved into the future. Values can be important in a local, regional or national sense.

The following statements of what is important about Narrawallee Inlet and its catchment were taken from records of public meetings, Task Force meetings and from other research on the area. A survey of residents was undertaken in 1999, and respondents were asked to rate these statements according to whether they considered them to be high, medium or low importance.

The table shows the percentages of responses for each of these value statements.

The priority score was established by creating an index. A score of plus one was attributed to a reply of high importance, and a score of minus one for a reply of low importance. No score was given for replies in the medium importance. For ease of comparison, this value was divided by the total number of questionnaires returned. The index is therefore a number between zero and one. This index aims to take into account scores for all three columns. The categories have been grouped to break up the list a little.

Additional values identified by respondents in the survey included;

- Trees on both public and private land
- Unique tranquil inlet
- Special and beautiful area;
- The whole inlet
- Coastline
- Peace and quiet

- No cost access, picnic facilities and amenities
- Passive recreation area including both the waterway and foreshores;
- Nature strip behind beach
- Safe swimming area;
- Unique so close to urban area;
- Fishing still good;
- Absence of broken bottles and syringes; clean beaches;
- Sea eagles on North Narrawallee Headland
- Natural foreshore appearance;
- Beautiful approaches to Milton and Narrawallee
- Sustainable dairying, recreation and residential areas

**Table 3.1 NARRAWALLEE INLET QUESTIONNAIRE, RANKING OF VALUES, DECEMBER 2000**

		<b>Score</b>	High	Medium	Low
AQUATIC	Water quality of the creeks and inlet	<b>0.97</b>	97%	1%	1%
SCENIC	The scenic quality of the entrance area, tidal flats, foreshores, beaches & headlands.	<b>0.94</b>	95%	4%	1%
TERRESTRIAL	Habitat for threatened and common native animals and birds	<b>0.88</b>	90%	6%	2%
AQUATIC	Populations of wading birds, fish and other aquatic animals	<b>0.87</b>	88%	8%	1%
TERRESTRIAL	The small pockets of remnant rainforest	<b>0.84</b>	86%	11%	2%
TERRESTRIAL	The coastal bushland and heath adjacent to the Narrawallee urban area	<b>0.82</b>	86%	10%	4%
TERRESTRIAL	The tall forests in the west of the catchment	<b>0.82</b>	86%	10%	4%
RECREATION	Recreational destination for local families with a safe environment for young children	<b>0.80</b>	86%	9%	5%
AQUATIC	Seagrass beds, mangroves and foreshore vegetation	<b>0.78</b>	82%	14%	3%
AQUATIC	The extensive wetlands around the inlet	<b>0.78</b>	83%	10%	5%
TERRESTRIAL	Vegetation on the banks of creeks	<b>0.73</b>	77%	19%	3%
RECREATION	Nature-based recreation, walking, and education in the wetlands and nature reserve	<b>0.71</b>	74%	23%	3%
RECREATION	A diverse range of recreational activities, in particular boating, fishing and swimming.	<b>0.69</b>	72%	25%	3%
SOCIAL	Low key, coastal residential lifestyle.	<b>0.58</b>	64%	28%	6%
SCENIC	The landscapes of the current and former dairy farms around Milton	<b>0.48</b>	60%	27%	12%
HERITAGE	Historic buildings and sites of early European settlement	<b>0.36</b>	51%	32%	16%
SOCIAL	Productive and profitable dairy and grazing industries.	<b>0.32</b>	49%	34%	16%
HERITAGE	Aboriginal sites around the foreshore areas	<b>0.30</b>	49%	31%	18%

## 4 MANAGEMENT ISSUES

Key issues and conflicts associated with the area were identified by the community, task force members, Local, State and Commonwealth Government representatives and from previous studies and reports.

In the 1999 survey, residents were asked to rate this range of issues, according to whether they saw them as a major issue, a minor issue or not an issue at all.

These issues are discussed in detail in the management plan section of this strategy and, where appropriate, management actions are proposed for dealing with them.

Table 4.1 shows the percentages of responses for each of these issues.

The priority score was established by creating an index. To calculate the index, for each questionnaire a score of plus one was attributed to a reply of that the issues was a major issue, and a score of minus one for a reply of not an issue. No score was given for a reply of a minor issue. For ease of comparison, this value was divided by the total number of questionnaires returned. The index is therefore a number between zero and one. This index aims to take into account the differing levels of response. The categories have been grouped to break up the list a little.

Respondents were asked to list any additional issues that they considered to be of importance. 59 respondents (40% of all replies) did so. Many respondents took this an opportunity to highlight the issues that they considered to be the most serious. Issues that were frequently mentioned included;

- A halt to commercial fishing and illegal fishing;
- The noise and nuisance caused by power boats and personal water craft.
- Littering and rubbish dumping around the foreshore and bushland;
- Dogs on the reserve and foreshore and
- Development and subdivision in urban and rural areas.

New issues raised by respondents included;

- speeding cars and the large volume of traffic in summer
- sand build up in the inlet
- poor urban design
- poor management of roads, foreshore and natural areas
- illegal fishing and the catching of undersized fish and lobsters and
- signage and overhead wires.

**Table 4.1 NARRAWALLEE INLET QUESTIONNAIRE, RANKING OF ISSUES, DECEMBER 2000**

	Score	% major	% minor	% Not an issue
Pollutants in the stormwater run off from urban areas	<b>0.89</b>	89%	6%	1%
Introduced animals including foxes, cats, black rats and rabbits	<b>0.87</b>	88%	6%	3%
The spread of weeds in native bushland	<b>0.86</b>	86%	9%	3%
Powerboat and jet ski usage in the channel	<b>0.84</b>	87%	5%	5%
Littering and degrading of natural areas	<b>0.85</b>	84%	12%	1%
Loss of sensitive ecosystems, habitat for native species & rainforest remnants	<b>0.80</b>	81%	12%	3%
The threat to fish stocks from loss of habitat	<b>0.76</b>	81%	10%	6%
Foreshore erosion	<b>0.72</b>	76%	16%	5%
Clearing of foreshore vegetation	<b>0.68</b>	73%	15%	5%
Loss of the wildlife corridor linking the coastal and inland natural areas	<b>0.69</b>	73%	16%	7%
Public health risks in the Inlet from bacterial contamination	<b>0.68</b>	76%	8%	10%
Increased rural residential development	<b>0.65</b>	66%	26%	3%
The threat to fish stocks from recreational and commercial fishing	<b>0.64</b>	68%	21%	7%
Damage to wetlands through inappropriate grazing, rural or recreational uses.	<b>0.60</b>	66%	20%	8%
Expansion of the urban areas (Narrawallee and Milton)	<b>0.59</b>	64%	25%	8%
Illegal access to and camping on the foreshore	<b>0.51</b>	59%	26%	11%
Agricultural practices and grazing of the creek banks	<b>0.49</b>	57%	27%	11%
Erosion from driveways in both urban and rural areas	<b>0.49</b>	56%	29%	10%
Overcrowding and overuse of the recreational areas of the Inlet	<b>0.45</b>	57%	28%	12%
Damage to the remaining Aboriginal sites	<b>0.32</b>	49%	29%	18%
Adequacy of the recreational and boating facilities	<b>0.22</b>	45%	27%	23%
Land shortages and restrictions on the dairying industry	<b>0.09</b>	29%	41%	22%
Difficulties in launching boats at low tide	<b>-0.05</b>	32%	27%	37%

## 5 MANAGEMENT PLAN

### 5.1 MANAGEMENT AREAS, OBJECTIVES, STRATEGIES AND ACTIONS

This management plan is grouped into eight management areas:

1. Water Quality
2. Erosion and Sedimentation
3. Water Flow
4. Nature Conservation
5. Entrance Management
6. Recreation
7. Visual Quality
8. Cultural Heritage

Each management area is discussed in further detail in the following sections. The issues of concern are documented, as are the actions required to manage the concerns and the environmental performance measures necessary for gauging the effectiveness of the actions in achieving environmental outcomes.

