

BENGELLO BOUNTY



A study of the Eurobodalla coast between
Broulee and Moruya River

Compiled by The Coastwatchers Assoc Inc

October 2005

BENGELLO IN A NUTSHELL

The Bengello sandplain between Broulee and the Moruya River is one of the most valuable natural assets in the Eurobodalla Shire.

Its geology is fascinating. The sandplain is one of the largest and most extensively studied beach-ridge plains on the eastern seaboard of Australia. The data it will continue to yield is critical for the prediction of the impacts of global climate change and sea level rise on sandy coasts.

Bordering the sandplain, water worn gravels are evidence that an ancient river, whose headwaters followed the course of the modern Clyde, ran across this area. Millions of years ago basalt intrusions and other changes to the landscape diverted the entrance of this river to its present location at Batemans Bay. Older still are the granites near Moruya River that have played such an important part in Moruya's history.

Most of the soils have proved poor for agriculture but this has meant that the natural vegetation systems have remained relatively intact. The area continues to support endangered forest ecosystems and significant coastal wetlands. Future fieldwork is needed to verify the boundaries of these ecosystems.

Fires that are too frequent pose a major threat to the forest and dune ecosystems. Strong action is required to prevent frequent burning. Council should explore how the area might be adequately protected in future perhaps by such options as publicity campaigns, offering rewards for information leading to the arrest of arsonists and encouraging the public to take ownership of the fire bug problem.

Not surprisingly, the forests of the area have been shown to be significant habitat for threatened fauna. Yellow-bellied Glider habitat extends over most of the area and into the hinterland. Other threatened species known to occur in the area include Powerful Owls, Sooty Owls, Barking Owls and Glossy Black Cockatoos. A thorough fauna survey is needed to find out what other animals live in the forests and wetlands and what needs to be done to ensure they survive there.

While there are some records of European history in the area, the Aboriginal history is very poorly understood. An archaeological study of the Bengello sandplain and hinterland should be conducted as part of the Shire's strategic planning.

One of the most valuable water resources in the Shire lies below the sandplain. The groundwater has been used in past droughts, most recently in 2004. If it is to be of use in the future it needs to be protected.

Eurobodalla Shire Council is the largest landholder in the Bengello area. It owns or manages all of the land on the eastern side of George Bass Drive, as well as the racecourse, the speedway and land on the northern side of Waliija Swamp. This last

parcel, together with a large private holding to its north, contains the least disturbed ecosystems and the best habitat areas. Council also owns land on the western side of George Bass Drive adjoining Broulee Road.

The Bengello area makes a significant contribution to the Nature Coast tourism strengths of the Shire and provides numerous opportunities for recreation. Sensitive management is needed to allow more people to enjoy the area while doing less damage.

The future of Bengello hangs in the balance. The community has voiced its strong desire that the environment of the Eurobodalla be protected and draft plans for rural and urban land in the Shire appear to be taking note. However, other forces are pushing for development of the land, especially that west of George Bass Drive as well as land nearest Broulee village around the Fire Station. Extension of the runway and development of the airport are almost certain.

All of the currently undeveloped areas between Broulee and Moruya River should remain in their natural state for present and future generations to enjoy. This can be achieved by incorporating them in Eurobodalla National Park or by Environment Protection zoning and permanent, legally enforceable conservation agreements.

Meanwhile people can demonstrate their support for the preservation of Bengello's bounty by taking part in community consultation during the exhibition of the Draft Urban Settlement Strategy and Draft Rural Lands Strategy and by making written submissions asking for its protection.

This study was produced by The Coastwatchers Association Incorporated, Eurobodalla's main environment group for over 20 years. The Association's voice is strengthened by extra membership. You can assist by joining the Association.

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BENGELLO BOUNTY

1. INTRODUCTION

The area covered by this study extends along the coast from the Moruya River in the south to Broulee Road in the north. It reaches inland to the hills behind the sand plain and includes three wetlands identified by State Environmental Planning Policy No 14 (SEPP 14). Most of it still remains undeveloped but this could soon change.

The aim of this study is to alert people to the natural and recreational values of the area; to summarise its history and land use; and to outline its possible future

The Broulee-Moruya North Head area is one of the most valuable natural assets in the Shire. It is valuable because of its vulnerable vegetation communities and the habitat it provides for threatened species. It makes a significant contribution to the “Nature Coast” tourism strengths of the Shire. The water resources that underlie the sands are essential to provide additional security of water supplies in times of drought. It provides many opportunities for passive recreation and possesses significant scenic values. In its undeveloped state it meets the expectations of the community that the environment will be protected, and that urban sprawl will be controlled by keeping green belts between settlements.

All of the currently undeveloped areas between Broulee and Moruya North Head should remain in their natural state for present and future generations to enjoy.



Map 1

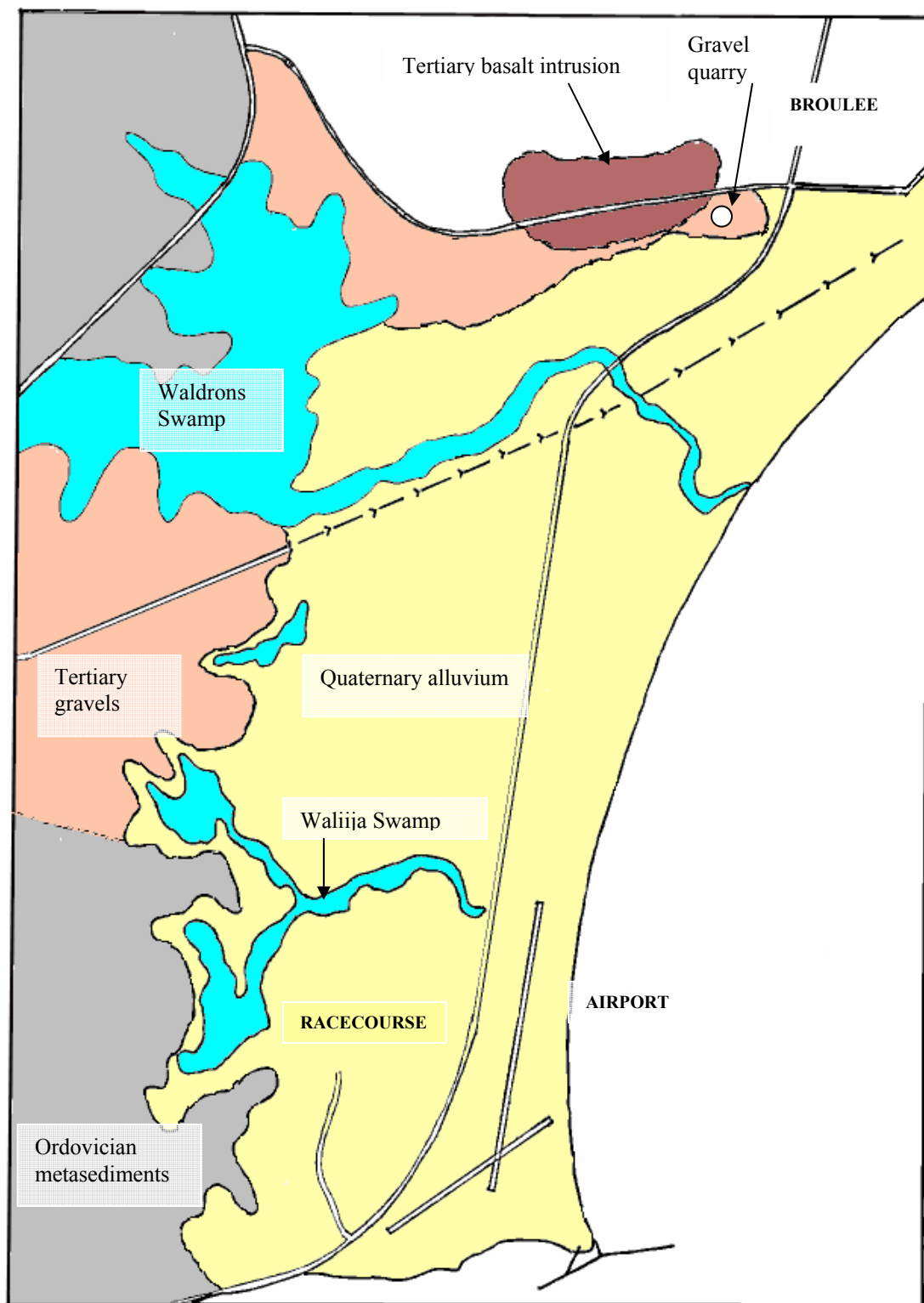
Location of the study area

(from Land and Property Information 1:25000 topographic maps
Mogo 8926-3N and Moruya 8926-3S Third Editions)



Aerial photo of the study area

(from Land and Property Information 1:25000 orthophoto maps
Mogo 8926-3N and Moruya 8926-3S Third Editions)



Map 2

Geology

(After Hally 1987 boundaries are only approximations)

2. NATURAL VALUES - GEOLOGY

2.1 Geology of the Area

The Broulee-North Heads area is part of the Lachlan Fold Belt – a complex area of Palaeozoic rocks extending north from Victoria through south-east NSW, folded several times and intruded by granitic rocks. The strike of the belt is roughly parallel to the coast and it dips very steeply in most pre-Permian rocks.

The oldest rocks in the area are Ordovician in age (500-440 million years old), and are parts of an Ordovician sequence of undifferentiated greywacke, shale, sandstone, argillite and phyllite. The beds are 1-2 metres thick with dips steep to vertical or even overturned. This has produced a rapid alternation of different soils due to the different lithologies. The rocks have become altered to hornfels where granite has intruded, and schist occurs locally where there is intense deformation (low-grade metamorphism).

Granitic rocks were intruded in these Ordovician rocks in the first half of the Devonian period (400-375 million years ago). Around the North Heads-Broulee area the main granitic rocks are granodiorite and tonalite. For example the quarry on North Head Drive is granodiorite.

Tertiary sediments of uncertain age occur near the coast and consist of poorly sorted quartz gravel. They occur as thin caps on ridges and the rocks underneath are very weathered. Around Mogo the deposits are thicker and were mined for gold. In recent times the gravels have been used for road surfacing and concrete. The gravel quarry near the old Broulee Tip is an example.

These deposits are believed to have been deposited by the ancient Clyde River. At that time the mouth of the Clyde was somewhere east of today's Bengello Beach. (Brown 2000)

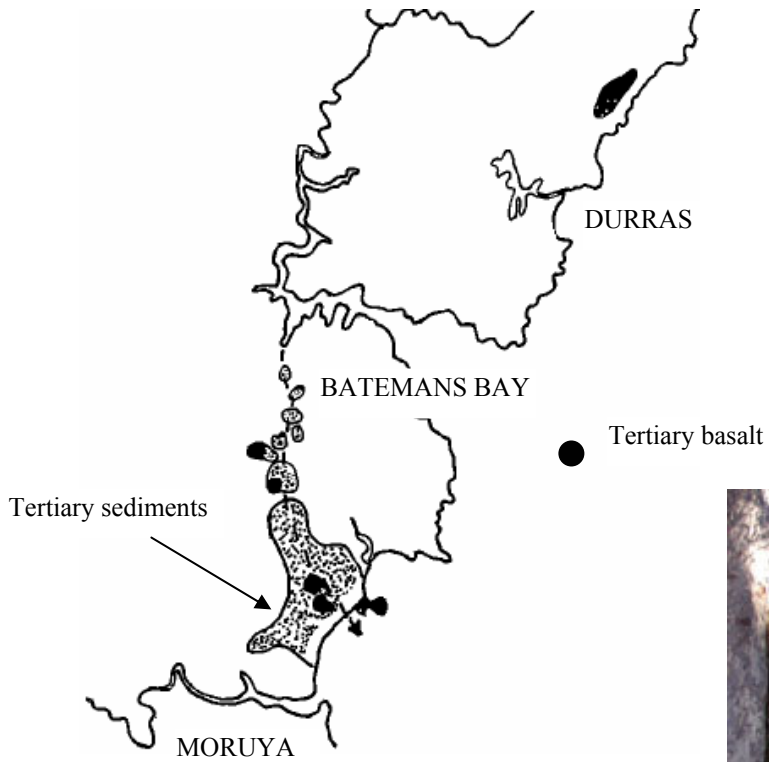
About 30 million years ago basalt intruded in the old river valley covering the gravels in places. Most of the basalt has since eroded but remnants occur west of Mogo and in the north of the study area. It is exposed at Broulee rock platform. (Spry et al 1999)

The majority of sediments in the area are of Quaternary age, probably laid down in the last 6000 years. Coastal deposits include quartz and shelly beach sand, sometimes blown up into dunes and sand sheets by wind (mainly from the south-east). Estuarine and lagoonal sediments include muds, clays and sands from wave action. Organic-rich clays are accumulating in Waldron's Swamp.

Map 3

The course of the ancient Clyde River

(after Brown 2000)



The old quarry near Broulee is at the top of the hill (right). It was overlain by basalt soils and some remnant basalt rocks can be found as fallen boulders on the southern side of the hill (top right).

The gravel mined in the quarry (below) contains water worn quartz and sandstone which are thought to be evidence that the ancient Clyde River ran this way before the river changed its course about 30 million years ago.



Exposed gravel



2.2 Geology in Relation to Landscape of the Area

1. The Ordovician sediments and low-grade metamorphic rocks are associated with steep and hilly country, gravelly and stony soils, and Eucalypt forest.
2. Tertiary gravel sediments form very poor soils, only capable of supporting scrubby woodland vegetation, even on the undulating rather than hilly country.
3. Granitic intrusions form different soils depending on the amount of granodiorite, tonalite, or other granitic rock. Different vegetation communities result.
4. The Quaternary alluvium forms a variety of landscapes depending on its situation in the area. The plains of alluvial silt at Moruya form the best farmland. The marine sand near the coast, with or without shell content, has weakly developed soils. Stable sand deposits can support forest where the watertable is not too deep. Sparse colonising vegetation exists where the sand is still being shifted by wind or waves.

2.3 Landforms

The geology needs to be studied in relation to the landforms of the area as well as the landscape.

