DRAFT COASTAL MANAGEMENT PLAN
SHIRE OF DENMARK

Department of Conservation and Environment
Perth, Western Australia

Bulletin 199 January 1987

DRAFT COASTAL MANAGEMENT PLAN

SHIRE OF DENMARK

Department of Conservation and Environment

and

Denmark Shire Council

Bulletin 199

January 1987

ACKNOWLEDGEMENTS

REPORT PREPARATION	:	Thane Riney Annette Van Steveninck Bill McArthur Michael Kerr
CONTRIBUTIONS	:	Eve Bunbury Danuta Hulajko
ASSISTANCE	:	Ernest Hodgkin John Randal Ashley Prout Local Workshop Groups at Ocean Beach, Parrys, Peaceful Bay and Boat Harbour; Denmark District Tourist Bureau; Volunteers conducting questionnaire
ARTWORK	:	Tony Berman
DESIGN/LAYOUT	:	Brian Stewart
PHOTOGRAPHY	:	Stuart Chape Annette Van Steveninck Gary Young Thane Riney

ISBN : 0 7309 0418 0
ISSN : 0156 - 2983

CONTENTS

TABLES

FIGURES

Page No

PHOTOGRAPHS

PREFACE

A growing public awareness in recent years, supported by concern over a good many more years by residents within this Shire, were the catalysts required to initiate investigation in conjunction within the Department of Conservation and Environment into the production of a comprehensive management plan for our coastal reserves.

Intrinsic fragility of the coastal system has been recognised for some time and increasing use by the pleasure seeking public has precipitated this action by Council. Every endeavour has been made to retard deterioration of sensitive areas and simultaneously provide access and enjoyment for users of the coastal areas. Achievement of these goals requires physical implementation of the plan, but more importantly active co-operation by the user public.

Considerable time and energy, input and debate has been the hallmark in preparation of this plan. From concept through active involvement of interested groups at site workshops, the Management Plan for Coastal Reserves within the Denmark Shire has evolved as a tool to ensure workability.

Many thanks must go to the Department of Conservation and Environment, Councillors and Staff and the enthusiastic support from local people.

L A BRENTON
PRESIDENT
DENMARK SHIRE COUNCIL

1. INTRODUCTION

1.1 Background

In 1976, the Environmental Protection Authority (EPA) published its 'Red Book', 'Conservation Reserves for Western Australia, Systems 1, 2, 3, 4 and 5', containing recommendations about the future control and management of certain land on the south coast of Western Australia. It recommended that working groups consisting of representatives of local government authorities, State Government departments and the community be convened to assist in this respect. Management was emphasised following the 1981 amendment to the Land Act which implied that a management plan would be requested by the Minister for Lands for areas vested with a local government authority.

Furthermore, the 1977 EPA 'Guidelines for an Environmental Protection Policy on the Coastal Zone of Western Australia'(EPA 1977a) recognised the role of local authorities as front-line managers of the coast.

The Denmark Shire Council believes that it should address these concerns, initially for the coastline within its boundaries. The Department of Conservation and Environment was requested to coordinate preparation of a coastal management plan.

The Denmark Shire Council supports further consideration of its coast within a broader regional context, following acceptance of this plan by the community and State Government.

1.2 Purpose of the Management Plan

The broad objective for coastal planning and management is stated in a State Government position paper (State Government, 1983): 'to achieve a balance between the protection of environmental quality and provision for the social and economic needs of the community' (p.3). It is recognised that the coast is a dynamic environment and that 'an understanding of complex interacting systems' is necessary in coastal planning and management (EPA, 1977, p.2). In particular, the Government Position Paper states, 'before coastal land is allocated for a particular use the physical capability of the land to support that development should be carefully considered' (1983, p.3). This report gives special attention to land capability criteria and assesses the hazards and constraints for use of specified land units.

This report contains policies, recommendations and site plans to guide the development of Denmark Shire coastal reserves. It is concerned with the provision of coastal access and facilities in a controlled manner so that environmental damage is minimized.

The management plan may assist in increasing people's awareness of the 'fragile' nature of the coastas its preparation has already involved active community participation and support in environmental protection. Places of unique landscape, scientific and cultural significance have been recognised and suggestions for their retention were included in management plans.

Also, it is important to provide a means of informing State Government and the community of Council's intentions and commitment towards managing the coast and the means of establishing controls, for example, through by-laws and caretaker/ranger services. This would become the basis for Council's applications for State and Commonwealth financial assistance to implement

management recommendations. It should also assist in establishing priorities and appropriate staging of developments.

1.3 Plan Preparation

The Department of Conservation and Environment (DCE) has co-ordinated preparation of this draft plan which incorporates Council's recommendations and policies for the coast based upon both local community and technical advice.