Management objectives were developed to ensure that the area's key values are maintained or improved. The objectives developed address the eight management areas identified.

Management strategies have been written to achieve the management objectives by addressing identified issues.

Actions required to implement the strategies are detailed for each management area.

The various strategies and actions consist of:

- advice on planning and development controls
- protective and remedial works
- education programs

- monitoring and research.

### 5.2 IMPLEMENTATION

Responsibility for implementation of the Management Plan and its individual components lies with the various organisations and individuals listed in the tables. The Narrawallee Inlet Task Force will monitor and advise on this implementation.

Following this exhibition of the draft plan, submissions will be assessed; changes to the draft plan discussed by the task force and a final plan put to Council for adoption. Following adoption, the task force will work with government departments, community groups, the Southern Catchment Development Board and funding agencies to implement the plan.

Timing for implementation of strategies is indicated. Three timeframes for implementation were chosen: short (present to June 2003), medium (July 2003 to June 2006) and long term (July 2006 to June 2011).

Implementation will depend on cost of the strategies and available funds. Consequently, some low priority strategies may be implemented in the short term because they require little or no additional funding for implementation. Indicative costs of some actions are given in the tables.

### 5.3 FUNDING SOURCES

Council will fund many of the actions set out in the plan. The level of resources provided by Council will be balanced against all of Council's other priorities. A range of funding sources (both State and Commonwealth) is available to assist Council with implementation of the plan. Tables 5-1 and 5-2 indicate State and Commonwealth funding programs.

Some of these programs accept grant applications at any time during the year whilst others have fixed submission periods. The organisations and individuals responsible for implementation of the plan will have to develop and submit applications for funds in a timely manner.

**Table 5-1 State Funding Sources**

Department	Program
Department of Land and Water Conservation	Estuary Management Program Coastal Management Program Waterways Program Floodplain Management Program Rivercare Incentive Scheme Land Management Programs Native Vegetation Conservation Program Public Reserves Management Fund
Waterways Authority	Waterways Asset Development and Management Program
Roads & Traffic Authority	Roadside Vegetation/Corridors
NSW Fisheries	Fishcare Recreational Fishing Trust State Fishways Program
EPA	Environmental Trust Grants Stormwater Trust Program

Industries & Energy	Fisheries Research & Development Corporation
Environment Australia	Natural Heritage Trust
Department of Tourism	National Ecotourism Program Ecotourism Grants Program
Department of Employment Education and Training	Work for the Dole Green Corp Jobskills Program

#### 5.4 ADAPTIVE MANAGEMENT - REVIEW

The Management Plan will be reviewed on an annual basis. The success of the plan will be judged against specific environmental performance measures and targets developed to assess actions and strategies against objectives. The plan will need to be updated as new data and feedback from the performance measures become available, as strategies are implemented and as community values or issues change.

**Table 5-2 Commonwealth Funding Sources**

Department	Program
Department of Primary	Farm Forestry Rural Access Program

## 6 WATER QUALITY

### 6.1 VALUES

Water quality is one of the key factors determining the ecological character of an estuary. It is important to people using the estuary for recreational or commercial purposes, for the tourist industry and for those living on its foreshores and adjacent areas.

The water quality of Narrawallee Inlet is considered to be very good. The entrance is permanently open, and effective flushing occurs along the length of the estuary. However, problems do occur in Croobyar and Yackungarra Creeks after rainfall events, particularly with bacterial pollution, elevated levels of nutrients and finer sediments.

The health of the biological communities and habitats of ecological value found in the creek as well as the wide variety of recreational opportunities depend upon an acceptable standard of water quality.

### 6.2 OBJECTIVES

To ensure that water quality in the creeks and inlet meets the NSW Governments Interim Water Quality Objectives for the protection of aquatic ecosystems, visual amenity, secondary and primary contact recreation, limited household and livestock water supply and aquatic foods (cooked).

The EPA has established Water Quality Objectives for the estuaries and freshwater creeks of the Shoalhaven. These objectives are quite lengthy and complex. Those applying to both the Narrawallee Inlet and its creeks are as follows.

- Nitrogen and phosphorous should remain below .5 and .05 mg/ml respectively;
- Turbidity should remain in the very low range.
- pH should not fall below 6.5; and
- Waters should be free of floating debris and litter

Different objectives apply to bacterial counts. A lower bacterial level is required for those creeks used for household water supply (zero cfus per 100 ml). Otherwise, the level required for primary contact recreation would be the general goal (150 cfus per 100 ml).

The fundamental principles guiding water quality management should be the notion of continual improvement in the management of activities in the catchment, and the implementation of the National Water Quality Management Strategy (Australian and New Zealand Guidelines For Fresh and Marine Water Quality, ANZECC 2000).

Implementation of the new ANZECC guidelines is seen as a long-term objective. The first necessary stage is to implement changes to the water quality monitoring program as outlined in action 23.

### 6.3 ISSUES

The most recent State of the Catchment Report (1998/2000) concludes for the fresh water quality in the Narrawallee Inlet catchment as follows;

*The water quality index (for Croobyar Creek, site 570) was in the poor category for all four sampling periods. ... These results do not reflect the water quality in Narrawallee Inlet, which is usually excellent.*

Nutrient levels (the concentration of nitrogen and phosphorus in the water) at site 570 (Croobyar Creek below the highway. See map on page 7) consistently exceed the EPA maximum level, and greatly exceed it after rainfall events. Chlorophyll-a levels (an indicator of algal growth) are also high, most likely in response to high nutrients.

Bacterial levels regularly exceed the EPA guideline level at all sites in the tributaries. Turbidity, a measure of the amount of suspended sediment in the water, is also regularly very high at site 570. In comparison, turbidity levels are very low at sites higher in the catchment (site 307).

Testing of oxygen levels has consistently shown low dissolved oxygen levels in several creeks during dry periods with low flows (sites 305, 306 and 307).

All of these indicators can have serious impacts on the aquatic life in the freshwater creeks, and possibly in the upper reaches of the estuary. These may include direct kills as well as the reduction or significant changes in the habitat of native species.

Upstream land management practices in the catchment that may influence water quality include (not in order of importance): dairy and pig sheds; grazing and degrading of riparian areas; clearing, residential development; increases in the area of hard surfaces; poor road and driveway maintenance and construction. The Milton or Narrawallee urban areas are not upstream of the test sites.

Narrawallee has 650 hectares of soils with a high probability of acid sulfate layers. These are the farming lands and wetlands at the top of the estuary. There is some potential for acid sulfate pollution of the inlet from three areas of farmland that were previously wetlands, as well as from drain maintenance. There is some past evidence of disturbed acid layers on Currowar Creek. Some investigation is required to assess whether acid drainage into the inlet is occurring.

Important Water Quality issues ranked by the community during the preparation of this plan are included in the following table. Alongside each issue are some comments regarding the extent of the issues.

<b><i>Issue</i></b>	<b><i>Comment</i></b>
<i>Pollutants in the stormwater run off from urban areas</i>	There are no pollution traps below Milton, while sediment traps service one third of the Narrawallee urban area. Urban development in Narrawallee has generated significant amounts of fine sediment that has, for example, filled up the drainage line known as Garrads Lagoon.
<i>Foreshore erosion</i>	Several areas of localised undercutting of the bank exist. Undercutting of the reserve above and below the boat ramp has occurred where there is little foreshore vegetation. An active headcut exist on agricultural lands below Garrads Lane.
<i>Public health risks in the Inlet from bacterial contamination</i>	No evidence of bacterial contamination has been found in the inlet itself. However, high coliform levels have been found after rain

	events in the tributaries.
<i>Increased rural residential development</i>	Clearing, development works, on site effluent treatment and increases in hard surfaces are all possible generators of bacteria, sediment and nutrients. The extent of any impact on water quality is uncertain.
<i>Damage to wetlands through inappropriate grazing, rural or recreational uses.</i>	Some areas of wetlands have been grazed or damaged by vandalism.
<i>Agricultural practices and grazing of the creek banks</i>	There are now 2 dairies and one piggery in the catchment. Their effluent systems are regularly inspected and subject to government controls. Dairy and beef cattle graze most of the riparian zones though not on a permanent basis. The extent of creek bank fencing has increased. In some flood prone areas, fencing would not be possible. The significance of this issue on water quality is difficult to quantify.
<i>Erosion from driveways in both urban and rural areas</i>	Erosion of driveways is common in both urban and rural areas. However, it is uncertain how significantly this contributes to sediment and nutrients in the waterways.