2.3.1 History

Most of the present landform features had developed by the end of the Tertiary Era, about 1 million years ago. The North Head-Broulee area is part of a major drainage area which brought Tertiary sands and gravels from the hills to the coast. This process is continuing today.

The sea level has fluctuated in the last 15,000-20,000 years due to the growth and decay of ice sheets. 10,000-12,000 years ago the sea level was 30 metres below its present level and the shoreline 2 to 3 kilometres eastwards. By 6,000 years ago the sea had reached the present level, the lowlands and lower valleys were drowned to form embayments and waves cut cliffs and rock platforms in the new coast.

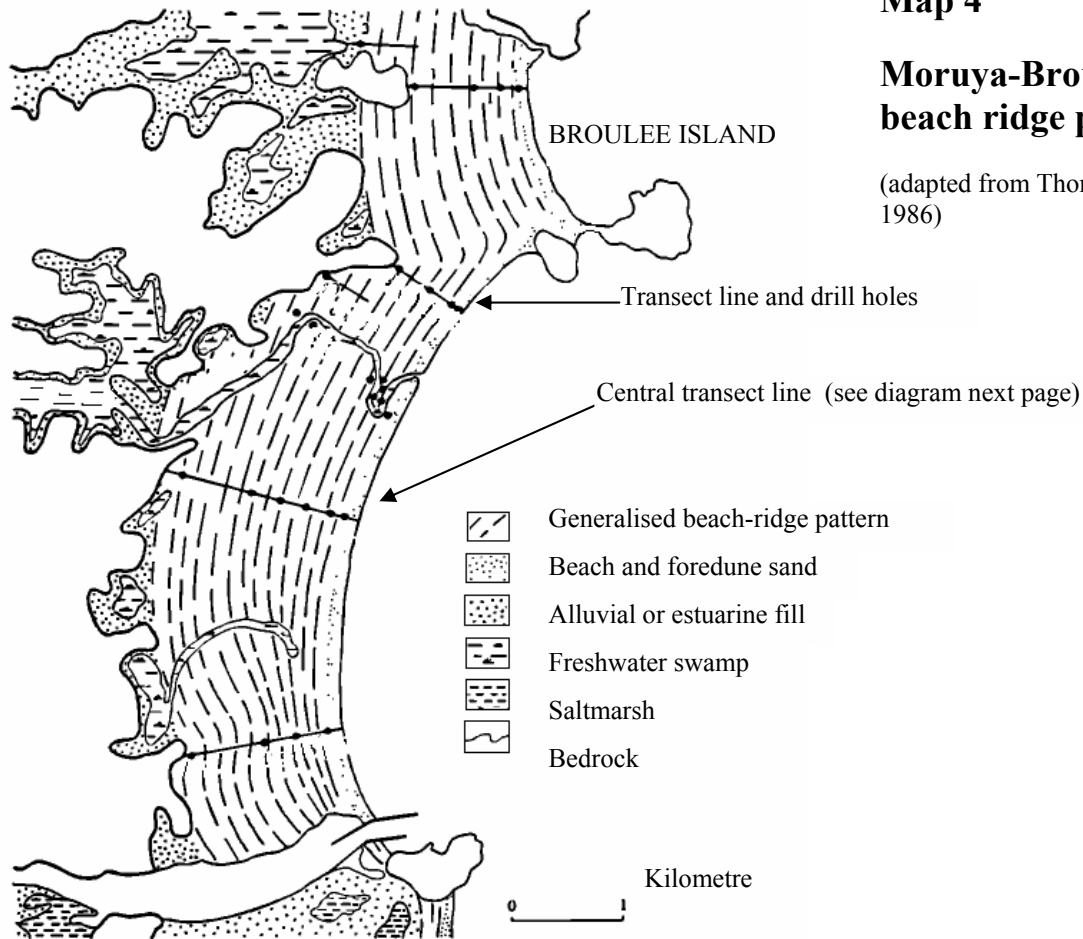
Broad sand barriers were deposited from Congo Point to Broulee. They closed inlets and embayments, creating lagoons which then evolved according to the permanency of the barrier, the sediment supply and the run-off. Waldrans Swamp formed because closure was permanent and infilling by freshwater organic accumulation followed.

Moruya estuary formed when the river valley mouth was partially submerged as a result of late Quaternary marine transgression (Bird 1974). It has consequently been infilled to a large degree, having an extensive plain of alluvial silt which has accumulated over 5,000-6,000 years.

Map 4

Moruya-Broulee beach ridge plain

(adapted from Thom et al 1986)



MORUYA BEACH RIDGE PLAIN

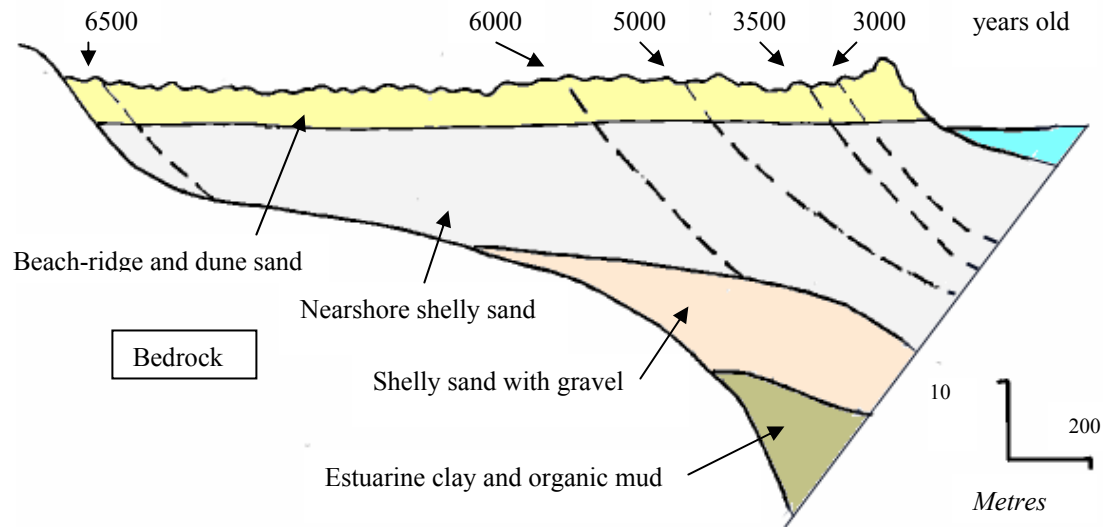
(from Moruya Beach Ridge Plan – A brief review of its scientific importance by PA Hesp and B G Thom)

The plain is composed of a series of parallel to subparallel relict foredunes (or beach-ridges). It is one of the largest and most extensively studied beach-ridge plains on the eastern seaboard of Australia

Radiocarbon dating was used to provide a detailed record of sea level changes over the last 10,000 years and is being used to increase knowledge of climate change in that period including periods of storms or cycles of storminess. This will aid the development of predictive models for future climate change.

A monitoring program was begun in 1972 to record the beach/dune profiles in order to determine short and long-term trends in beach accretion and erosion. This data is critical for the prediction of the impacts of global climate change and sea level rise on sandy coasts.

It is critical that very well studied, scientifically significant sites such as the Moruya beach-ridge plain be conserved, not only for their current scientific importance but their potential to realise far greater environmental and scientific information as new methods of enquiry, research and dating become available.



Cross section of Moruya beach-ridge plain along the central transect
 (see map on previous page) approximate time lines are shown
 (from Thom et al 1986)

2.3.2 Recent Processes

The storms in the winters of 1973 and 1974 led to extensive beach erosion, cut back foredunes, isolated concrete loading ramps, damaged coastal roads and threatened buildings with destruction. An adequate buffer stock of sand needs to be held in the foredune to cope with storms such as these.

In the winter of 1974 there was increased run-off from the hills. This enlarged the outflow from Waldrons Swamp from 2 pipes about 60cm in diameter to a channel some 10 metres wide by 1 metre deep.

Wind removes some sand from the back of the beach and from exposed parts of the foredune but overall stability is maintained unless regeneration of the vegetation is seriously impaired by human activity.

Dr Jiashu Shen has been monitoring Bengello Beach since January 1972. His surveys show how severe the beach erosion was in the early 1970s, but since 1980 it has been relatively stable.

The Moruya-Deua River still carries silt towards the coast from the hills and up-river, but the process is very slow. Human activity is a threat because destruction of trees on slopes, (clearing, fires and road construction) without an immediate stabilisation of soil on the slopes, speeds up the siltation process enormously. This would cause increased flooding to already flood-prone areas and add increased amounts of silt to an already silted-up Moruya estuary.

2.4 Bengello Creek – something special

Bengello Creek is different to most other waterways in NSW and has been classified as a new kind of river – one controlled by sand dunes. Shifting dunes come right down to the banks of the creek and dictate the movement and ecology of the eastern end of the stream.

Scientists at Macquarie University developed criteria to classify different types of streams. There are about 50 categories in the whole of NSW. Since 2002 the different types of rivers have been surveyed by Dr David Outhet, a geomorphologist with the Department Natural Resources. He is identifying the most pristine reaches of each category to demonstrate what that type of river should look like.

Dr Outhet was very impressed with the good condition of Bengello Creek. He has chosen the section near the entrance to represent a dune-controlled reach and has measured the width and cross section and taken photographs. Bengello Creek will feature on the website of the Department of Natural resources when the river categorization work is complete.

Reference James Woodford, “New species helps bridge the scientific gap”,
Sydney Morning Herald, 23 August 2005 , and
Dr David Outhet, personal communication.

Bengello Creek and the dunes



The main references used for this section were
Lee Ann Hally, (B.Sc.Paleoecology), Geology Section, Moruya North Head – Broulee Environment Study
1987; papers by Thom B et al; and personal communication with Dr Jiashu Shen

3. NATURAL VALUES - SOILS

Thirteen soil profiles (exposed vertical sections of soil) were taken over a variety of terrain that portrayed obvious different characteristics based mainly on parent material.

3.1 Soil Groups

Four major different soil groups were defined in the study area.

3.1.1. Uniform Sandy Soils

These soils are formed on siliceous sands and compose the major soils within the study area. They extend from Bengello Beach westward to the hills about 2 kilometres away. They are formed within materials originally transported by wind or waves. Beach samples (profile 1) show little or no profile development but further inland (profiles 2,3,4,5,7,8,9 and 10) the upper portion (0-15 cms) is sandy loam, dark grey in colour from a mixture of sand and organic matter. The colour quickly changes with depth to grey then white with little or no organic matter in the deeper layers.

The soils are formed on an ancient undulating relict sand dune system and the swales are lower and are more susceptible to water logging. The land slopes downward west of George Bass Drive making the water table closer to the surface further from the coast. It was reached at profiles 4, 9 and 10.

3.1.2 Massive Soils with Gradational Textures

These soils are formed on a parent material of Ordovician greywacke, shale, phyllite and metasediments which make up the western portion of the study area (profiles 6 and 11) The soils are on hilly areas and are generally well drained but relatively impermeable. In other words water easily runs off them.

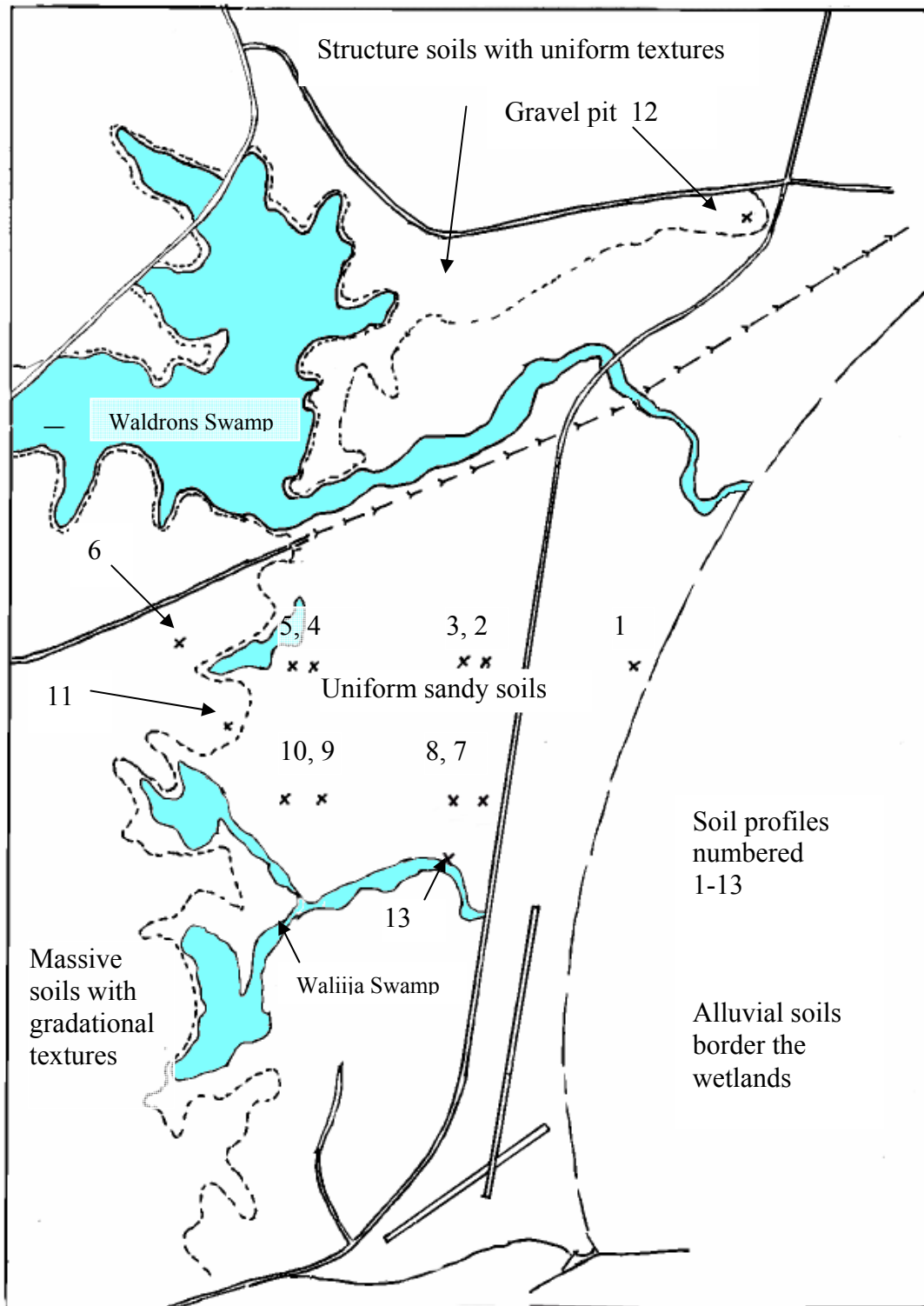
The top layers are generally hard packed grey sandy clay (0-15 cms) going down to a yellow clay soil with particles of coarse gravel. Soil deposition will occur where gradients decrease.