Workshops were conducted to obtain information and ideas from community groups regarding the four major recreation reserves at Ocean/Light's Beaches, Boat Harbours, Parry's Beach and Peaceful Bay (see Figure 2). A survey was conducted by Denmark Environmental Group volunteers over Easter 1985 to provide further direction for the planning process (see Appendix 2 for survey questionnaire and results). Council will encourage written comment on this draft plan for three months following its release to the public.

With respect to technical advice, DCE has requested comments from State Government departments and local interested groups on their concerns for the Denmark coastal district. Experts in specific fields have been employed to provide input to the plan, which, after completion, will again be circulated to Government departments for additional comments.

1.4 Location/Study Area

The Denmark Shire lies within the southwest region of Western Australia, some 420 kilometres south of Perth (see Figure 1).

The study area includes approximately 100 kilometres of coast with Frankland River forming the western boundary ($116^{o}53'E$), Hay River the eastern boundary ($117^{o}29'E$) and the South Coast Highway the northern boundary (see Figure 2).

Denmark, located at latitude $34^{o}57'S$ and $117^{o}21'E$, is the major town within this coastal district. There is a leasehold settlement with 163 lots at Peaceful Bay and several shacks, mostly owned by professional fishermen, at Peaceful Bay and Parry's Beaches.

Council has requested that the management plan consider the entire Denmark Shire coastal zone and, also, eventually focus specifically on reserves vested in Council at Ocean and Light's Beach, Parrys, Boat Harbour and Peaceful Bay. Estuaries and swamps are considered as part of the coastal environment.