#### 6.4 EXISTING DATA

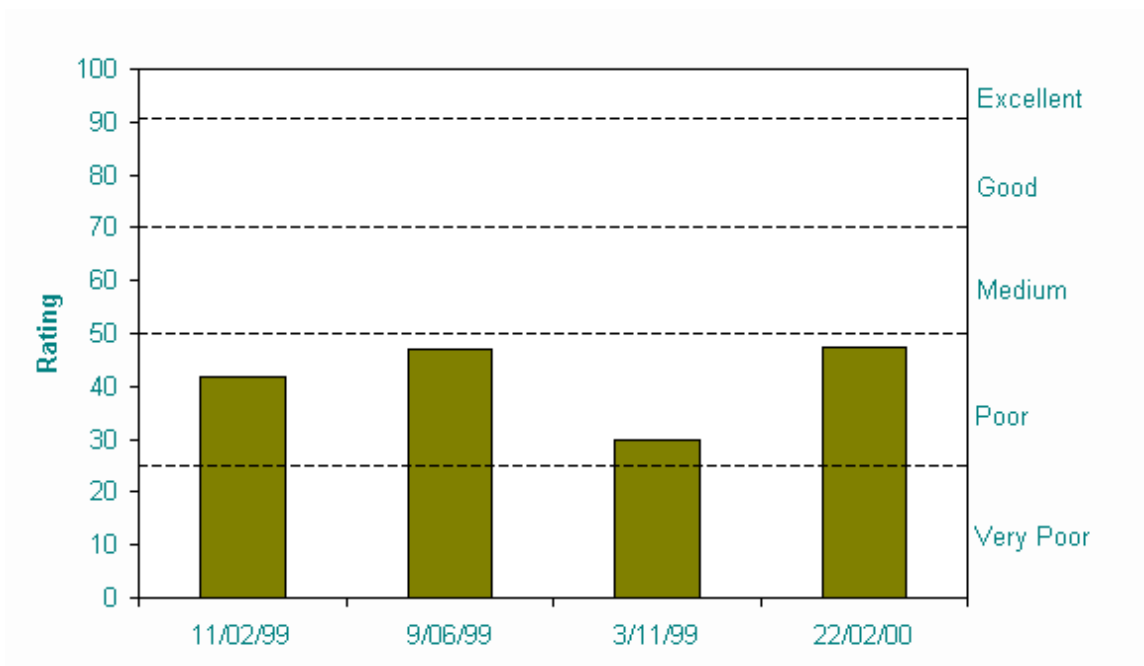
The issue that is not well understood is which of the land uses contribute most significantly to the water quality problems. There is little reliable data to identify what actions would most significantly contribute to water quality improvements. Council has completed a study in the neighbouring a study for the Burrill Lake Catchment, aimed at identifying where the most significant improvements can be made in water quality. This study concluded that works to improve riparian management would have the most significant impact on water quality.

Data measuring the physical, chemical and biological parameters of water quality in Narrawallee Inlet and its tributaries are available for the years 1991 to the present. Testing has occurred at a number of sites over this period (see figure 2.2). Data is

available for most sites for bacterial contamination, dissolved oxygen, pH, temperature, salinity and turbidity during this period. Nutrient testing was done initially at the entrance (site 309), and later at Croobyar Creek below the highway (site 570).

Water quality testing results for the period 1998-2000 can be found on Councils web site at [www.shoalhaven.nsw.gov.au/soer](http://www.shoalhaven.nsw.gov.au/soer)

In a bid to simplify the assessment of water quality monitoring data, Council has adopted a composite water quality index. The index for Croobyar Creek below the Highway (site 570) for the period 1999-2001 is shown in table 7.4.2. This should be read in conjunction with section 2.3, which explains the monitoring program.



**Water Quality Summary, Croobyar Creek (Site 570).**

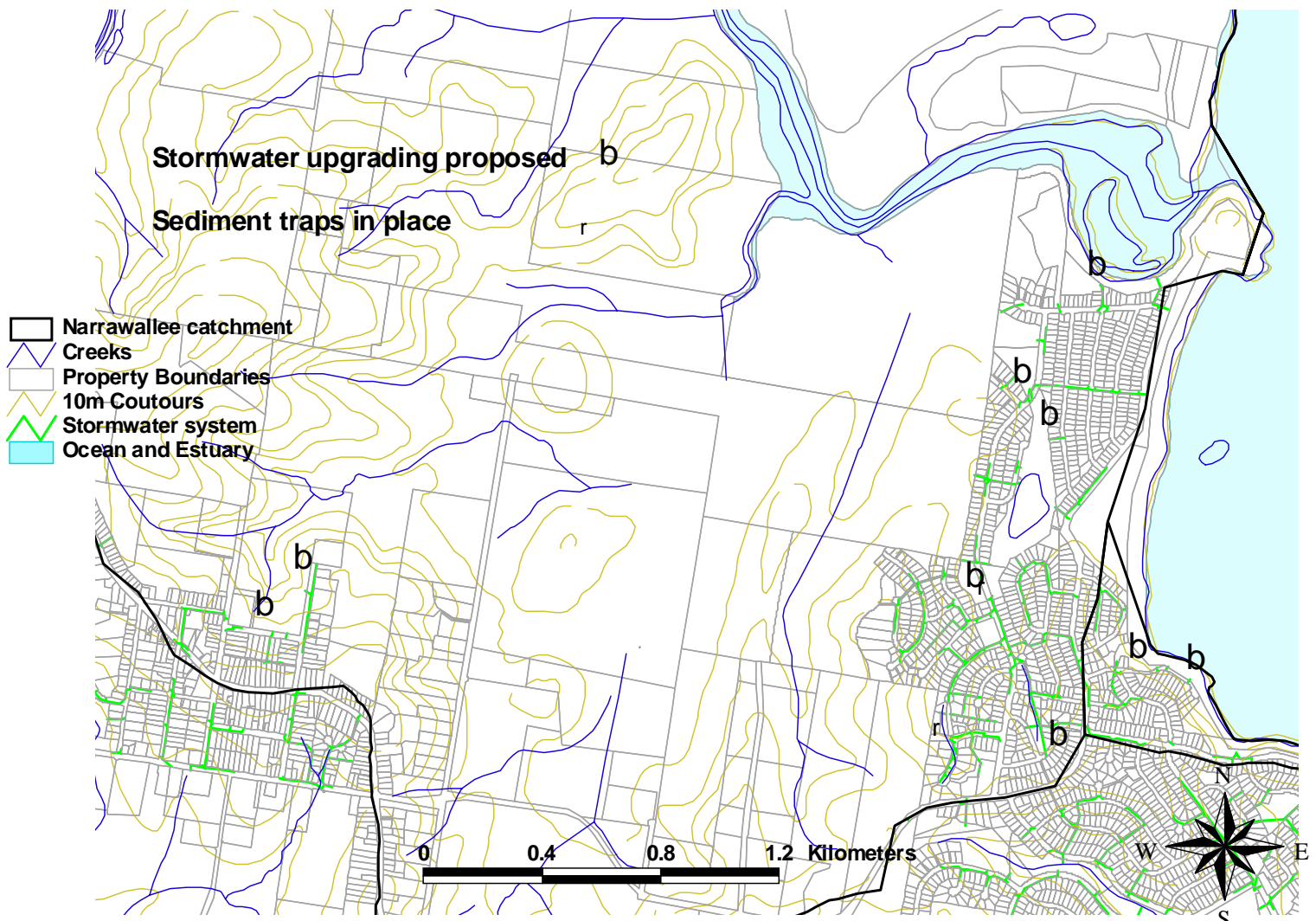


Figure 6.1 Urban Stormwater Proposals  
 Narrawallee Inlet Natural Resources  
 Management Strategy