3.1.3 Structure Soils with Uniform Textures

This soil grouping was found in the northern section of the study area formed on a parent material of basalt. This soil is well drained reddish brown clay loam to medium clay and associated with the undulating area (profile 12). The profile was taken from a Council pit.

3.1.4 Alluvial Soils

Alluvial soils are associated with swamps in the study area. These soils can best be described as shallow to moderately deep, loamy soils underlain by organic deposition (profile 13). Organic debris accumulates in and around the edges of the swamps.



Map 5

(after Aschmann 1987 boundaries are approximations)

Soils

The main reference used was
 Aschmann J, (MA Geography), Moruya North Heads-Broulee Environment Study 1987- Soils Section)

3.2 Erodability

Erosion is influenced by interactions between soils and other factors such as rainfall intensity, slope and plant cover. Evidence of sheet erosion was observed within the Ordovician hill areas near profiles 6 and 11. Small gullies were also observed within this area.

The uniform sandy soils are very porous resulting in a lack of surface streams and erosion.

There was little evidence of erosion of the basalt soils even though most of the land was cleared and grazed.

3.3 Biotic Factors

As mentioned previously these are mainly responsible for the accumulation of organic material in swamps. Plants are also a major stabilising agent for beach sands and contribute to soil formation.

3.4 Soil-water Relationships

Soil properties affecting water transmission and retention are primarily depth, texture, porosity, structure and organic matter content. Organic matter on sandy subsoil impedes the downward flow of water and causes swamps that then collect alluvial soil.

The Ordovician metasediments are non porous. Water quickly runs off them, filters down into the uniform sandy soils and forms an underground reservoir before moving slowly towards the sea. Council tests of the groundwater quality have revealed a comparatively high iron content.

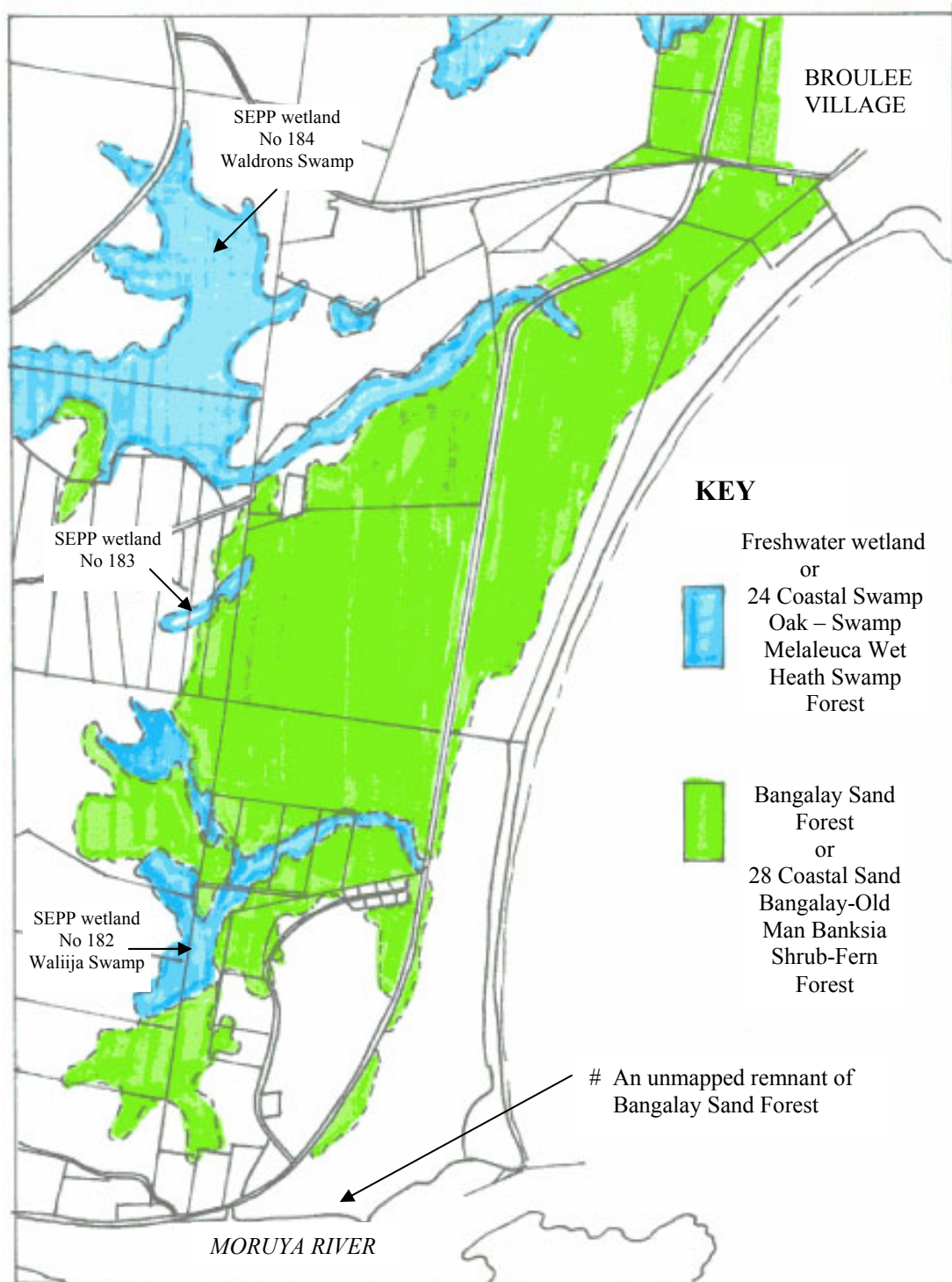
3.5 Soils and Future Land Use

The soils in the study area are not suitable for commercial farming with the possible exception of the basalt soils in the north.

The CSIRO study identified the uniform sandy soils as being unsuitable for septic tanks and presumably for other on-site sewage treatment. Pollution of the groundwater would be inevitable.

The soft sandy soils are easily broken up. This is evident where horses and vehicles have made tracks through the forest.

However, the sandy soils support a vulnerable vegetation community and very valuable fauna habitat that, together with the wetlands and unspoilt dunes, contribute a great deal to the recreational and tourism values of the study area.



Map 6

(from report to Eurobodalla Shire Council 27 July 2004)

Vulnerable Vegetation – both vegetation communities are highly vulnerable.

Note Some remnants of vulnerable vegetation are not shown on this map, for example the piece between the airport hangars and the river.

4. NATURAL VALUES - VEGETATION

4.1 The Vegetation Communities.

A succession of natural vegetation communities stretch inland from Bengello Beach to the inland hills.

The coastal foredunes are covered with a wide variety of native plant species and are mostly in good condition.

Inland from the foredunes the beach ridge plain contains two main vegetation communities both of which have high conservation value. They are:

- a) The Bangalay Sand Forest (NSW Scientific Committee) also called 28 Coastal Sand Bangalay – Old Man Banksia Shrub-Fern Forest (Gellie 2001); and
- b) Freshwater Wetlands of Coastal Floodplains (NSW Scientific Committee) or 24 Coastal Swamp Oak-Swamp Melaleuca Wet Heath Swamp Forest (Gellie 2001).

4.1.1 The Bangalay Sand Forest

The Bangalay Sand Forest covers more than 600 hectares of the ancient dune system. It is of mixed age and is the largest area of this forest type on the Eurobodalla coast. North of the airport and racecourse it is relatively intact, apart from fires and some clearing for the runway approaches. The dominant trees grow to about 25-30 metres in height but salt and winds reduce vegetation near the coast to a dunal succession.



(Photo taken in July 2005)

Bangalay, *Eucalyptus botryoides*, is the main tree species near the coast with an understorey of Coast Banksia, *Banksia integrifolia*, and Old Man Banksia, *Banksia serrata*, to 10 metres. Further inland the middle understorey is dominated by Old Man Banksia.

Burrawang, *Macrozamia communis*, dominates the lower understorey. These cycads grow thickly and are almost impenetrable in places. About a kilometre from the coast the Burrawangs are concentrated on the slopes and crests of the ancient dunes. The swales mainly contain an occasional Blackbutt, *Eucalyptus pilularis*, or Bloodwood, *Corymbia gummifera*, a stand of monocotyledon herbs and *Lomandra longifolia*.

Blackbutt occurs over most of the study area and is one of the most common tree species west of George Bass Drive. The tall forest has been identified as an important habitat area for fauna (see Section 5.1) while the *Banksia* trees provide important winter food sources for many species including nomadic honeyeaters

The understorey of this Bangalay Sand Forest contains a wide variety of small shrubs, herbs and grasses. Some are listed in Appendix I.

4.1.2 Freshwater Wetlands

Three wetlands are found towards the western side of the relict barrier dunes. They are listed as SEPP 14 Wetlands .

Waldrons Swamp (SEPP Wetland No. 184) in the north-west of the study area, is the largest of the wetlands. Swamp Paper-bark, *Melaleuca ericifolia*, grows along the southern side of the wetland and in clumps in the middle of the swamp. Yellow Teatree, *Leptospermum poygalifolium*, is also found beside some sections of the shore. Creeks which feed the swamp are frequently lined with dense *Gahnia*. The swamp drains towards the sea via meandering Bengello Creek which only opens when there is a sufficiently large backup of water to break through the beach sand.

Walijja or Y Swamp (SEPP Wetland No. 182) near the racecourse in the south of the study area is a 'blind' drainage lagoon where the water table is visible at the surface. Sainty described it as a high conservation wetland with low nutrient conditions and widely fluctuating water levels. Its plants include species that thrive under low nutrient conditions such as the endangered Waterwheel Plant, *Aldrovanda vesiculosa* (a submerged carnivorous plant) and *Brasenia schreberi* (a food for waterfowl) . (Sainty 1999)



A small un-named wetland (SEPP Wetland No. 183) lies between Waldrons and Walijja Swamps and is fully enclosed by thick *Melaleuca* and *Gahnia*.

Some of the plants found around Waldrons Swamp are listed in Appendix I. *Aldrovanda vesiculosa* was also found in this wetland.

The freshwater wetlands act as refuges for inland birds in times of drought.

4.1.3 Inland Communities

Other communities border the western part of the study area on the ridges of consolidated Ordovician sediments and Tertiary gravels, clays and sands. The extensive catchment of Waldrons Swamp is mostly consolidated sedimentary geology with Dry Sclerophyll Forest dominated by Spotted Gum, Stringybark, Blackbutt and Ironbark. Forest Red Gum, *Eucalyptus tereticornis*, is also found on the western verge of Waldrons Swamp.

4.2 Threats

The Freshwater Wetlands and most of the least disturbed and biodiverse Bangalay Sand Forest are found on private land or portions that Council owns and is considering for development. (see Maps 8 and 11)

4.2.1 The coastal dunes

Most parts of this community have been affected to some extent by fire. In parts the vegetation has been severely damaged and will require a long period without fires to recover

Germination of Bitou seedlings, *Chrysanthemoides monilifera*, and other weeds is particularly dense in areas that have been severely damaged by fire. Bitou infestation is listed as a key threatening process in the Threatened Species Conservation Act



1995. Coastal Spurge, *Euphorbia paralias*, was recently rediscovered near the airport.

Uncontrolled use of vehicles is also causing extensive damage to dune vegetation. Tracks are proliferating and many go right down onto the beach although the use of vehicles on beaches is prohibited in the Shire.

4.2.2 The Bangalay Sand Forest

Possible future development of private and council-owned land west of George Bass Drive is a major threat to this vegetation community. Eurobodalla Shire Council is currently rezoning part of the public land east of George Bass Drive to 7(f1) Coastal Protection but large areas of the Bangalay Sand Forest lie outside this proposed zone.

As part of the review of rural land planning, the Broulee Regional Precinct Plan, is considering using some of the council owned land for a variety of urban uses. A considerable portion of the Bangalay Sand Forest in the northeast part of the study

area has been set aside for possible urban and recreational uses, which will necessitate extensive clearing. Council also plans to clear a much larger strip to the north of the airport runway.

A significant portion of the northern section west of George Bass Drive is used as a sand quarry. This involves clearing of the forest and eventually the excavations become 'blind' lagoons filled by the water table.

Too frequent burning in recent years, due to both arson and attempts to control the resulting fires, is threatening to severely reduce the biodiversity of the understorey and destroy habitat trees. There needs to be a period without fires to allow shrubs and small trees such as Coast Banksia and Black Sheoak to mature and set seeds. . Daly recommended a fire frequency of less than one in every 20 years and said burning should occur in autumn or early winter so that spring nesting birds are not impacted. (Daly 2001). Strong action is required to prevent more frequent burning. Council should explore how the area might be adequately protected in future perhaps by such options as publicity campaigns, offering rewards for information leading to the arrest of arsonists and encouraging the public to take ownership of the fire bug problem.



*The forest will fully regenerate after fire if given time.
(Arson damage October 2005)*

In 1987 Craven noted that the plant communities of the Broulee Forests were stable except in places where disturbance of the soil had allowed Bitou Bush to become established, such as along the verges of George Bass Drive. Since then Bitou has become more widespread but is most evident nearer the coast. Council is using various methods to control the weed including spraying and biological controls. Other weeds are spreading from illegally dumped garden rubbish, particularly near Broulee village.

4.2.3 The Freshwater Wetlands

Parts of Waldrons Swamp are affected by grazing and run-off from adjoining rural land and the Princes Highway. This could encourage weed invasion. In the 1990s Walijja Swamp suffered an infestation of *Salvinia molesta*, which was controlled by manual removal and spraying. The threat of re-infestation remains although low nutrient conditions may assist in limiting its growth. (Sainty 1999) It is essential that nutrients from the stables and other developments are prevented from entering the wetland. A warming climate will also make *Salvinia* control more difficult as it grows best in warmer water.

Council has upgraded the bores near George Bass Drive to supplement town water supplies. All the wetlands are connected via the water table and could be affected by excessive extraction of the groundwater, especially during times of drought

4.3 The Need to Preserve the Vegetation Communities Intact

Nic Gellie, in his Report on Vulnerable Ecosystems and Landscape Planning in the Eurobodalla Shire (2001) included the Bangalay Sand Forest and Freshwater Wetlands although he gave them different names (see 2.1). He looked at these vulnerable ecosystems on private land and for both these communities he recommended “*integrated landscape protection and management*” and explained what this meant

“Planning and management actions should limit the further fragmentation and loss of structural and species diversity from rural residential subdivision, grazing and patch clearing. Pending verification these ecosystems are considered to be subject to high overall threat. Where possible, ecological pressures on these ecosystems should be stabilised to levels that ensure long-term conservation of ecological integrity and health of the remaining remnant patches.”

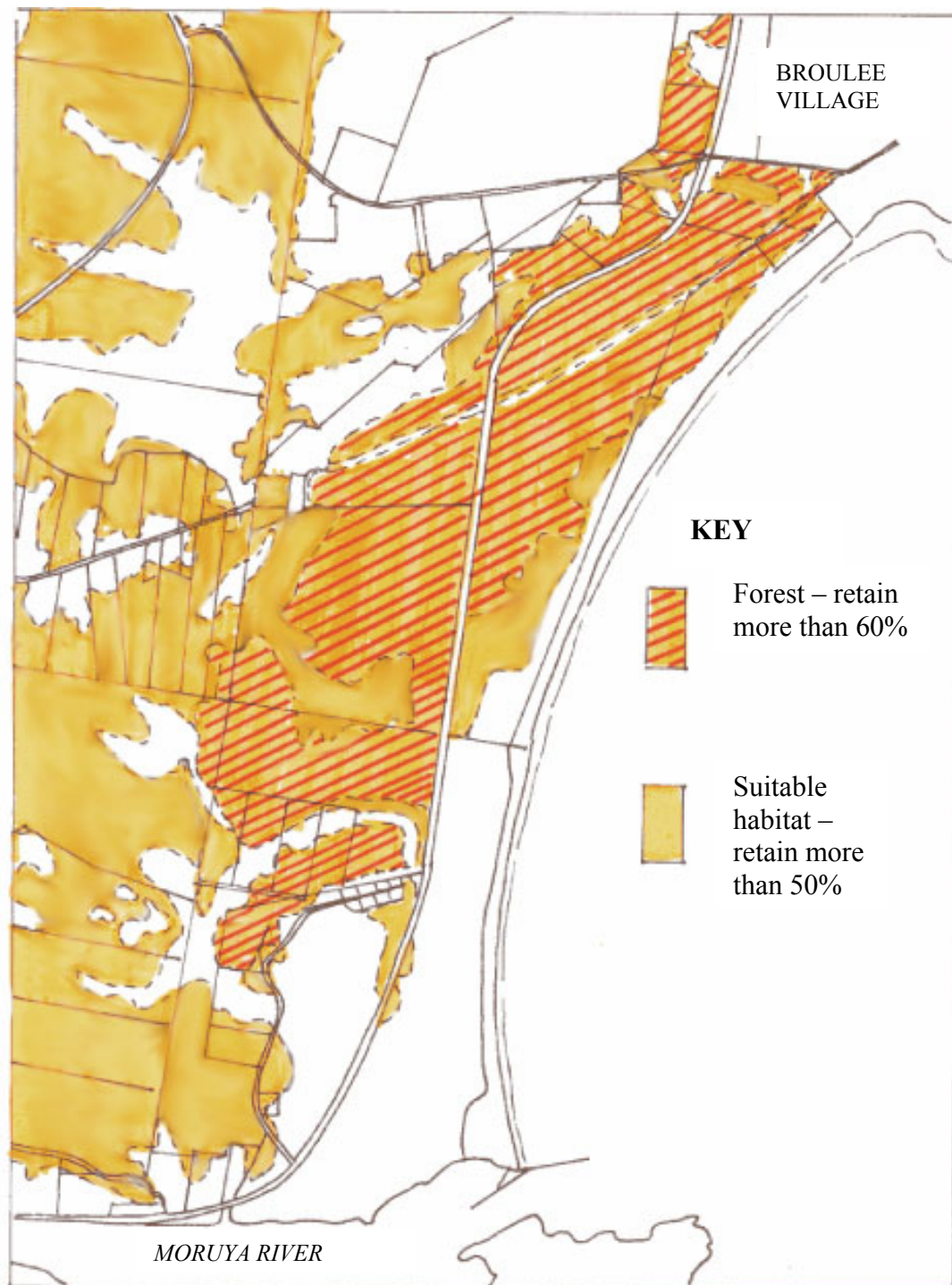
In October 2005 the NSW Scientific Committee listed the Bangalay Sand Forest as an Endangered Ecological Community in the South East Region of NSW under Part 3 of schedule 1 of the Threatened Species Conservation Act 1995. This listing means the Community is likely to become extinct in NSW unless activities such as land clearing and degradation cease.

Freshwater Wetlands on Coastal Floodplains were listed as Endangered Ecological Communities in the South East Region of NSW in December 2004. SEPP14 wetlands are protected from activities such as filling or draining.

When an activity is proposed in an Endangered Ecological Community the impact must be considered and if this is likely to be significant then refusal is more likely. Currently proponents have to prepare Species Impact Statements.

A recent amendment to the Act allows the Minister to grant biodiversity certification to an environmental planning instrument (such as a Local Environmental Plan, LEP) if it will help maintain the biodiversity values of the threatened community, species or habitat. If certification is granted then any development consistent with the LEP will be assumed not to have a significant impact and there will be no need to consider impacts on threatened communities or species when assessing individual development applications. Council will endeavour to obtain this certification for the new integrated LEP.

The main reference for this section was
Craven PJ (B.Nat.Res.(Hons) 1987, **Moruya North Head – Broulee Environment Study**, Flora and Fauna section.
Additional information came from other references cited and personal observations.



Map 7

(from report to Eurobodalla Shire Council, 27 July 2004)

Areas identified in Council's Yellow-bellied Glider Policy as needing protection

(note Yellow-bellied Gliders also live in forest between George Bass Drive and Broulee village but this habitat will eventually be cleared)

5. NATURAL VALUES - FAUNA

5.1 Fauna Habitats

The size and range of habitats in the Study area has encouraged a wide diversity of native amphibians, reptiles, birds and mammals. A list of some of the vertebrate fauna appears in Appendix II

Bengello Beach is used by several species of shore birds including the threatened Pied Oystercatcher, *Haematopus longirostris*. The endangered Hooded Plover, *Thinornis rubricollis*, is occasionally seen on the beach but has not bred there successfully since the 1980s.

Most of the Bangalay Sand Forest is identified as important habitat for the threatened Yellow-bellied Glider, *Petaurus australis*. (Daly 2001). This animal lives in small family groups with large, virtually exclusive home ranges, requires over-mature trees with hollows for den sites, and needs to be able to move through the canopy. Peter Turner conducted surveys in September 2005 and confirmed that the Yellow-bellied Glider territories in the study area were still occupied.

Because of the habitat requirements of the Yellow-bellied Glider it was used by



One of the trees with hollows

Council as an indicator species for management of other forest-dependant fauna although some other animals will have special requirements.

Other hollow dependent threatened species that are known to occur in the area are Powerful Owls, *Ninox strenua*; Barking Owls, *Ninox connivens*; Sooty Owls, *Tyto tenebricosa*; Masked Owls, *Tyto novaeollandiae* and Glossy Black Cockatoos, *Calyptorhynchus lathami*. Greater Gliders, *Petauroides volans*, also live in this forest. (Mills 1994).

Council commissioned a conservation plan for Yellow-bellied Gliders through the Broulee-North Head precinct. The resulting Policy and plan mapped the habitat in the area and recommended protection of more than 50-60% of the forest on any

given property. On the remaining part there is to be retention of all sap-trees and all large hollow-bearing trees, and the retention of vegetation in configurations that allow the movement of the gliders. (ESC 2002) (see Map 7)

This Policy should help maintain the population of Yellow-bellied Gliders in the area but, as Daly pointed out, additional surveys are needed for other significant species of fauna, in particular trapping surveys for ground dwelling fauna. (Daly 2001)

5.2 Threats

Degradation and fragmentation of the habitats and linkages are the major threats to the fauna of the Study area.

Frequent fires have degraded large areas of the dune and forest habitat. Plants are beginning to regenerate but they offer reduced food and shelter at present. Large stands of Black Sheoak, a major feed tree for the endangered Glossy Black Cockatoo, have been killed by fire. The best remaining stands are in the northeastern section of the Council owned land and are threatened with possible clearing and development. (see Maps 8 and 11)

Corridor linkages are vital for the dispersal and survival of many small fauna species. Some attempt was made to ensure widening of the Princes Highway at Waldrons Swamp did not prevent Yellow-bellied Gliders from crossing to western forests but the Highway is probably still a barrier to many other species. George Bass Drive already has a wide road reserve and further clearing of roadside vegetation will further isolate many species. Other barriers to dispersal are the clearings for the power lines.

Slashing the roadside of George Bass Drive has the side effect of encouraging kangaroos to feed there making road kills inevitable and providing an extra hazard for motorists.

No doubt feral animals are present in the study area but there does not appear to be any attempt to assess how many or to manage them. As an indication of the presence of feral animals pigs were noted in the fauna survey in 1985, foxes have been seen on Broulee Island and rabbits numbers are multiplying in Broulee. Feral pigs and predation by foxes have both been listed as key threatening processes under the Threatened Species Conservation Act 1995.

6. LAND USE

6.1 Past and Present Land Use

6.1.1 Aboriginal

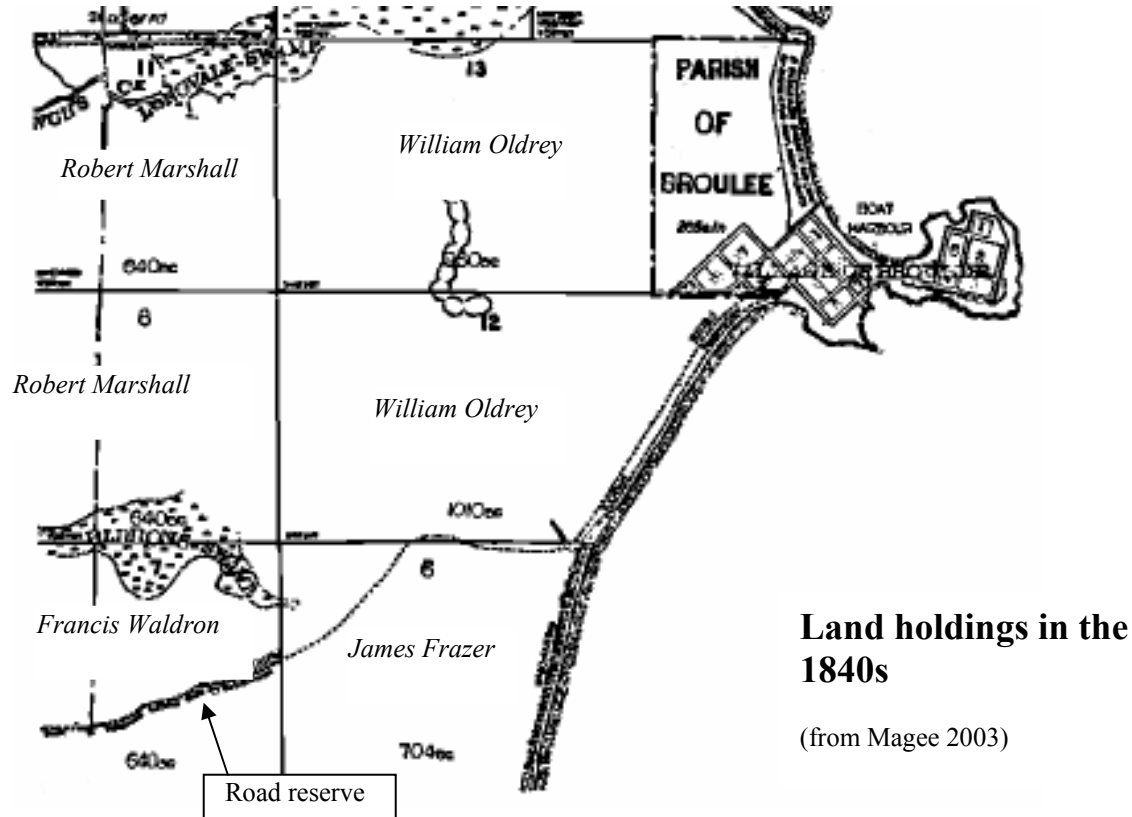
The area has never been archaeologically assessed but known Aboriginal sites are concentrated at Broulee and Moruya Heads with other middens on the immediate coastline. (Mills 1994). The North Head area is still very important to Aboriginal people.

Mills noted that the Aboriginal scarred tree, located on George Bass drive west of Broulee, is highly significant because it is an excellent example and is one of the very few scarred trees still surviving in the area.

Percy Davis, whose tribal name was Narramurrao, was the last member of the local Yuins who spoke his tribal language. He died in 1968 at about 90 years of age. Percy Davis Drive is named in his honour. (Warry 1991)

6.1.2 Original land purchases

The first land releases south of Broulee village were made in 1839 and 1840 with military personnel able to buy at discounted prices. Captain Oldrey purchased land



around the village including 1010 acres along the coast from Broulee headland to the entrance of Bengello Creek. Major James Frazer bought a 704 acre coastal block south of Oldrey's and Ensign James Garland purchased 980 acres at North Head. Waldrons Swamp was divided down the middle in two 640 acre portions, one to Robert Marshall (north) and one to ex-army officer Francis Waldron (south). (Magee 2003 and Gibbney 1980)

If the study area was ever cleared for agriculture most of it would have been uneconomic because of the poor sandy soils and the forests regenerated. Oldrey's block was subdivided again and changed hands several times before most of it was sold to Council sometime after 1973 (Magee 2003).