## 6.5 WATER QUALITY STRATEGIES AND ACTIONS

<i>Strategy</i>	<i>Action</i>	<i>Priority</i>	<i>Timing</i>	<i>Estimated Cost</i>	<i>Responsibility</i>	<i>Performance Indicator</i>	<i>Target</i>
Upgrade urban stormwater treatment in Milton and Narrawallee	1. Install appropriate sediment and nutrient amelioration measures at priority stormwater outlets – 2 in Milton and 7 in Narrawallee	Medium	Medium and long	Uncosted	SCC	Turbidity and coliform levels measured before and after works.	9 outlets upgraded
	2. Monitor the sediment extracted from the Leo Drive and Wondalla Way sediment traps	Low	Short	No cost	SCC		Regular reports to Task Force
	3. Maintain the vegetated character of the 'Garrads Lagoon' creek bed and riparian zone.	High	Medium	Unknown	SCC, DLWC, private land owner	Foreshore vegetation, weeds, erosion	Character maintained
	4. Investigate the need to remove sediment from Garrads Lagoon.	Low	Medium	Unknown	SCC, DLWC, private land owner	Depth of additional material deposited	Investigation completed
Reduce the generation of pollutants in the stormwater from Milton and Narrawallee	5. Maintain grassed road verges in the Milton and Narrawallee flats areas, with kerb and gutter construction on the steeper slopes of Narrawallee and sealed verges in selected areas	Medium	Ongoing	Uncosted	SCC	Evidence of erosion of verges or deposition downstream	Stable roadside verges on all urban roads.
	6. Maintain Councils street sweeping program.	Medium	Ongoing	No additional cost	SCC		Program maintained

<i>Strategy</i>	<i>Action</i>	<i>Priority</i>	<i>Timing</i>	<i>Estimated Cost</i>	<i>Responsibility</i>	<i>Performance Indicator</i>	<i>Target</i>
	7. Implement best practice erosion and sediment controls on all subdivision and building sites within the catchment	High	Short	Variable	Builders, SCC	Best management Practices widely used	No evidence of sedimentation below building sites
	8. Install rollover diversions on eroding bush tracks and driveways	Medium	Short	Not costed	Owners		Education programs implemented
	9. When necessary, remove sediment from drains in sections, leaving time for one section to recover before disturbance of next section	Medium	Short	No additional cost	SCC	Evidence of erosion on tracks and driveways	No data available to establish targets
	10. Ensure new or remodelled drains are designed with adequate capacity to incorporate vegetation	Medium	Medium	Variable	SCC		Strategy adopted and implemented by Council
	11. Continue to educate Council field staff in best practice for stormwater management	Medium	Short	\$1000	SCC		SCC internal design guideline adopted
	12. Use best practice sediment controls when working in drains	Medium	Short	No extra cost	SCC		Design guideline adopted
	13. Allow only compatible fill in the Narrawallee and Milton urban areas	Medium	Short	No cost	SCC, DLWC	Report to Task Force from SCC	
Promote best practice in the management of riparian areas	14. Seek native vegetation along all foreshore areas of the tidal section of the estuary	High	Short	Unknown	SCC, DLWC, NSW Agriculture, farmers	Fencing and foreshore vegetation	3 sites fenced and revegetated

<i>Strategy</i>	<i>Action</i>	<i>Priority</i>	<i>Timing</i>	<i>Estimated Cost</i>	<i>Responsibility</i>	<i>Performance Indicator</i>	<i>Target</i>
	15. Seek incentives and assistance to finance improvements in riparian management.	High	Short	Not costed	SCC, DLWC, Milton Rural Landcare	Grants and incentives gained	At least one per year.
	16. Seek farm management of grazing areas which minimises stock access to foreshore areas and riparian areas incorporating shelter belts away from watercourses, off stream watering and fencing where appropriate	High	Short	No public cost	SCC, DLWC, NSW Agriculture , farmers, Milton Rural Landcare	Continuing changes in farm management	Discussions held with all farmers with riparian lands and management arrangements in place
Promote best practice in the management of rural industries and activities	17. Encourage all intensive agriculture to implement the irrigation of effluent, effective sediment and nutrient traps below bare or heavily trafficked areas and riparian buffers below areas with intensive use within negotiated time periods	High	Short and Ongoing	No public cost	SCC, local farmers	On ground works in place	Negotiations with farmers to establish targets and timeframes.
	18. Encourage and promote continual water quality improvements in the management of all rural activities	Medium	Ongoing	Not costed	SCC, DLWC	On ground works in place	Information provided to landowners.
	19. Undertake programs to reduce sediment run off from rural roads,	Medium	Short	Uncosted	SCC	Table drains diverted into traps at regular intervals	Works in place.

<i>Strategy</i>	<i>Action</i>	<i>Priority</i>	<i>Timing</i>	<i>Estimated Cost</i>	<i>Responsibility</i>	<i>Performance Indicator</i>	<i>Target</i>
	20. Adopt the objective of no net increase in sediment and nutrient export from all new developments in rural areas.	High	Short	No public cost	SCC	Works in place. Turbidity levels in creeks below developments	Development controls in place. Particular targets to be established.
	21. Develop water quality controls for rural lifestyle developments.	Medium	Medium	Uncosted	SCC	Works in place. Turbidity levels in creeks below developments	Development controls in place. Particular targets to be established
	22. Liaise with owners of lands with acid sulfate soils and advise on best management practices.	Medium	Short	Uncosted	SCC	PH in watercourses below sites.	Investigation completed.
	23. Modify the water quality monitoring program in order to increase the understanding of the impact of particular land uses.	High	Short	Uncosted	SCC		Changes implemented
Educate residents and visitors on stormwater issues and solutions	24. Implement Stormwater Management Plan education initiatives directed at companion animals, car washing and bushland friendly parks and gardens.	Medium	Short	Refer Stormwater Management Plan	SCC		Changes in resident behaviour.

## **7 EROSION AND SEDIMENTATION**

### **7.1 VALUES**

Stable soils and creek banks mean that land remains productive, for agriculture, for sustaining ecological communities and for supporting human uses. Foreshore and riparian vegetation are a significant component of stable foreshore areas.

Coastal waterways are subject to some natural infilling by sediment transported from the catchment and eroded from banks. Narrawallee is an extreme case of this, with significant infilling over the past 5,000 years resulting in extensive wetlands and floodplains and a narrow, elongated waterbody.

### **7.2 OBJECTIVES**

To minimise the erosion of soil from the catchments and creek banks and to protect Narrawallee Inlet and its creeks from excessive sedimentation.

### **7.3 ISSUES**

The sediment load of Narrawallee Inlet is contributed to from erosion of tracks, erosion of unsealed road verges & stormwater drains in Narrawallee and Milton, run off from building sites and newly developed areas & from other disturbed areas. All of these issues are covered in the water quality section and will not be discussed further here.

The sand shoals near the entrance are a significant ecological element of the estuary. They also contribute to restricted boat access from the Normandy St boat ramp. There is some community pressure for dredging in this area. This is discussed in the recreation and entrance management sections.

The foreshore reserve adjoining the urban area has had several stages of stabilisation works. In addition, a revegetation program along the foreshore has been implemented. However, none of these works have been fully effective in halting erosion. Additional works are in train to reinforce existing works with fill and replanting.

Some foreshore erosion and undercutting is apparent at a number of locations along the lower reaches of the estuary. Storm seas have dislodged log retaining walls along the reserve. There is also some head cutting at the tidal limit of drainage lines towards Milton.