6.1.3 Hamlets and villages

Broulee village abuts the north of the study area. It was surveyed on and around Broulee Island in 1837 when the bay was already the main harbour for the district. The village grew to a maximum European population of 46 inhabitants in the 1840s and boasted two stores, one inn a police station, court house and lock-up. Although plans were made to expand the settlement, the growth of shipping via Moruya River caused Broulee's population to decline. By 1851 only the lock-up keeper remained and the settlement was officially abandoned in 1852.

Garland's purchase was soon auctioned off and promoted as the Garland estate in the 1840's. A small tannery operated at Garlandtown in the 1850's but the hamlet remained tiny.

The North Head area must have been a relatively busy place during the heyday of the Moruya granite quarry. Nearby Granitetown, established in 1925, reached a population of around 300 before declining after 1931 when the Sydney Harbour Bridge was finished. (Warry 1991).

Apart from a recent small "stables" subdivision at the racecourse, the only other residential dwellings in the study area in 2005 are in the tiny old settlement at Garlandtown and several rural dwellings near Broulee Road.

6.1.4 Airport

Eurobodalla Council purchased the land in 1935 assisted by unemployment relief funds and Federal government defence funds (Bayley 1964). The airport was opened in 1939. In 1940 a commercial operator flew fish to inland towns. During World War II the RAAF set up No.11 Operational Base Unit in tents at what is now the airport and constructed bunkers in the surrounding forest. Those still in existence have been included in the Shire's Heritage List and one near the Speedway is now being used for a pistol range.

In 1946 the airport was returned to the Department of Civil Aviation, which improved the runways to cater for all weather. The “new” aerodrome was officially opened in 1950 and Butlers began a Sydney-Moruya service that day (Bayley 1964) Council leased the land to the Department until operations were handed over to Council in 1991.

6.1.5 Roads

The map of 1839-40 land grants shows a road reserve, probably the one surveyed in 1828. It appears to almost follow the present power line easement from Percy Davis Drive then across to the coast at Bengello Creek and up what is now a gravel road behind the foredunes. A road from the Princes Highway to Broulee was opened in 1926.

The old road behind the Bengello Beach foredunes was later extended to North Head and was the only coastal road between Broulee and Moruya River. It was partly washed away in the storms of 1973-74. Despite widespread community opposition, Council constructed the major road, George Bass Drive, in the early 1980s. On the western side of the road Council retained a narrow strip that effectively controlled access points from private landholdings.

A gravel road was constructed under part of the powerline easement and continues as a sand track to Broulee.

Today the larger population and more four-wheel drives are resulting in a proliferation of tracks through the forest and especially on the foredunes.



Four-wheel drive damage at Bengello Creek

6.1.6 Water

Historical records show a recurring sequence of droughts and floods. The drought, which began in 1979, resulted in a critical water shortage for the Shire (Warry 1991). Deep Creek Dam was begun in 1980 but not completed until 1983. Council constructed two bores to extract groundwater from the Broulee sandplain in 1983 and shortly afterwards floods broke the drought.

Hydrologist, Emmett O’Loughlin, did an hydrology study of the area for Council in the 1990s and noted that the groundwater was one of the most valuable water resources in the Shire and needed protection from development that could contaminate it. (O’Loughlin personal communication)

The bores were refurbished in 2004 when yet another drought brought the Shire’s water supplies to very low levels. The water was thought suitable for domestic use when mixed with water from Deep Creek Dam.

6.1.7 Racecourse

Race meetings were held at various locations around Moruya until a course was constructed on Council land near the airport. The Jockey Club moved to these new premises in 1985. (Warry 1991)

6.1.8 Primitive Camp Ground

North Head has been a popular camping spot for local people and visitors since at least the 1890s. The Aboriginal family of fishers, the Brierleys, lived there prior to the construction of the airport. (Currie, personal communication).

From as early as 1986 there has been a sequence of proposals to develop the camp ground. A tourist facility, aged care complex, and conference centre were just some of the suggestions. All have met with such strong opposition, especially from the Aboriginal community, that they have not proceeded. Council bowed to public opinion and left the camp ground as Community Land in 1994 when the airport itself was classified as Operational.



One of the many meetings held to retain the primitive camp ground

At that time the primitive camping ground did not meet the new State Government regulations but people were adamant that they wanted it to remain for primitive camping and not be turned into more developed facilities. After considerable lobbying from the community, Council negotiated with the Department of Local Government in order to keep it open. Part of the land to the north of the runway was amalgamated with the camping ground to make a total of approximately 180 ha. This northern land was to remain accessible for the use of campers but the actual camping area was to be contained within the previous camping ground.

The pressure for development continues but as of 2005 the primitive camp ground remains.

For more information about development proposals in the study area see Appendix III

6.1.9 Recreation

Recreation is such an important use of the study area today that it is dealt with separately in Section 7

6.2 Current Landholdings

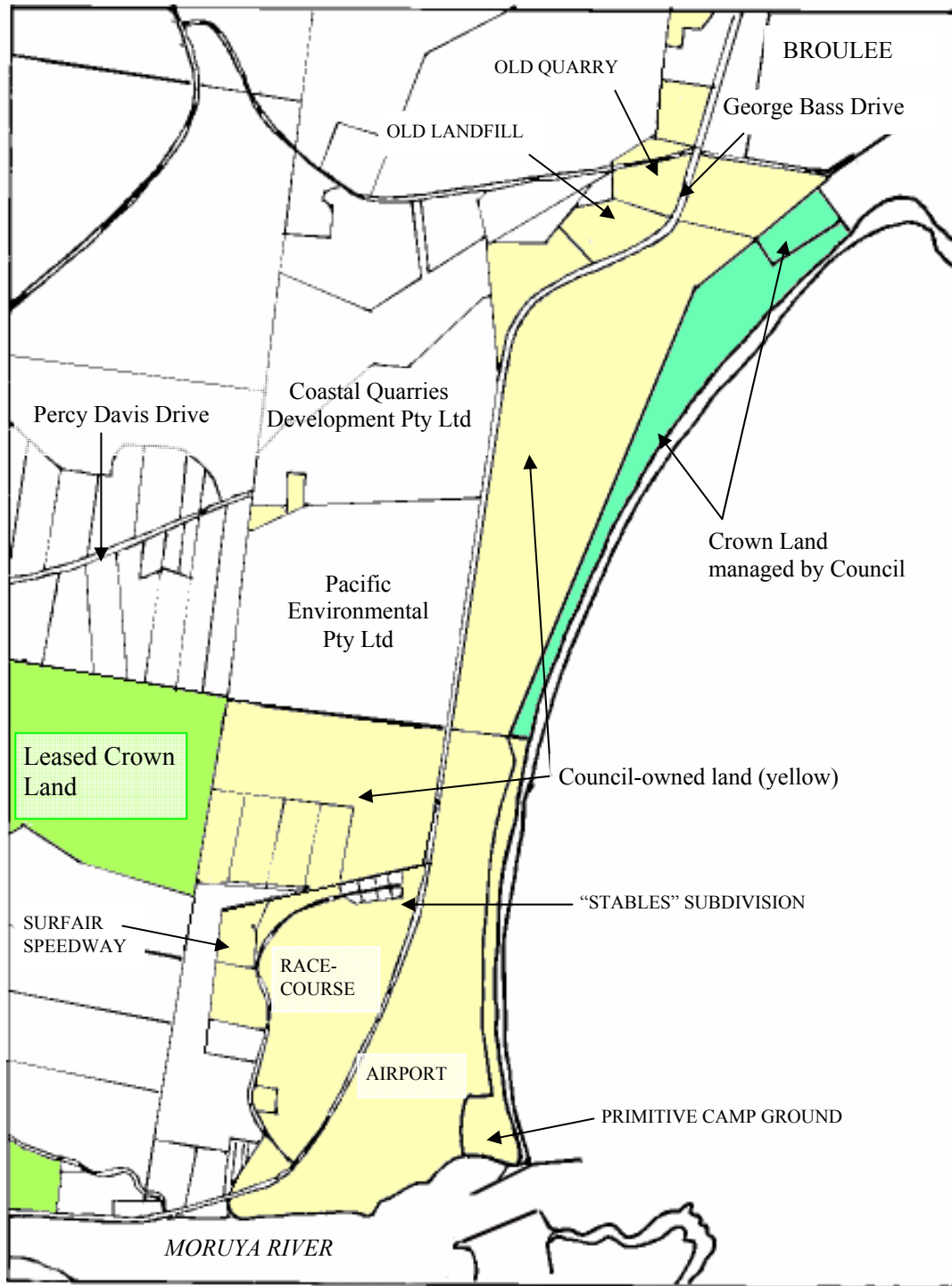
Council is the major landowner in the study area, about 649 ha (see Map 8). Council-owned land is classified either Community or Operational. The use of Operational land is less restricted and it can be sold.

The Council-owned lands include:

- The airport (Operational)
- the Moruya River foreshore with its boatramp (Community)
- the primitive camping ground (Community)
- land north of the airport through to Broulee Road on the eastern side of George Bass Drive (Community)
- the racecourse land, apart from the small privately owned “stables” subdivision (Operational)
- the speedway to the west of the racecourse leased to Surfair (Operational)
- an 8.4 ha parcel south of the racecourse, between Donnelly’s and George Bass Drives (Operational)
- a rectangular block of about 57 ha to the north of the racecourse on the western side of George Bass Drive. This land include part of Walijja Swamp (Community)
- a small portion near the eastern end of Percy Davis Drive- the old sanitary depot (Operational)
- several small portions on the western side of George Bass Drive at the northern end of the study area (all Operational) –
 - a 9.8 ha portion on the corner of Broulee Road some of which was used in the past for a gravel quarry
 - a 12.3 ha portion where the old Broulee landfill was located
 - a 16.4 ha site south of the old landfill, and
 - a 3 metre wide strip along the western side of George Bass Drive road reserve

Council also has care and control of the 56 ha wedge shaped section of Crown Land near Bengello Beach.

Other major landholdings in the study area are a 136 ha portion south east of Percy Davis Drive on the western side of George Bass Drive; and 147 ha adjacent to the north partly used for a sand quarry. North of the quarry is a 30 ha farm. Virtually all of the wetlands are on private land.



Map 8

Major land holdings

7. RECREATIONAL USES AND VALUES

7.1 Recreational Uses

Many of the recreational uses of the area have been covered previously. Those involving constructed facilities are mainly concentrated near the Moruya River – horse racing at the racecourse, go-kart and motorbike racing at Surfair Speedway, pistol shooting in an old bunker, and camping at North Head. An aero club uses the airport and joy flights operate from there. A major caravan holiday park is at the southern end of Broulee.

The breakwall and Bengello Beach are very popular with fishers, and many small fishing craft launch from Brierley's Boat Ramp near the airport. Sand build-up near the ramp prevents larger craft launching there at present but an improved ramp is planned.

Personal Water Craft use has been restricted recently to waters offshore from the breakwall and beach apart from low speed direct runs to and from the boat ramp. The river is becoming increasingly popular with canoeists and sea-kayakers.

Surfboard riders use South Broulee, the area near the breakwall and the river mouth. The surf areas break well on different wind and swell directions meaning that on most days good surfing will be available within the study area.

At the breakwall, the historic rock pool (what is left of it after the Public Works Department half filled it with sand) is sheltered from the wind and is very popular with families in the summer.

Sunbathing occurs all along Bengello Beach but is concentrated at either end, as is swimming, body surfing and surf-ski riding. Most of the beach is dangerous for swimming but the northern end, near the Broulee Surf Club, is safer and is patrolled in summer.

Sailboarding and kite-surfing are also becoming more popular.

Cyclists' clubs regularly race along George Bass Drive to Moruya. The old coast road is used by other bicycle riders and has been identified as a possible part of a future cycleway along the NSW coast.



The old coast road and pedestrian bridge across Bengello Creek – part of the route proposed for a cycleway

There are no developed picnicking facilities in most of the study area but the beach is popular in good weather, and many locations behind the foredunes offer shade and shelter from the winds. Fireplaces are provided at the primitive camping ground.

Walking is probably the activity with the most participants year round. Broulee Island attracts many walkers, and more and more residents and visitors walk along Bengello Beach and in the forests behind. In the study area there are no constructed walking tracks but the old gravel road is often used.

Part of Bengello Beach is listed as a place for dog-owners to walk their pets and is used by many locals and visitors for this purpose.

Touring and sight-seeing is a major recreational activity in the region but George Bass Drive is a straight, high speed road and is not suitable for this purpose. However, North Head Drive is one of the most scenic roads in the Shire.

Unfortunately, more off-road vehicles, including trail bikes, are using the area. Unrestricted use of these vehicles destroys vegetation and conflicts with other more passive uses.

7.2 Scenic Values

The study area consists of a long sandy beach enclosed by a low headland on the northern end and a breakwater to the south. The long panoramic views extend well out of the immediate study area and such long views are not easily obtained from many other vantage points in the shire.



Bengello Beach in winter

Bengello Beach has an extended natural dune system. West of the dunes is an extensive forest on relict beach ridges. Wetlands and forested hills border the study area to the west.

A 1982 study by Ken Taylor, landscape geographer, evaluated the scenic attributes of many locations in the shire. Waldrons Swamp, Moruya River, Broulee forest and South Broulee beach and dunes were all evaluated for variety, vividness, ecosystem intactness,

visual unity and ecological vulnerability. They were found to have moderate to high significance in nearly all regards

Taylor pointed out that the inter-relation of these units is important and that a change in one unit, even if it is already of low significance, may adversely affect others. For example, Taylor said that although the Moruya Aerodrome area is of low visual significance, it is situated against units of high visual unity and ecological vulnerability. He recommended that no buildings be built that are not directly related to the aircraft function of the aerodrome.