#### 7.4 EROSION AND SEDIMENTATION STRATEGIES AND ACTIONS

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
Retain and protect the vegetated foreshores of the estuary	25. Stabilise and revegetate foreshore areas at and upstream of the urban area, using appropriate means.	High	Short	\$22,000	SCC, DLWC		Foreshore stabilisation completed
	26. Monitor bank erosion and undercutting in the middle and lower reaches of the estuary – (This is a possible university student project)	Low	Ongoing	Uncosted	DLWC, NPWS, SCC,	Rate of foreshore recession	Monitoring completed and assessed.
	27. Undertake works to halt head cutting in drainage lines below Milton	Medium	Short	Uncosted	Landowners		Works completed
Minimise input of sediments into the estuary	See actions under Water Quality						

## **8 WATER FLOW**

### **8.1 VALUES**

Water flows in Croobyar, Yackungarra and Currowar Creeks are important for the freshwater ecology and for domestic and farm water supply. Several weirs have been constructed along Croobyar Creek for this purpose.

### **8.2 OBJECTIVES**

To maintain the natural flow patterns of the creeks into the estuary

The EPA has established Water Flow Objectives for all of the coastal estuaries, including Narrawallee Inlet. These objectives are:

- To maintain wetland and floodplain inundation;
- To manage groundwater for ecosystems;
- To minimise effects of weirs and structures; and
- To maintain or rehabilitate estuarine processes and structures.

Water Flow Objectives have also been established for unprotected streams (Croobyar, Yackungarra and Currowar Creeks). Additional objectives relevant to these creeks include;

- To protect pools in dry times
- To protect natural low flows
- To mimic natural drying in temporary waterways and
- To maintain natural flow variability.

### **8.3 ISSUES**

No specific issues regarding water flows were surveyed in the community in the preparation of the plan. There are two irrigation licences on Croobyar Creek. These appear to be infrequently used.

Croobyar Creek has a series of five weirs constructed along its length, built or approved by the Water Resources

Commission to maintain water supplies to farms during dry periods. It is understood that the creek would dry up entirely during dry periods. The lowest weir serves to prevent the tidal inundation of farmland and to provide fresh water for stock and dairy use.

Some landowners manage the top four weirs to hold water during dry periods, and to occasionally supply water to the weirs further down. They have recently been inspected by NSW Fisheries as barriers to the passage of fish along the creek. It seems likely that the cost of their modification or removal cannot be justified by the ecological improvements. No such weirs were built on Yackungarra or Currowar Creeks.

Flooding is an issue in the Garrads Lane area, with water draining off the Milton urban area. The increase in hard surfaces in Milton, and the loss of native vegetation, would be expected to increase the amount and speed of this run off, increasing local stormwater problems. Subsequently, water flow in the creeks would dry up more quickly, causing longer periods of reduced and no flow.

Water sensitive design in new development and the restoration of riparian vegetation, would reduce the amount and speed of run off during rainfall events, as well as maintain flows in creeks for a longer period after rain.

Groundwater is widely used on the Narrawallee flats for watering gardens. More frequent use might be expected as reticulated water charges increase. Natural recharge during rain would be expected to more than fully recharge the groundwater supplies. On this basis, it is considered that there is little risk associated with continued patterns of groundwater use.

#### 8.4 WATER FLOW STRATEGIES AND ACTIONS

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
Maintain natural water flows as far as possible into the creeks and estuary	28. Implement water sensitive urban design in new developments, incorporating rainwater tanks and in ground absorption of stormwater as appropriate.	Medium	Medium	Unknown	SCC, DUAP	Number of developments using water sensitive design	Development control procedures in place.
	29. Review the functioning of the weirs on Croobyar Creek, and remove where weirs are no longer justified on economic or environmental grounds	Low	Medium	Unknown	DLWC, SCC, Fisheries, landowners		Review completed and appropriate actions implemented
	30. Restrict future rural residential development to areas away from creeks, so as to limit any increase in riparian water usage.	Medium	Medium	Unknown	SCC, DLWC		Development control procedures in place
Promote riparian vegetation along all watercourses in the catchment.	See Habitat and Conservation and Water Quality Strategies						

## 9 NATURE CONSERVATION

### 9.1 VALUES

Narrawallee Inlet's Creeks and their catchments support a large variety range of ecological communities, some of which are relatively undisturbed. These are important from a conservation perspective as well as an attractive attribute of the area for many residents and visitors.

Narrawallee Creek Nature Reserve has been included on the register of the National Estate due to the diversity and quality of its habitats including mangroves, high dune forest, salt and freshwater lagoons.

### 9.2 OBJECTIVES

To maintain or, where necessary, restore the ecological integrity and biodiversity of the Narrawallee Inlet and its catchment.

Specific objectives for nature conservation are being developed by

Council in its Conservation Plan and by the Southern Catchment Management Board. The Conservation Plan is in an early stage of preparation. The Southern Catchment Management Board has released a draft catchment blueprint, setting objectives for habitat and vegetation conservation across the region.

Apart from those for threatened species under the Threatened Species Conservation Act 1995, the only relevant objectives for fauna conservation are those in the NSW Biodiversity Strategy. It is generally assumed that conservation of habitat and vegetation should conserve fauna populations.

### 9.3 ISSUES

Important Nature Conservation issues ranked in the survey during the preparation of this plan are included in the following table. Alongside each issue are some comments regarding the extent of the issue.

<b>Issue</b>	<b>Comment</b>
<i>Introduced animals including foxes, cats, black rats and rabbits</i>	No specific local data on the size of the issue.
<i>The spread of weeds in native bushland</i>	Privet and lantana are the most significant weeds on the fringes of native bushland. A <i>Caulerpa taxifolia</i> infestation has been identified in the channel upstream of the shoals.
<i>Littering and degrading of natural areas</i>	More significant at the more popular locations.
<i>Loss of sensitive ecosystems, habitat for native species &amp; rainforest remnants.</i>	Some populations of threatened and rare species exist on private lands; only 2 of the subtropical rainforest remnants occur in public reserves, while the Forest Red Gum, once widespread across the agricultural lands, is limited in extent. There are small and aging copses scattered across the catchment.
<i>The threat to fish stocks from loss of habitat</i>	Loss of habitat occurs from changes in foreshore areas and wetlands; from increases in turbidity affecting seagrass distribution; and from barriers (weirs and creek modification) to the movement

	of aquatic species
<i>Clearing of foreshore vegetation</i>	Some illegal clearing of vegetation on the dune has occurred along Matron Porter Drive. Some foreshore vegetation is being damaged through vandalism. Grazing continues in some foreshore areas.
<i>Loss of the wildlife corridor linking the coastal and inland natural areas</i>	The fauna populations of the coastal bushlands have become isolated. Clearing south of Lake Conjola Road has disrupted the vegetation corridor to the escarpment forests.
<i>Increased rural residential development</i>	Clearing of the understorey in rural residential areas removes a large part of the habitat value. Rural residential areas have been proposed for the Little Forest and Pointers Road areas.
<i>The threat to fish stocks from recreational and commercial fishing</i>	Commercial fishing in the inlet has been quite limited. The current levels of commercial and recreational fishing levels do not seem to be intense enough to threaten fish stocks.
<i>Damage to wetlands through inappropriate grazing, rural or recreational uses.</i>	Some wetlands are grazed.
<i>Expansion of the urban areas</i>	The future expansion of Narrawallee suburb takes areas of high habitat value, though the adjoining bushland retains its habitat value. A strip of land 500m wide west of the suburb is zoned environment protection.
<i>Illegal access to and camping on the foreshore</i>	Some unauthorised access and camping occurs immediately above the shoals, and some littering and damage to vegetation has occurred.
<i>Agricultural practices and grazing of the creek banks</i>	Creeks through the agricultural lands have either little native vegetation, or only a thin band.