7.3 Tourism

A survey of visitors to the Shire during the off-season from March to November in 1986 found the top four reasons why tourists came to the Eurobodalla Shire were:

1. unique variety and clean beaches
2. magnificent coastal scenery and water views
3. climate ...lovely weather for a holiday
4. clean and uncrowded environment

Nearly 75% of all the activities popular with tourists were directly related to the natural environment.

The attractions for visitors did not change much in the subsequent decade and it can be argued that they remain so today, although the strengths of the region are increasingly threatened. In 1997 Advance Tourism produced the Eurobodalla Nature Coast Tourism Development Strategy for Council. The strategy made these points:

- *Further development should not be at the cost of the region's greatest competitive strength and appeal, that is its unspoilt natural attractions and scenic beauty (p14)*
- *The region's strength is its clean untouched and undeveloped natural attractions such as pristine beaches, forests and waterways (p19)*
- *A positive perception is that the region is minimally developed (p 34)*
- *A negative perception is that some commercialization which has taken place is seen as the beginning of the end (p35)*

7.4 How to preserve the area's recreational and tourism values ?

Development of any of the currently undeveloped land in the study area will adversely affect the recreational potential, scenic and tourism values of the whole area. Council should dedicate all its undeveloped land for ecologically sustainable passive recreational purposes. New development proposals for the already disturbed areas such as the racecourse and airport need to be very carefully assessed against the need to maintain the scenic values and tourism strengths of the area.

Council needs to develop a recreational policy for the area as part of a Plan of Management for the Community Land between Broulee and Moruya River. The Plan of Management should be governed by the carrying capacity of the area and strive to reduce conflict between recreational uses.

Noise can affect the value of the area for passive recreational activities. The current restrictions on personal watercraft should remain and boating facilities should be designed to encourage the use of non-motorised craft.

For reasons of noise, safety for other users and the need to protect fragile sandy soils and dunes, vehicle access needs to be controlled. Restricting vehicles to a few defined access roads and parking areas is desirable. The ban on all vehicles on beaches should be maintained and the signage improved to incorporate foredunes in the ban.

Trail bikes should not be allowed off road in the natural parts of the study area. There are hundreds of kilometers of roads in the State Forests that can be used by registered trail bikes.

High speed traffic on George Bass Drive is very noisy, makes the road unsuitable for sight seeing and results in more animals being killed. A lower speed limit would reduce these problems. In any case a wide buffer with thick understorey vegetation is needed between the road and residences such as those at the “stables” subdivision and those proposed for the airport.

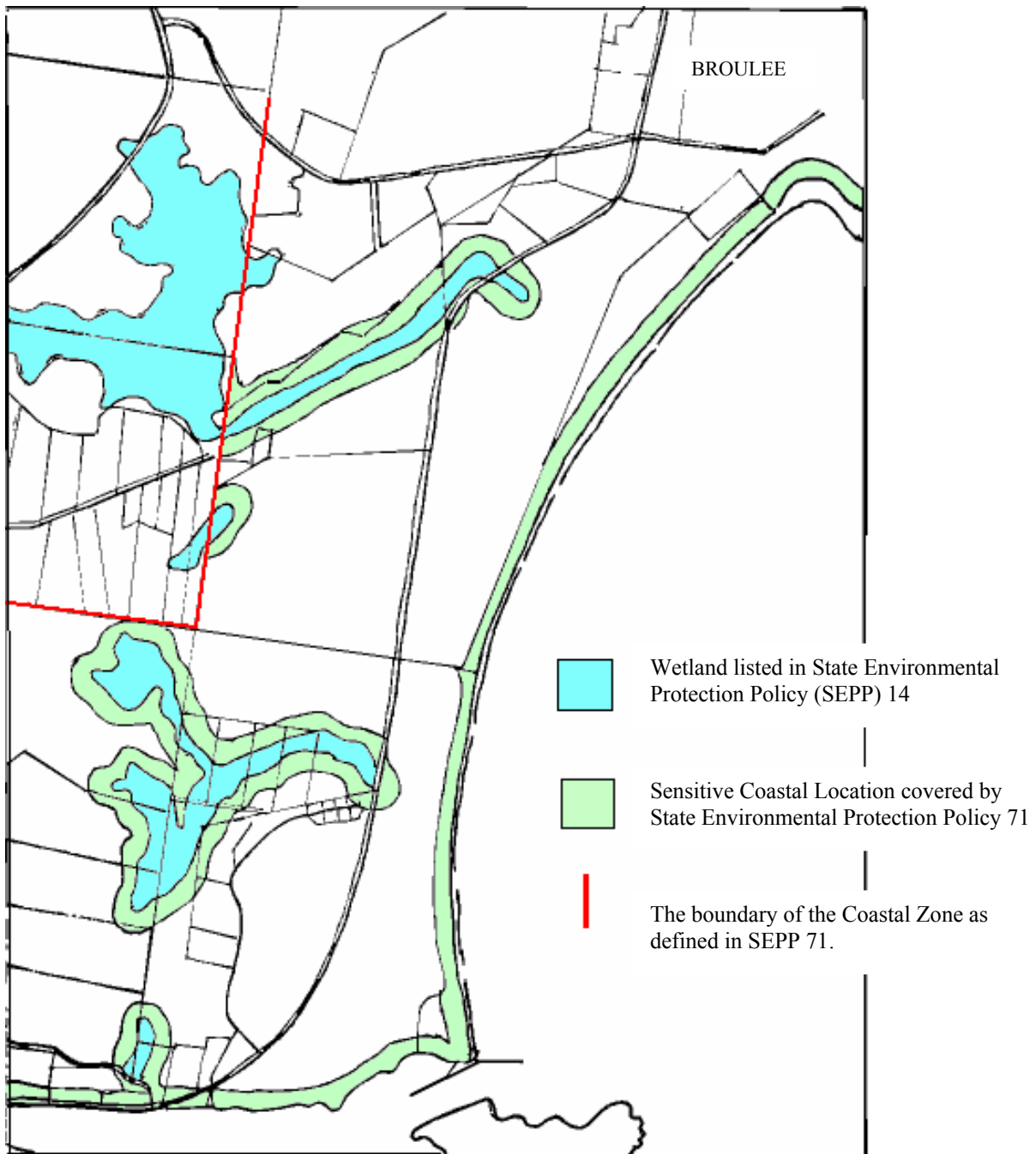
Developed picnic grounds and barbecue facilities should be restricted to open land near the Broulee surf club and the boat ramp area beside the Moruya River. Facilities within the undeveloped areas would only result in litter and more fires.

If endangered shore birds try to nest on Bengello Beach they may be successful if local people help monitor the sites, and erect and maintain fencing around the nests. The National Parks and Wildlife Service’s Shorebird Recovery team would be able to advise and assist.

There is considerable potential for improving walking access to points of interest such as Waliija Swamp, the heritage listed bunkers and the gravel quarry – part of the ancient bed of the Clyde River.

7.5 Conclusion

The study area is presently fulfilling the needs of a vast number of people by offering a diverse range of settings that allow a wide choice of recreational activities. However, overcrowding will diminish the enjoyment of participants, lead to conflicts and degrade the environment. Low-key management based on carrying capacity will allow the recreational uses to continue in a more ecologically sustainable way.



Map 9 (from report to Eurobodalla Shire Council 27 July 2004)

**Boundary of the Coastal Zone,
SEPP 14 Wetlands and
SEPP 71 (Sensitive Coastal Locations)**

8. LAND ZONING

The study area is currently zoned under Eurobodalla Shire's Rural Local Environmental Plan 1987 (see Map 10) apart from a small area near Broulee village zoned 6a (Public Open Space) under the Urban LEP.

Council is in the process of rezoning some of land on the eastern side of George Bass Drive from Rural 1a (Environmental Constraints and Agriculture) and 6a (Public Open Space) to 7f1 (Environmental Protection - Coastal Lands Protection). The objectives of the 7f1 zone include the aim to *“minimise development on land which has significant environmental constraints or hazards and ensure that any development in these areas makes adequate provision for maintaining environmental quality.”*

The Rural 1a zone has much broader objectives and allows many more land uses. Unfortunately, the western side of George Bass Drive contains some of the highest value vegetation and fauna habitat, as does the Council-owned land around the fire station, but these areas will not be included in the 7f1 zone.

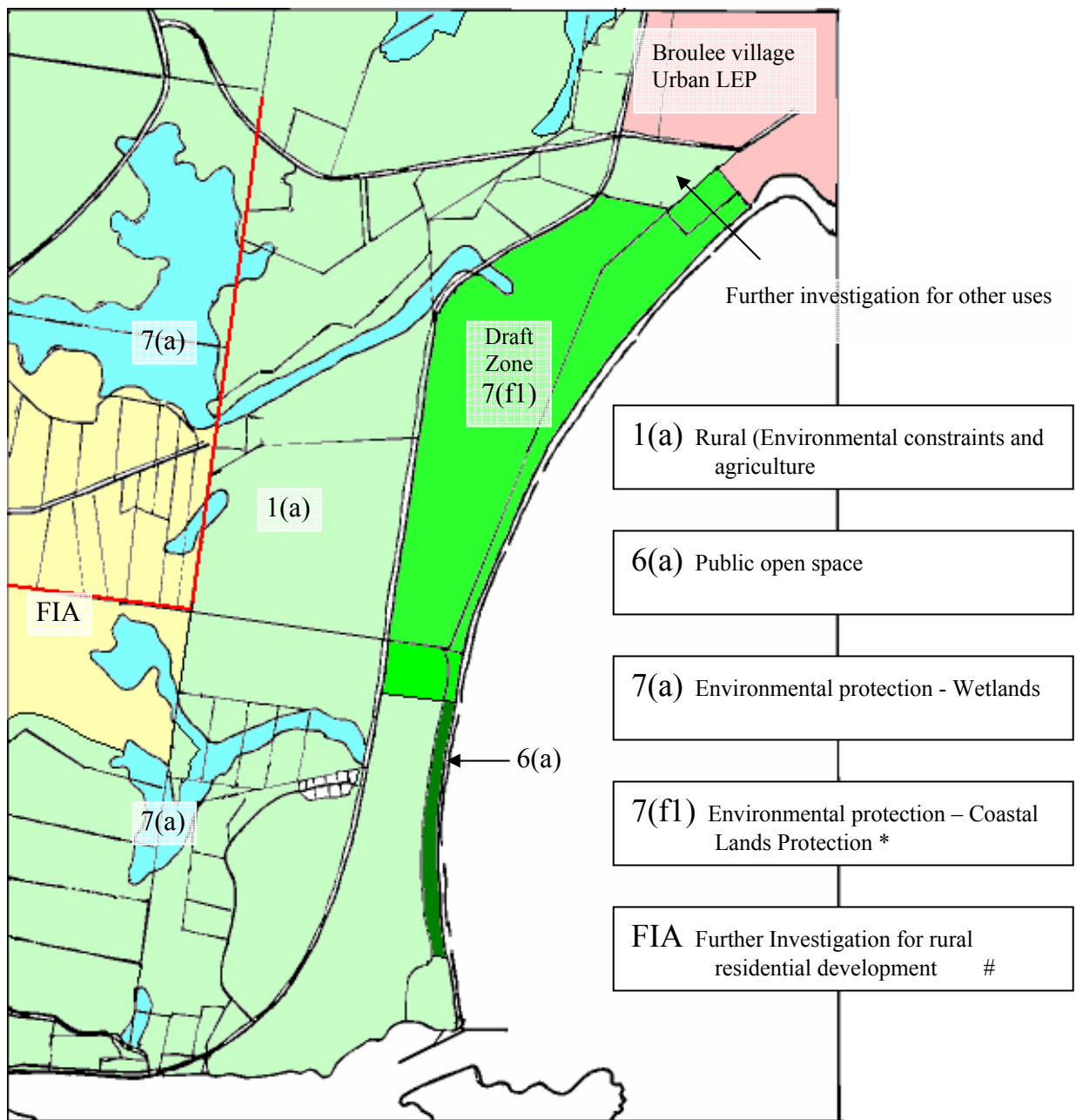
Land west of George Bass Drive is zoned Rural 1a while the SEPP 14 wetlands are zoned 7a (Environment Protection – Wetlands). Some of the western portion of the study area on either side of Percy Davis Drive is identified for further investigation as 1c Rural Residential zoning and is being considered as part of the current review of the Rural LEP.

The NSW government intends to introduce a template Local Environmental Plan and standardised zones throughout the state. It remains to be seen whether this will be an improvement as far as the Eurobodalla Shire is concerned.

In 2002 the state government introduced State Environmental Planning Policy No 71 (SEPP 71) Coastal Protection as an interim measure until new Regional Strategies are prepared. It generally covers land within one kilometre of the sea, and includes land around bays, estuaries, coastal lakes and lagoons. The policy aims to *“ensure that the coastal zone is protected in accordance with the principles of ecologically sustainable development; that development is appropriate and suitably located; and there is a clear and consistent development assessment framework for the coastal zone.”*

Land within 100m of the mean high water mark or around SEPP 14 wetlands is among those areas defined in SEPP 71 as a Sensitive Coastal Location and most development applications for these areas must be referred to the department for review and comment. The boundaries for the Coastal Zone and Sensitive Coastal Locations are shown on Map 9.

Most large development proposals for land in the SEPP 71 Coastal Zone are determined by the Department of Infrastructure, Planning and Natural Resources but when the new Local Environmental Plan is adopted the planning powers will probably be handed back to Council.



Map 10

(based on a report to Eurobodalla Shire Council 27 July 2004)

Zones under the Rural LEP 1987 with proposed amendment to 7(f1)

* The 7(f1) zoning was not gazetted at the time of this publication

The draft Eurobodalla Rural Lands Strategy indicates this FIA land should not be made rural residential but should be zoned either rural or environmental constraints

9. WHAT DOES THE FUTURE HOLD ?

Over the last twenty years the study area has been subject to a series of ad hoc development proposals (see Appendix III and Section 6 - Land Use). The Coastwatchers Association began asking for a co-ordinated plan for the area in the 1980s and in 1992 the NSW Department of Planning flagged to Council the need to treat the area as a strategic unit for planning purposes.