#### 9.4 EXISTING DATA

SCC has all of the vegetation communities mapped, although this information is not yet available. NPWS has good information on the animal and plant communities in National Parks.

Lists of animal and plant communities in private and public forests and bushland proposed for development or otherwise investigated have been collated from Council reports and from other reports. Information on the flora and fauna in the wetlands is available from the Shoalhaven Wetlands Survey.

Some data on the rainforest remnants is available from studies by Mills and Associates (1996), Thompson and Mitchell (2000) and Robinson and Boefeldt (1998).

Threatened fauna recently recorded in coastal part of the catchment include;

- Powerful Owl
- Glossy Black Cockatoo
- Hooded Plover
- Little Tern
- Pied Oystercatcher
- Grey-headed Flying-fox
- Southern Brown Bandicoot
- Osprey

Threatened fauna recently recorded in the western part of the catchment include;

- Masked Owl
- Ground Parrot
- Striated Fieldwren

Threatened or endangered fauna species likely or possibly found in the catchment include;

- Little Tern (Recovery Plan finalised and being implemented)
- White-footed Dunnart
- Yellow-bellied Glider
- Australian Bittern
- Sooty Oystercatcher
- Superb Fruit Dove
- Olive Whistler

One threatened flora species, *Budawangia gnidioides* has been recorded on the western escarpment. This small herb inhabits sandstone overhangs on the escarpment.

A number of other vulnerable and threatened fauna species are likely to occur within the catchment, including

- several orchid species in the dry sclerophyll coastal forests;
- several saltmarsh species in the intertidal areas; and
- several herbs and shrubs in the forest and heath communities.

Mainly anecdotal information is available on weed infestations in the catchment. Weeds that are important to note as posing a significant risk to natural and agricultural resources in the catchment include the following.

- Blackberries remain a minor problem on agricultural lands and monitoring for fireweed is required to ensure that any outbreaks are controlled at an early stage.
- A range of weeds including impatiens, cassia and cotoneaster pose a significant threat as escapees from urban areas into adjoining bushland.

- Riparian and foreshore areas have significant infestations of some rapidly colonising weeds. Madeira vine, bridal creeper, moth vine, morning glory and turkey rhubarb are fast growing climbing vines that have become established and threaten the biodiversity of foreshore and riparian areas. Privet, asparagus fern and bitou bush spread rapidly from the large production of berries, spread by birds.

No data is available on fish or aquatic species. Commercial fishing statistics reveal minimal commercial catch. Between 1990 and 1996, an average of 370 kg of fish per year was recorded caught in the inlet from an average effort of 22 fishing days per year. No threatened species are likely to occur in the creeks and estuary, though a number of protected aquatic species are likely to occur, including the elegant wrasse and the weedy sea dragon.

The invasive algae, *Caulerpa taxifolia*, has been recorded immediately upstream of the shoals over the past 2 years. This algae has been present in Lake Conjola for at least 10 years, and has spread in that lake to the stage where it has covered much of the aquatic vegetation and substrate around the lake margins and shallow areas. *Caulerpa taxifolia* has spread rapidly and smothered aquatic vegetation in many salt water ecosystems around the world.

The likely impact of *Caulerpa taxifolia* on the aquatic ecosystem is not clear. Many microorganisms grow on the leaves of seagrass. This is the major source of food in the seagrass beds. *Caulerpa* does not support as much of this food source. However, research has been inconclusive, showing both minor to significant decline on fish numbers, depending on the site.

NSW Fisheries had expected to remove the initial infestation during the winter of 2001. However, the infestation was larger than expected and hand removal was not possible. Any removal work is now dependent on trials of larger scale control techniques (salt treatment) being undertaken on the Central Coast. It is also dependent on funding being available to implement these control techniques to the South Coast estuaries.

The strategy adopted to address the *Caulerpa taxifolia* issue in this plan is to promote the education of the local community and visitors regarding the threat posed by this invasive algae and the control actions that individuals need to take; to increase monitoring so that small outbreaks can be controlled while they are still small, and to support efforts to introduce salt treatment on the South Coast.

No data exists on

- feral animal populations or impacts; and
- impact of domestic animals on wildlife.

## 9.5 HABITAT AND SPECIES CONSERVATION STRATEGIES AND ACTIONS

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
Promote the understanding of the natural environment among residents and visitors	31. Implement educational strategy on the foreshore, promoting the role of vegetation in coastal processes and habitat conservation, in particular mangroves;	Medium	Short	\$3000	SCC		Strategy implemented
Remove artificial barriers to the distribution of native species	Review functioning of weirs on Croobyar Creek – see Water Flow action 29	Low	Medium	Uncosted	Fisheries		Review completed and appropriate actions undertaken
	32. Investigate a vegetated wildlife corridor linking the Narrawallee Creek Nature Reserve to other native bushland areas.	Medium	Medium	\$3000	SCC, DLWC, NPWS, Milton Rural Landcare		Investigation completed and appropriate actions undertaken
Protect important ecological communities on private lands through a mixture of education and assistance;	33. Encourage a joint strategy among private owners of rainforest remnants involving mapping, species identification, fencing and weed control (as appropriate);	Medium	Short	\$5000	SCC, Milton Rural Landcare, NPWS	Number of owners involved	Mapping and appropriate actions undertaken;

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
	34. Promote the exclusion of stock from estuarine wetlands and foreshores through NHT, Green Corp and fencing assistance.	High	Short	\$20000	DLWC, Fisheries, SCC, NPWS, landowners	Km of foreshore fencing	Fencing completed and farm management modified;
	35. Maintain the visual buffer between Milton and Narrawallee with coastal forest and in an ecologically sustainable manner	High	Ongoing	Unknown	SCC, DP	Viability of coastal forests	
	36. Maintain the flora and fauna values in developments in the west of the catchment, particularly in the rural residential areas.	Medium	Short	Uncosted	SCC		
Implement control programs for noxious and feral pests	37. Educate local fishers and divers about <i>Caulerpa taxifolia</i> and the importance for early identification of any outbreaks.	High	Short	Uncosted	Fisheries, SCC		Educational campaign implemented
	38. Remove infestation of <i>Caulerpa taxifolia</i> from the inlet.	High	Short	Uncosted	Fisheries		Outbreak removed
	39. Encourage the expansion of the Bushcare Group for coastal and estuarine areas, focusing on weed control	High	Short		SCC	Number of volunteer hours	Decline in weed infestations

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
	40. Seek joint program of land manager and owners in conjunction with Rural Lands Protection Board for feral animal control (such as foxes and rabbits) throughout the catchment.	Medium	Short	\$20,000	RLPB, landowners, NPWS, Milton Rural Landcare		Program implemented
	41. Undertake an educational campaign among ratepayers, residents and visitors to reduce the impact of companion animals on native species.	Medium	Short	\$4000	SCC		Educational campaign implemented
	42. Implement education and inspection program regarding weeds specified in this report.	High	Short	\$ 20,000	SCC		Decline in weed infestations

## 10 ENTRANCE MANAGEMENT

### 10.1 VALUES

The entrance area is the most beautiful part of the Narrawallee Inlet and the most frequently used by residents and visitors.

### 10.2 OBJECTIVES

To maintain the Narrawallee Inlet entrance in a natural state.

### 10.3 ISSUES

Important issues ranked by the community during the preparation of this plan included;

- powerboat and personal water craft usage in the channel
- difficulties in launching boats at low tide

The entrance and the beach are quite exposed to storm activity and can change significantly. Storm events can mobilise and rearrange the sands near the entrance and change the appearance of the beach and the sand flats.

There is some community pressure to dredge the shoals inside the entrance of the inlet. Most of this pressure is to improve boat access from the boat ramp to the deeper water of the channel. (See discussion on pages 42-43) This, however, is not related to the functioning of the entrance. The entrance is used for access to the sea by sea kayaks and personal water craft.