9.1 Information required for good planning

A report to Council on 14 July 1992 said any study of the area would need to account for the following:

- (i) *the importance of the area as a resource for continued scientific research and the likely implications of development;*
- (ii) *the impact of development on SEPP No 14 Wetland areas on the subject land and in the locality;*
- (iii) *the importance of groundwater resources and the likely impact of development on water quality and quantity;*
- (iv) *the landscape values of the area;*
- (v) *an assessment of flora, fauna, heritage and archaeological values;*
- (vi) *the impacts of development on any possible future expansion and/or increased utilisation of Moruya airport;*
- (vii) *supply and demand for rural smallholdings within the Shire and the locality;*
- (viii) *availability and desirable levels of servicing;*
- (ix) *likely impacts of increased residential densities on adjoining recreational resources, particularly Bengello Beach;*
- (x) *implications of the NSW Coastal Policy; and*
- (xi) *consideration of the provisions contained within the Lower South Coast Regional Environmental Plan No.2 as relevant.*

Other factors to consider were the potential influences of coastal processes and flooding. For example, it is already known that Bengello Beach is eroding at the southern end and accreting in the north.

Since 1992 Council has been accumulating information on the study area. The Coastal Capacity Plan covers most of the Shire's rural land outside State Forests and National Parks. It maps constraints to development in computerised layers based on Geographical Information System (GIS) measurements. Several of the maps in this study are based on those layers.

The constraints include flooding; acid sulphate soils; gradients; hydrology and other factors. Vulnerable vegetation communities (as mapped during the Comprehensive Regional Assessment prior to the Regional Forest Agreement) are also included. The boundaries of these communities and of the SEPP 14 Wetlands remain to be confirmed by future fieldwork. The fauna, heritage and archaeological values of the area still have not been properly assessed.

9.2 A Regional Precinct Plan for Broulee-Moruya North Head

In a report on 27 July 2004 Council flagged a Regional Precinct Plan as part of the process underway to review the Shire's Rural Local Environmental Plan and develop an Urban Settlement Strategy with the NSW Department of Infrastructure, Planning and Natural Resources.. The purpose of the Regional Precinct Plan is to *"consider the future uses, development and preservation of areas of Council-owned land in the precinct from Broulee Road south to the airport at North Head."* Some senior Council staff and councillors are keen to see a public-private partnership, rather than a direct sale, to develop part of the land.

The report went on to say that the focus of the strategic planning will be on *"what types of public and private investment is appropriate in what localities and on what sites, based on the environmental and infrastructure capacity of that land"*. Community consultation, subsequently conducted by Illawarra Regional Information Service (IRIS Research), would assist councillors decide the sites and uses. It would also guide the development of the Urban Settlement Strategy and help frame a place-statement for Broulee. The Regional Precinct Plan will have to align with both of these.

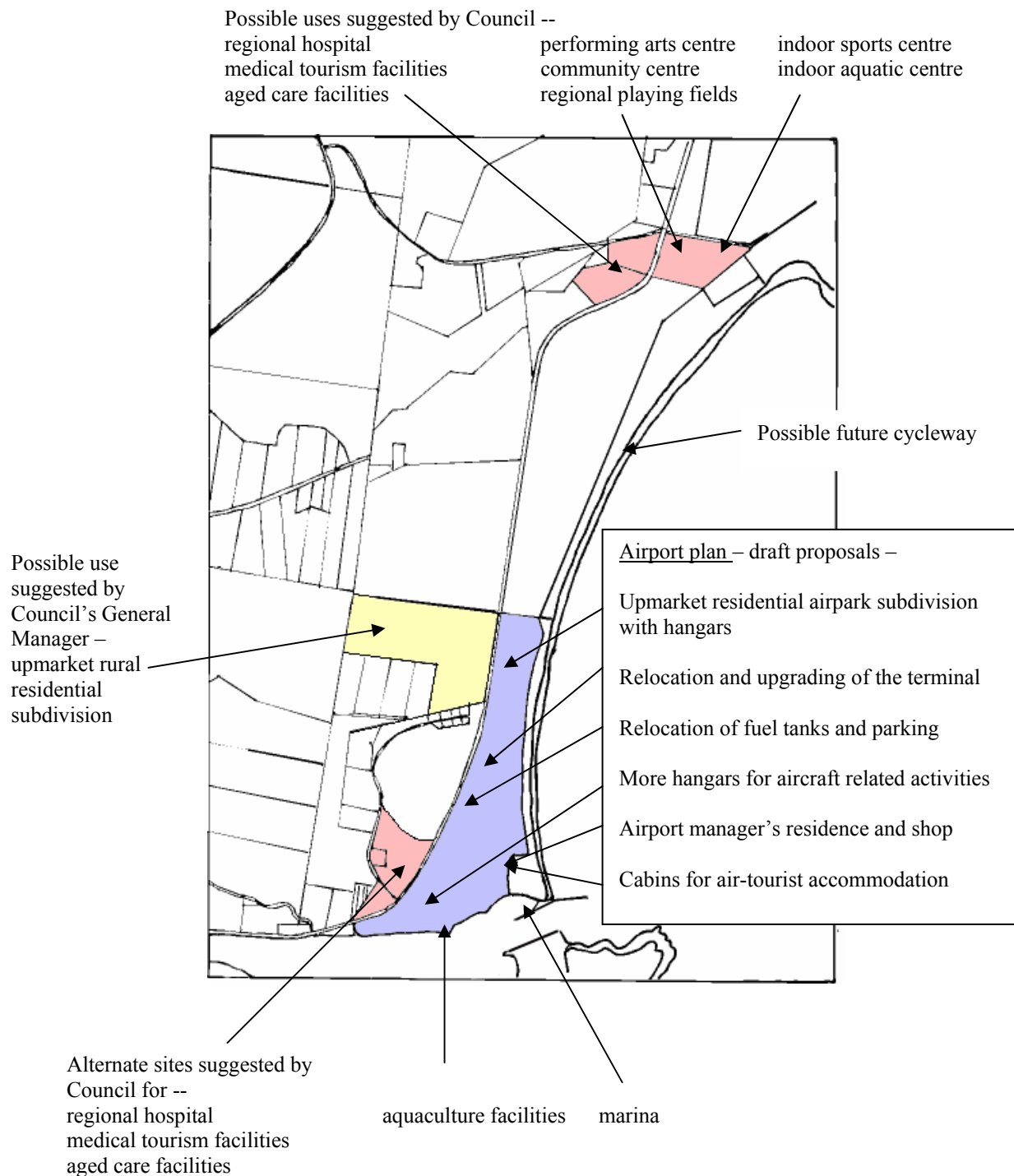
At an earlier workshop for councillors some of the uses suggested included:

the airport	a cycleway
a residential airpark	regional playing fields
aged care facilities	an indoor aquatic centre
a public hospital	an indoor sports centre
medical tourism facilities	a marina
a performing arts centre	conference facilities
a community centre	an eco tourism resort

Possible aquaculture pursuits or shellfish hatcheries may also be considered for land near the river. (see Map 11)

Map 11

Sites being investigated for development under the Airport Plan and Regional Precinct Plan



Conference facilities and an eco tourism resort are also being considered for sites near the river

More studies will be needed before detailed plans can be prepared. It is proposed a Triple Bottom Line matrix will then be devised “*to give suitable weighting to each of the environment, social, infrastructure (lifecycle) and economic risks and benefits*” for each use and site in the precinct. Such weightings are subjective judgments not necessarily related to the values the community would give. If the process gets to this stage the weightings will be crucial in directing councillors’ decisions.

9.3 IRIS Research findings

Of the five most dominant visionary principles to emerge from the community workshops conducted by IRIS, the first three are relevant to the Broulee-Moruya North Head area.

1. Preservation of the natural environment Participants in community workshops overwhelmingly wanted “*the natural environment to be preserved and valued.*” They envisioned a future where “*development has been carefully controlled and planned with a visionary approach to have minimal impact on the environment. Beaches and waterways remain pristinely clean and are complemented by an abundance of untouched bush areas.*”... “*Environmental preservation should remain a central tenet of all planning and development decisions and policies in the Shire.*”

2. Health Care The participants’ wished for a super regional hospital in the centre of the shire with adequate essential medical services existing in other major towns and more local specialist medical services. The Moruya area was commonly acknowledged as the most equitable location.

3. The Built Environment Participants wanted to maintain both the environment and the inherent character of towns and precincts in the Shire. They were prepared to accept some medium density development infill but questioned whether this needed to occur at the expense of the natural environment and the ambience of the area. They wanted the Shire to do growth differently. There was strong support for retaining significant green belts around townships and future housing estates and for distinct planning strategies driven by the characteristics of each area and by input from local residents.

9.4 The Draft Urban Settlement Strategy

The IRIS findings reflect the community reference group consultation forums held to discuss the directions of the Urban Settlement Strategy. Participants overwhelmingly wanted to stop urban sprawl and were willing to accept sensitive infill of existing settlements in exchange for the protection of large undeveloped areas between them.

The specific objectives of the draft Urban Settlement Strategy are encouraging. Those relevant to the study area are:

- *To protect and enhance cultural, ecological and visual characteristics of a locality*

- *To limit coastal sprawl by establishing separation and greenbelts between settlements*
- *To integrate new development with surrounding land uses*
- *To protect local character*
- *To encourage new coastal settlements to be appropriately located*

A draft of the Urban Settlement Strategy says, “*Given the importance of ecological, rural and coastal landscapes throughout the shire, and the desire to conserve natural resources, the plans support the existing pattern of urban settlement across the shire as well as providing a framework for protecting the scenic and landscape values into the future.*”...

In recognition of this settlement pattern, the plan co-locates major public uses in existing centres to strengthen commercial viability and provide opportunities for more locally run businesses. The plan does not identify the need for any new centres either large or small outside of settlement boundaries.” The map for the Broulee-North Head area appears to show the Broulee village confined to its current southern boundary and no settlement between there and North Head.

The Strategy classes Broulee as a coastal village and says, “*coastal villages are set within a natural landscape which makes each place unique.*” It goes on to say that recreational and commercial functions that are not required daily should be in the towns.

Higher education, sporting facilities, hospitals and other health services, transport infrastructure and tourist accommodation are among the facilities that should go in the main towns.

9.5 The Draft Eurobodalla Rural Lands Strategy

The draft Rural Lands Strategy is based on the capacity of the land to be developed sustainably. Of particular relevance to the study area are the key matters of:

- environment protection – eg “*conserve endangered ecological communities, vulnerable ecosystems and other high conservation value vegetation; protect wetland communities*”
- land availability – “*given market analysis, difficulties in servicing rural residential land and the environmental impacts associated with the development of this land it is not intended to rezone any further rural land for rural residential purposes*”..... “*land (previously labelled Further Investigation Areas for 1(c) Rural Small Holdings) be zoned rural or environmental constraints as appropriate*”

9.6 Meeting Community Expectations

If Council takes any notice of its own studies, the findings of the IRIS survey, the objectives of the draft Urban Settlement Strategy, and the draft Rural Lands Strategy then the land between Broulee and Moruya North Head will not be used for any of the uses suggested in the report on a Regional Precinct Plan (see Section 9.2). The only exceptions are a cycleway and the airport and its associated facilities.

Ideally, undeveloped private land in the study area would be acquired and together with the forested public land and wetlands would be given permanent protection, by inclusion in Eurobodalla National Park, for instance.

Alternatively, Council and the private owners could enter into Voluntary Conservation Agreements (VCAs) with the NSW Department of Environment and Conservation. These are legally binding and perpetual on title so that the agreement stays in place if the property is sold. Landowners who enter into VCAs get exemption from Council rates and receive funds to assist in fencing and managing the land. However, this assistance may not be enough to obtain VCAs over the private land in the study area unless the owners are philanthropic.

10 CONCLUSION

This study, together with all the information Council has gathered, demonstrates that the Broulee-Moruya North Head area is one of the most valuable natural assets in the Shire. It is valuable not only for ecological reasons but because of the contribution it makes to the tourism strengths of the Shire, the way it meets the expectations of the community that the environment will be protected, the water resources that underlie it, the passive recreational opportunities it provides, and the significant scenic values it possesses.

All of the currently undeveloped areas between Broulee and Moruya North Head should remain in their natural state to protect these values and enable present and future generations to enjoy them.

This can be achieved by a combination of methods:

- All the undeveloped areas should be mapped on Council's Geographic Information System as having absolute constraints and should be zoned Environment Protection
- The undeveloped land should be managed to preserve the values of the area and the management needs to include strong action to reduce the frequency of burning.
- Owners of partly developed land in this area, including Council, should have to enter into a Voluntary Conservation Agreement for the natural areas remaining on their land prior to any development being approved on the rest of the land
- Preferably sooner rather than later, the undeveloped land should be acquired by the state government and incorporated in Eurobodalla National Park

Sometime in 2005 the Draft Urban Settlement Strategy and Draft Rural Lands Strategy will go on public exhibition. This will give people the opportunity to voice their support for the protection of the Bengello coast and hinterland. Council and the state government need to be made aware of the strength of support for preserving these forests and wetlands.