Some people see the sand flats as evidence that the entrance area is shallowing and infilling, and may eventually close up. The whole of the Narrawallee floodplain is an infilled barrier estuary. The Inlet has reached a mature stage, and large scale infilling is not considered to be

occurring. The sand flats and channels represent a dynamic system that are eroded and built up by flood and storm events and by winds and tides. The flats and emerging mangroves represent a degree of protection for the foreshore against storm activity.

Dredging of the entrance to improve flushing for water quality purposes is not necessary. Narrawallee Inlet, being a small estuary, would still have good flushing even if the entrance were significantly narrower. The entrance has not been known to close.

While there is some flood prone land in the catchment, this is predominantly rural and wetland areas. Localised flooding in the catchment occurs along Garrads Lane, at Croobyar, Yackungarra and Currowar Creeks below the highway and in the urban area of Narrawallee.

Narrawallee Beach has largely recovered from the effects of significant storm events, partly as a result of dune stabilisation works. The dune restoration, in particular, has been undertaken following the severe storms in the 1970s, to provide protection to the residential area. However, the beach is still experiencing recession at a rate estimated at between 0.2m/year and 0.4m/year.

### 10.4 EXISTING DATA

There are very few historical photographs that indicate the past condition of the entrance. An elevated railway bridge was built across the entrance in 1924, to transport silica from the mines north of the inlet to export. Some remains of the bridge and railway route can still be found at the southern end of Buckley's Beach.

Hinwood and MacLean have researched the impact of storms on the dynamics of the entrance.

The Narrawallee Inlet has been significantly filled over the past 5000 years, and the present inlet is only a small remnant of a much larger lake. Nichol (1991, 1992) has extensively researched these coastal processes. The research indicates that the filling involved mostly marine materials with little fluvial sediment. There appears to be no capacity for further infilling, and the estuary is believed to be in a stable condition.

### 10.5 ENTRANCE MANAGEMENT STRATEGIES AND ACTIONS

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
Minimise any intervention in the functioning of the estuary entrance	43. Adopt an entrance management policy which specifies nil future intervention in the entrance	Medium	Medium	No cost	SCC, DLWC, Task Force		Entrance policy adopted
	44. Investigate the nature of sedimentation in the lower section of the estuary. (Possible Wollongong University student project)	Medium	Medium		SCC		Investigation completed

## 11 RECREATION

### 11.1 VALUES

Narrawallee Inlet entrance area is valued for passive recreation and swimming by both residents and visitors. The most popular activities undertaken by residents are walking on the foreshore, swimming, fishing and canoeing.

The breaks to the north of the headland are a special surfing location that draws riders from a wide area. Narrawallee Inlet is becoming a newly popular sea kayaking destination, as well as the start of a personal water craft route along the coastal beaches.

### 11.2 OBJECTIVES

To provide a range of nature-based recreational facilities for both locals and visitors.

### 11.3 ISSUES

Specific recreational issues identified during the preparation of this plan were:

- powerboat and jet ski usage in the channel
- littering and degrading of natural areas
- the threat to fish stocks from recreational and commercial fishing
- damage to wetlands through inappropriate grazing, rural or recreational uses.
- illegal access to and camping on the foreshore
- overcrowding and overuse of the recreational areas of the Inlet
- adequacy of the recreational and boating facilities
- difficulties in launching boats at low tide

Some conflict exists regarding several issues.

- The presence of dogs on the beach and foreshore has caused considerable community protest.
- The difficulty in boating access outside high tide has brought demands for dredging to improve powerboat access. Other people believe that powerboat usage should be discouraged, and that canoeing and rowing be promoted.
- The increase in personal water craft usage has prompted requests for their use to be banned or restricted.
- Summer traffic volumes have increased significantly, which disrupts the low-key, coastal lifestyle appreciated by many residents.

### 11.4 EXISTING DATA

The recreational activities of residents were surveyed in December 2000, as part of the preparation of this Plan. Some results of this survey are shown on page 44.

### 11.5 BOATING ISSUES

Some residents have sought improvements in boating access to the Inlet, such as dredging the shallow channel from the boat ramp to the main channel, to allow access during the mid and lower tidal periods. These residents believe that the enjoyment of the inlet by boaters and fishers is being unnecessarily restricted, and that Council should provide good boating access to all estuaries.

The nature of change in the southern channel has not been documented over the longer term. Some accounts indicate that boating access has not changed significantly in recent years. Other sources state that the southern channel was significantly deeper 30 years ago. If infilling is occurring, it is possible that the channel could infill to such an extent that boating access

was no longer possible from the Normandy St ramp.

Maintaining boat access for a wider range of tidal conditions would involve Council in a regular dredging program of a channel approx 300m long. The existing channel is lined with seagrasses. Dredging would be likely to affect the stability of the narrow foreshore reserve.

Dredging would be expected to generate significantly increased boat usage that might also raise demands for upgrading of the boat ramp and associated parking facilities. This would be difficult to accommodate on the small site currently occupied by the boat ramp.

The survey of resident usage revealed low usage of the inlet by power boats. Only 28 of 146 returned questionnaires reported using power boats in the inlet, with ten reporting weekly or more frequent usage. By way of comparison, 45 reported using canoes or rowing boats (13 weekly or more frequent), while 79 reported fishing in the inlet (30 weekly or more frequently). This low power boat usage may well be result of the difficulty of access. On the other hand, the community may have adjusted well to the situation.

Some residents have proposed that Narrawallee should remain as a low power boating area, promoting the area for swimming and rowed craft.

Considerable concern has also been raised regarding personal water craft. Some residents see these as a danger to swimmers, and that the channel is too narrow for their safe use. The use of PWCs in the middle or upper reaches of the inlet appear to pose a risk to the stability of the bank, as several areas are at risk of erosion.

Current use of PWCs in the inlet seems primarily to gain access to the ocean. Users appear to want to use their craft in the ocean and on the Narrawallee and Mollymook beaches. If current regulations are adhered to, PWCs should be able to use the channel area to access the ocean without any risk to swimmers and to people crossing the entrance to gain access to Buckley's Beach

**Table 11.1 NARAWALLEE INLET, FREQUENCY OF USAGE FOR RECREATIONAL PURPOSES, DECEMBER 2000**

	Surfing	Swimming in Inlet	Fishing	Canoeing/ro wing boats	Powered boats	Foreshore picnics	Foreshore walking	Natural area biking	Natural area walking
Daily	14	7	2	1	1	2	34	5	17
3-5 times per week	5	3	0	0	0	2	2	2	2
Twice weekly	3	2	3	1	2	1	2	5	2
Weekly	17	30	25	11	7	11	14	8	7
Summer/Holidays/ n season	13	10	2	0	2	3	1	1	0
All year	1	0	1	1	1	3	4	1	3
Often	7	10	9	0	1	3	6	2	4
Frequently	5	2	6	3	0	2	5	3	5
Fortnightly	2	2	1	2	0	2	2	1	2
Regularly	4	4	3	3	1	4	3	1	2
Monthly	11	9	13	12	6	15	13	2	8
Bimonthly	2	5	0	3	1	3	4	0	1
Occasionally	4	4	4	1	0	8	4	0	3
Infrequently	1	1	2	2	0	1	1	1	1
Quarterly	4	2	2	1	1	9	3	0	4
Twice yearly	0	2	3	3	3	8	2	0	2
Annually/Seldom	0	0	3	1	2	1	0	1	0
Total non blank answers	93	93	79	45	28	78	100	33	63
Average no of users per time	2.5	3.2	2.5	2.3	2.5	5.8	2.6	2.0	3.9

## 11.6 RECREATION STRATEGIES AND ACTIONS

<i>Strategy</i>	<i>Action</i>	<i>Priority</i>	<i>Timing</i>	<i>Estimated Cost</i>	<i>Responsibility</i>	<i>Performance Indicator</i>	<i>Target</i>
Maintain inlet as a passive boating area, encouraging rowed rather than motorised craft	45. Maintain the current 4 knot speed limit within the estuary and educate boat users regarding appropriate usage of the estuary	High	Short	No cost	Task Force, Waterway Authority	Number of incidents reported by Waterway Authority	Appropriate signage installed. Satisfactory reporting from Waterways Authority.
	46. Adopt a passive boating usage strategy with no upgrading of the boat ramp.	Medium	Short	No cost	Task Force, SCC, Waterways		Strategy implemented
	47. Develop canoe platform proposal to protect foreshore and allow easy launching	Low	Medium	Uncosted	SCC, DLWC, Task Force		Works completed
Improve the visitor facilities at the Narrawallee foreshore and beach	48. Develop and implement a planting program for the foreshore and picnic areas	Medium	Short	\$3000	SCC, Narrawallee Bushcare, Task Force		Works completed
	49. Formalise foreshore walkways along urban foreshore areas.	Medium	Medium	Uncosted	SCC, DLWC,		Works completed
	50. Increase the number of formalised beach access routes along the foreshore of the inlet	Medium	Medium	\$10,000 - \$20,000	SCC, Narrawallee Bushcare,		Works completed
	51. Improve picnic a facilities and visitor infrastructure in the foreshore and beach reserves	Medium	Short and Medium	Uncosted	SCC,		Works completed

<i>Strategy</i>	<i>Action</i>	<i>Priority</i>	<i>Timing</i>	<i>Estimated Cost</i>	<i>Responsibility</i>	<i>Performance Indicator</i>	<i>Target</i>
	52. Evaluate the adequacy and function of the boat access and parking facilities.	Medium	Medium	Uncosted	SCC		Evaluation completed and appropriate actions undertaken
	53. Connect the foreshore toilet block to the sewer.	High	Short		SCC		Works completed
	54. Develop and install interpretative signage in high usage areas to increase visitor understanding of the ecological and heritage values of the catchment.	Medium	Short	Uncosted	SCC		Works completed

## 12 VISUAL QUALITY

### 12.1 VALUES

The Narrawallee Catchment incorporates four major areas of visual importance. These are

- the pastoral landscapes and forested ridgelines as travellers enter and proceed through the rural areas west of the inlet;
- the views from Milton towards the coast, across grazing lands to the coastal forests and the headland and seas beyond;
- the views around the inlet and foreshore area, with both the inlet and the urban area surrounded by forests;
- the coastal views along Narrawallee and Buckley's Beaches, both to and from the headland.

### 12.2 OBJECTIVES

To retain and enhance the visual quality of the catchment.

### 12.3 ISSUES

Important visual quality issues ranked by the community during the preparation of this plan included;

- foreshore erosion
- clearing of foreshore vegetation
- expansion of the urban areas

The protection of visual assets of private land is difficult, since visual assessment is not an objective measure. Other objectives may be given priority. Clearing on rural lands largely does not require Council or State Government approval.

### 12.4 EXISTING DATA

Shoalhaven City Council undertook a visual management study of the Milton area in 1992. This study recommended

the upgrading of development controls in particular areas, and has been incorporated in the development control procedures. This study was used in the development of the Milton Ulladulla Structure Plan.

Three areas of the catchment are specifically zoned for scenic protection, although the protection of scenic values is provided for in agricultural production and environmental protection zones. Specific scenic protection zones are;

- the forested ridgeline west of Boolgatta Flat;
- the paddocks and forested hillside north of Milton; and
- the forested ridge immediately to the west of Narrawallee township.

The forested ridges south of the Inlet, and the foreshore west of the urban area are proposed as scenic protection under the current LEP amendments.

## 12.5 VISUAL QUALITY STRATEGIES AND ACTIONS

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
Restrict the development of foreshore structures along the estuary	55. Adopt a policy for the Narrawallee foreshore generally prohibiting any new structures on or along the foreshore, other than public access structures on public reserves	Medium	Short	No cost	DLWC, SCC		Policy adopted by SCC and DLWC
	56. Develop and implement a sustainable foreshore reserve landscape plan.	High	Short	Uncosted	SCC		Plan adopted and appropriate actions undertaken
	Maintain the visual buffer between Milton and Narrawallee with coastal forest and in an ecologically sustainable manner. See Habitat and Species Conservation action 35.	High	Ongoing	Unknown	SCC, DP	Viability of coastal forests	

## 13 CULTURAL HERITAGE

### 13.1 VALUES

The catchment contains evidence of past Aboriginal and European heritage.

### 13.2 OBJECTIVES

To protect known items of Aboriginal and European heritage and to promote the understanding and commemoration of cultural heritage items in the community' and encourage land use activities that are compatible with the cultural values of the area

### 13.3 ISSUES

Much of this cultural heritage is subject to the pressures of change and development affecting many coastal areas.

The Inlet is believed to have been a site of intense Aboriginal occupation for over 20,000 years and a number of sites are likely along the foreshore area and along frequently travelled routes. However, very few of these have been identified. Adequate investigations during the development assessment phase are required to identify and assess possible sites.

Buildings and sites from early European settlement may be protected under planning and heritage legislation where they are listed in the LEP. The sites identified in the Heritage Study are currently being included in the LEP.

The pastoral landscapes are under pressure from changes in land use, particularly with the changes to the dairy industry. Current zoning of the prime agricultural lands preventing further subdivision offers some protection to this landscape.

There is considerable potential to use the cultural heritage of the inlet to show visitors the diverse history of the area, both Aboriginal and European.

### 13.4 EXISTING DATA

There is considerable local knowledge in the Aboriginal population regarding natural history, flora and fauna and past occupation.

The Aboriginal community mined substantial deposits of nearly pure silica near Pattimores Lagoon for thousands of years. Silica mined and traded from here has been found up and down the coast. Other known archaeological sites include middens, campsites, artefact scatters and grinding grooves.

The catchment is rich in relics from early European settlement, due to the early settlement on highly productive agricultural soils. The pastoral landscapes identify the pattern of this early settlement. The many farm buildings and public buildings in Milton highlight the importance of agricultural production from the area. Seventy-three items from Milton are listed on the Shoalhaven Heritage Study.

A European silica mining operation in the 1920s a tramline was built to transport silica from the Pattimores lease area, now part of Narrawallee Creek Nature Reserve, across Narrawallee Inlet to Bannisters Point at Mollymook. Evidence of the tramline across the inlet remains in the form of wooden pillars that can be seen at low tide while the raised tramline route, cuttings and mounds remain at the northern end of the nature reserve.

Early European settlement has been documented in Kendall, Shoalhaven City Council and the Milton-Ulladulla and District Historical Society. Items of local and regional significance are listed in the Shoalhaven Heritage Study 1995-1998. The Milton-Ulladulla and District Historical Society holds considerable records. The Tabourie Museum holds a considerable collection of items of European settlement.

### 13.5 CULTURAL HERITAGE STRATEGIES AND ACTIONS

<b>Strategy</b>	<b>Action</b>	<b>Priority</b>	<b>Timing</b>	<b>Estimated Cost</b>	<b>Responsibility</b>	<b>Performance Indicator</b>	<b>Target</b>
Ensure the protection of all known Aboriginal sites	57. Undertake Aboriginal archaeological survey around the foreshores of the Inlet covering both public and private lands.	Medium	Medium	Uncosted	NPWS, SCC, landowners		Survey completed and appropriate actions undertaken.
Promote the understanding of the Aboriginal and European heritage among locals and visitors	58. Identify scope for incorporation of heritage into tourism industry	Medium	Medium	Unknown	SCC		Increased role for cultural tourism
	59. Develop and install educational materials highlighting significant items of cultural heritage at appropriate sites, such as the silica railway line	High	Short	\$3000	SCC, DLWC, NPWS, Ulladulla Land Council		Visible Aboriginal and European heritage presence
Understand and plan for the conservation of the pastoral landscapes and heritage items	60. Assess likely impact of dairy deregulation, and issues for the continuation of the dairy industry	High	Short	Unknown	SCC, NSW Agriculture, Dairy Industry group		Strategy for dairy industry future

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