APPENDIX I FLORA

Some native plant species of the Bengello Beach foredunes

<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle
<i>Atriplex cinerea</i>	Grey Saltbush
<i>Banksia integrifolia</i>	Coastal Banksia
<i>Carpobrotus glaucescens</i>	Pigface
<i>Correa alba</i>	White Correa
<i>Leucopogon parviflorus</i>	Coastal Beard Heath
<i>Lomandra longifolia</i> .	Spiny-headed Mat-rush
<i>Pelargonium australe</i>	Native Storksbill
<i>Senecio lautus</i>	Coastal Fireweed
<i>Spinifex sericeus</i>	Beach Spinifex

Some native plant species of the Broulee Bangalay Sand Forest

<i>Acacia implexa</i>	Hickory Wattle
<i>Acacia mearnsii</i>	Black Wattle
<i>Acacia suaveolens</i>	Sweet Wattle
<i>Acacia longifolia</i> var. <i>longifolia</i>	Coastal Wattle
<i>Allocasuarina littoralis</i>	Black Sheoak
<i>Banksia integrifolia</i>	Coastal Banksia
<i>Banksia serrata</i>	Old Man Banksia
<i>Bulbine bulbosa</i>	Golden Lily
<i>Caesia vittata</i>	Blue Grass-lily
<i>Carpobrotus glaucescens</i>	Pigface
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Diuris</i> sp.	a ground orchid
<i>Eucalyptus botryoides</i>	Bangalay
<i>Eucalyptus pilularis</i>	Blackbutt
<i>Eustrephus latifolius</i>	Wombat Berry
<i>Gahnia sieberiana</i>	Red-fruited Saw-sedge
<i>Glycine clandestina</i>	Twining Glycine
<i>Goodenia ovata</i>	Hop Goodenia
<i>Hardenbergia violacea</i>	False Sarsaparilla
<i>Hibbertia obtusifolia</i>	Grey Guinea Flower
<i>Hibbertia</i> sp	a guinea flower
<i>Hypoxis hygrometrica</i>	Golden Weather-grass
<i>Imperata cylindrica</i>	Blady Grass
<i>Indigofera australis</i>	Austral Indigo
<i>Kennedia rubicunda</i>	Dusky Coral-pea
<i>Leucopogon parviflorus</i>	Coastal Beard Heath
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Macrozamia communis</i>	Burrawang
<i>Microlaena stipoides</i>	Weeping Grass

Monotoca elliptica
Notelaea ovata
Oxalis corniculata
Pittosporum revolutum
Poa labillardiera
Pratia purpurescens
Pteridium esculentum
Ranunculus lappaceus
Schelhammera undulata
Senecio lautus
Senecio linearifolius
Solanum aviculare
Solanum prinophyllum
Solanum stelligerum
Stellaria flaccida
Thelymitra sp
Themeda australis
Viola hederacea
Wahlenbergia stricta

Tree Broom-heath
 Mock-olive
 Creeping Oxalis
 Yellow Pittosporum
 Tussock Grass
 Whiteroot
 Bracken
 Common Buttercup
 Lilac Lily
 Coastal Fireweed
 Fireweed Groundsel
 Kangaroo Apple
 Forest Nightshade
 Devil's Needles
 Forest Starwort
 a sun orchid
 Kangaroo Grass
 Ivy-leaf Violet
 Tall Bluebell

(Craven 1987 and ERBG 2000)

Some plant species found around Waldrons Swamp

<i>Acacia mearnsii</i>	Black Wattle	
<i>Acacia rubida</i>	Red-leaf Wattle	
<i>Aldrovandra vesiculosa</i>	Waterwheel Plant	Rare and endangered
<i>Banksia integrifolia</i>	Coastal Banksia	
<i>Banksia serrata</i>	Old Man Banksia	
<i>Breynia oblongifolia</i>	Coffee Bush	
<i>Bursaria spinosa</i>	Native Blackthorn	
<i>Calochlaena dubia</i>	Common Ground Fern	
<i>Carpobrotus glaucescens</i>	Pigface	
<i>Casuarina glauca</i>	Swamp Sheoak	
<i>Corymbia maculata</i>	Spotted Gum	
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	
<i>Desmodium varians</i>	Slender Tick-trefoil	
<i>Dipodium punctatum</i>	a hyacinth orchid	
<i>Eucalyptus fibrosa</i>	Red Ironbark	
<i>Eucalyptus paniculata</i>	Grey Ironbark	
<i>Eucalyptus pilularis</i>	Blackbutt	
<i>Eucalyptus tereticornis</i>	Forest Red Gum	
<i>Gahnia sp</i>	a saw-sedge	
<i>Hibbertia obtusifolia</i>	Grey Guinea Flower	
<i>Hibbertia scandens</i>	Climbing Guinea Flower	
<i>Hypoxis hygrometrica</i>	Golden Weather-grass	

Kennedia rubicunda
Leptospermum polygalifolium
Leucopogon lanceolata
Macrozamia communis
Melaleuca ericifolia
Notelaea venosa
Ozothamnus argophyllus
Ozothamnus diosmifolius
Persoonia linearis
Phragmites australis
Pittosporum revolutum
Pseudoraphis paradoxa
Pteridium esculentum
Pultanea villosa
Ranunculus lappaceus
Santalum obtusifolium

Dusky Coral-pea
Yellow Teatree
Lance-leaf Beard Heath
Burrawang
Swamp Paper-bark
Veined Mock-olive
Spicy Everlasting
White Dogwood
Narrow-leaf Geebung
Common Reed
Yellow Pittosporum
a spiny mudgrass
Bracken
Bronze Bush-pea
Common Buttercup
Sandalwood

(Craven 1987 and ERBG 2000)

APPENDIX II

FAUNA OBSERVED IN THE STUDY AREA IN PAST SURVEYS

(most species listed are from Craven 1987 - further surveys are needed, especially of the wetlands)

Herpetofauna

Reptiles

<i>Chelodina longicollis</i>	Eastern Long-necked Tortoise	Swamp
<i>Amphibolurus muricatus</i>	Jacky Lizard	Forest/Dune
<i>Physignathus lesuerii</i>	Eastern Water Dragon	Swamp
<i>Varanus varius</i>	Lace Monitor	Forest
<i>Lampropholis mustelina</i>	Weasel Skink	Forest
<i>Tiliqua scincoides</i>	Blue-tongued Lizard	Forest
<i>Pseudechis porphyriachus</i>	Red-bellied Black Snake	Swamp edge
<i>Notechis scutatus</i>	Tiger Snake	Swamp edge
<i>Pseudonaja textilis</i>	Eastern Brown Snake	Forest

Amphibians

<i>Limnodynastes peroni</i>	Brown Striped Frog	Forest/swamp
<i>Litoria ewingii</i>	Brown Tree Frog	Swamp
<i>Litoria Peronii</i>	Peron's Tree Frog	Swamp
<i>Ranidella signifera</i>	Common Eastern Froglet	Forest

The endangered Green and Golden Bell Frog was observed at Waldrons Swamp in the past.

Avifauna

The birds listed were sighted during surveys done by the Eurobodalla Natural History Society on 5th and 6th October 1985. Many other species inhabit or visit the area. Those marked with an asterisk (*) were sighted in surveys for threatened species done by Peter Turner in September 2005.

Sighted in and around around wetlands

<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant
<i>Porphyrio porphyrio</i>	Eastern Swampphen
<i>Cygnus atratus</i>	Black Swan
<i>Anas superciliosa</i>	Black Duck
<i>Haliaeetus leucogaster</i> *	White-bellied Sea Eagle and nest
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo
<i>Phaps chalcoptera</i>	Bronzewing Pigeon
<i>Leucosarcia melanoleuca</i>	Wonga Pigeon
<i>Todiramphus sanctus</i>	Sacred Kingfisher

<i>Cormobates leucophaeus</i>	White-throated Treecreeper
<i>Malurus cyaneus</i>	Superb Fairy-wren
<i>Melithreptus lunatus</i>	White-naped Honeyeater
<i>Lichenostomus flavicollis</i>	White-eared Honeyeater
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater
<i>Microeca fascinans</i>	Jacky Winter
<i>Pachycephala pectoralis</i>	Golden Whistler
<i>Rhipidura fuliginosa</i>	Grey Fantail
<i>Oriolus sagittatus</i>	Olive-backed Oriole
<i>Neochmia temporalis</i>	Red-browed Finch

Sighted in the Bangalay Sand Forest

Except for the waterbirds, all the species listed above were seen in the forest. Other species seen in the forest were:

<i>Callocephalon fimbriatum</i>	Gang Gang Cockatoo	Vulnerable
<i>Platycerus eximus</i>	Eastern Rosella	
<i>Anthochaera carunculata</i>	Red Wattlebird	
<i>Anthochaera lunulata</i>	Little Wattlebird	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	
<i>Pachycephala rufiventris</i>	Rufous Whistler	
<i>Rhipidura leucophrys</i>	Willie Wagtail	
<i>Strepera graculina</i>	Pied Currawong	

Some additional birds observed in the study area recently

<i>Porzana fluminea</i>	Australian Spotted Crane	
<i>Calyptorhynchus lathami</i>	Glossy Black-cockatoo	Endangered
<i>Ninox strenua</i> *	Powerful Owl	Vulnerable
<i>Ninox novaeseelandiae</i> *	Southern Boobook	
<i>Ninox connivens</i> *	Barking Owl	
<i>Tyto tenebricosa</i> *	Sooty Owl	Vulnerable
<i>Tyto novaehollandiae</i> *	Masked Owl	Vulnerable
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater (a colony)	
<i>Climacteris erythrops</i>	Red-browed Treecreeper	

Mammals

The species marked with an asterisk (*) were sighted in surveys for threatened species done by Peter Turner in September 2005.

<i>Tachyglossus aculeatus</i>	Echidna	
<i>Antechinus stuartii</i>	Brown Antechinus	
<i>Sminthopsis murina</i>	Common Dunnart	(CSIRO 1978 study)
<i>Perameles nasuta</i>	Long-nosed Bandicoot	
<i>Petauroides volans</i> *	Greater Glider	
<i>Petaurus australis</i> *	Yellow-bellied Glider	Vulnerable

<i>Petaurus breviceps</i>	Sugar Glider
<i>Trichosurus vulpecula</i>	Common Brushtail Possum
<i>Acrobates pygmaeus</i>	Feathertail Glider
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Wallabia bicolor</i>	Swamp Wallaby
<i>Hydromys chrysogaster</i>	Water-rat
<i>Rattus fuscipes</i>	Bush Rat
<i>Rattus lutreolus</i>	Swamp Rat

Bats were also observed but not identified.

APPENDIX III

DEVELOPMENT PROPOSALS AND WORKS SINCE 1986

(Refer to Map 8 for locations of properties)

The Broulee-North Head area became a focus of developers' interest during the 1980s when the Eurobodalla Shire was booming. Prior to 1986 an airport casino where patrons could fly in to gamble was just one of the concepts being discussed.

July 1986 – A large resort and conference centre was proposed for North Head campground

(Coastwatchers Association produced a study of the Moruya North Head-Broulee in 1987 and asked Council and the Department of Planning for a co-ordinated plan for the whole area.)

1989 – Pacific Environmental Pty Ltd asked for their land to be rezoned to 1(c) Rural Residential but after several attempts and lengthy negotiations with the Department of Planning the request failed. In July 1992 the Department said it would be unlikely to approve the rezoning as there was enough 1(c) land in the Shire, and asked Council to do a strategic review of the whole area. Council decided not to proceed with rezoning at that time. Since then the company has several times sought access to the property from George Bass Drive, most recently in 2005, but were not prepared to pay the price Council asked.

About 1990 A V Jennings planned to build an aged care/retirement village etc. at North Head. This also lapsed.

1993 – A tourist facility was proposed for North Head by Allied Projects. In September a report went to Council on the development proposal and options of how to handle the rezoning. The proposal did not go ahead when the campground was classified as Community Land in 1994.

Dec 93 Coastal Quarries Development Pty Ltd subdivided off Lot 1 containing the extractive industry and agreed to give Council right of carriageway over Lot 2 (for the power and water easement) in exchange for right of carriageway over Council's small lot near Percy Davis Drive.

April 94 - Council classified the airport Operational but the rest of the Council-owned land east of George Bass Drive became Community Land.

Sep 94 Council approved a camp ground on private land near the Speedway subject to the concurrence of the Department of Planning. The development has so far not gone ahead.

- Nov 94 The Airport Master Plan noted that land to the north of the airport would be needed for extension of the runway and approximately 55 ha further north would have to be lopped to maintain the clearance gradient.
- Aug 95 – The Public Works Department project to upgrade the breakwater at North Head pushed sand into the rock swimming pool substantially filling it.
- Feb 96 – Part of the public land adjoining Broulee Road was allocated for the Candlagan Bushfire Brigade Reserve despite most public submissions saying they wanted the natural bushland retained intact.
- Nov 96 - The Airport Advisory Committee reported to Council recommending development of the airport.
- May 97 – The Tourism Development Strategy was released recommending a major tourist development at the primitive campground site.
- 24 June 97 - The Airport Sunset Committee was formed to examine proposals for use and upgrading of the airport.
- 28 July 98 – The report of the Sunset Committee to Council recommended among other things tourist development of the primitive campground, with rezoning and reclassification so that it could be sold or leased. Reasons given included a resort operator /developer could take over some or all of the costs of operating the airport.
- Late 1990s – Council subdivided land between the racecourse and Walijja Swamp as a residential development with stables.
- 1999 - Council proposed a resort/conference centre on the primitive camp ground site, relocation of the campground further upstream, the possibility of a waste treatment package, and upgrading the airport. Council subsequently commissioned GHD to do a study of the social and economic effects of the proposed development. The report was far from enthusiastic and there was considerable public opposition to the development of the primitive campground.
- Aug 2002 – Council called for expressions in interest in the development, management and operation of the airport and airport related industries, excluding the primitive campground, boat ramp and possible marina behind the breakwall. The concepts presented were so excessive that Council did not accept any, deciding instead to try for something more acceptable to the community.
- Oct 2003 - Council laid water and sewer pipes under the Moruya River to service the North Head area.

2004 - Council refurbished the bores to extract groundwater for use during the drought.

March 2004 – Council began the rezoning process to make some of its land north of the airport on the eastern side of George Bass drive 7(f1) Coastal Protection. The draft plan was exhibited in June 2005.

July 2004 – Council proposed a Regional Precinct Plan as part of the Shirewide planning review (rural and urban) with the aim of developing some of the Council owned land between Broulee and the Moruya River.

May 2005 – A plan for airport related development inside the boundaries of the airport was presented by Council's business development manager. The proposals included an upmarket residential–hangar subdivision, relocation of the terminal and fuel tanks, and cabins near the primitive campground. A program of consultation began shortly afterwards.

2 August 2005 – Council voted to exhibit the draft Urban Settlement Strategy and draft Rural Lands Strategy for public consultation.

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