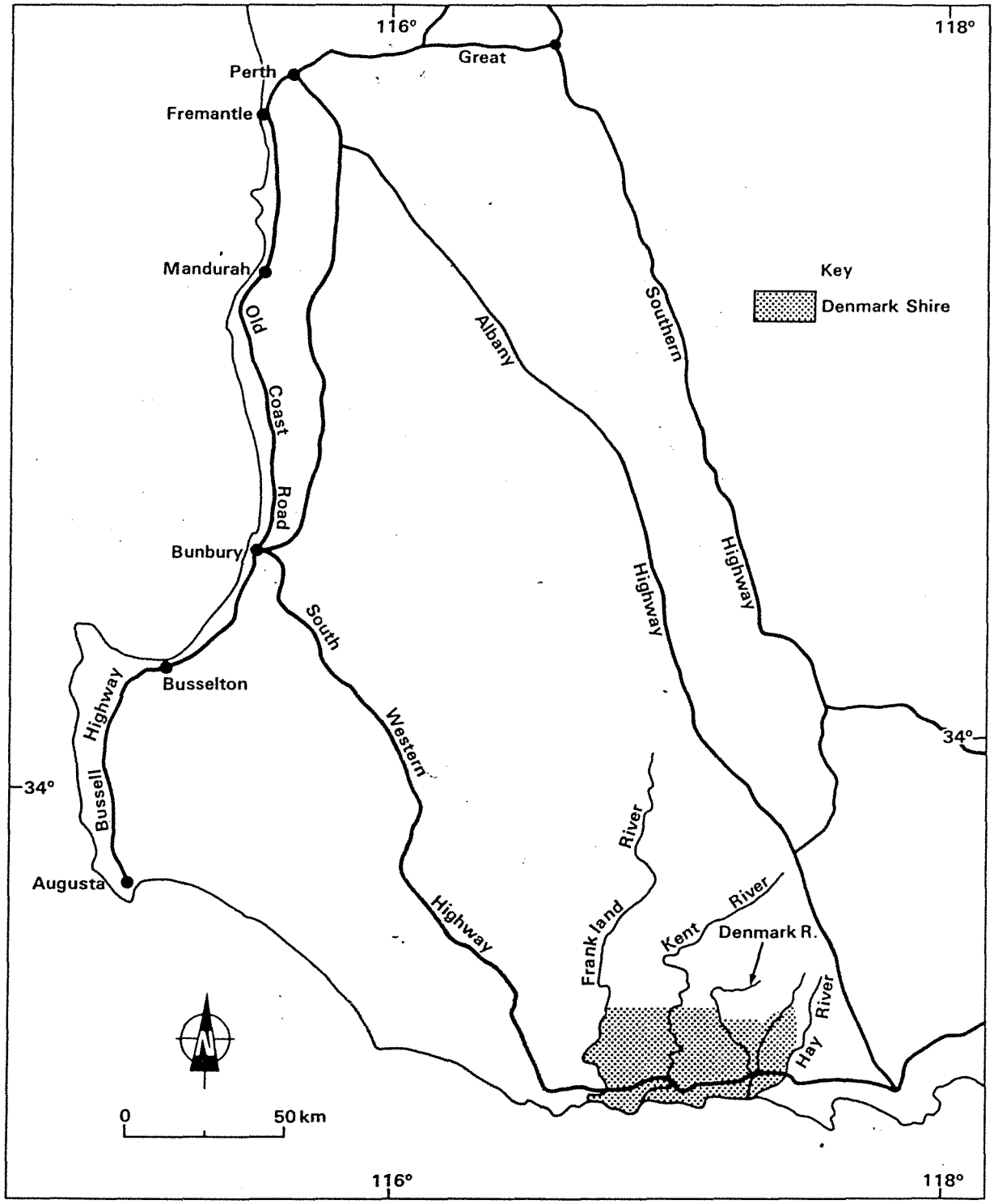


Figure 1. Location of Denmark Shire

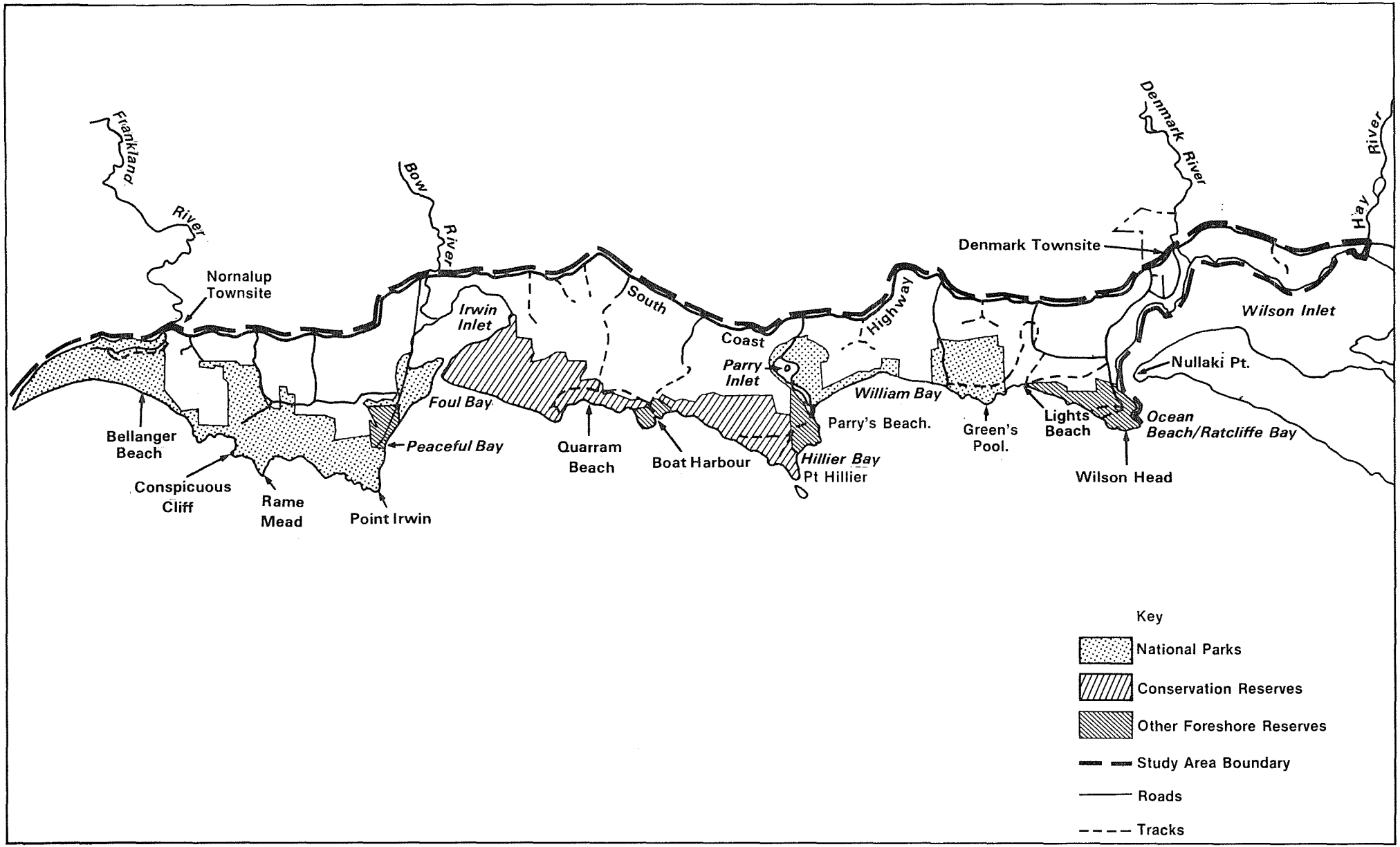


Figure 2 Study Area.

2. NATURAL ENVIRONMENT

2.1 Climate

Climate in the Denmark area is Mediterranean, with cool, wet winters and warm, dry summers. There is a marked gradient in rainfall (see Table 1) from west to east, with mean annual rainfall of more than 1250 mm at Nornalup and less than 1000 mm at Wilson Inlet. The number of wet days along the coastal zone is fairly constant at about 180 per year. The temperature gradient is generally from the coast to the inland but changes seasonally. During winter the mean temperature along coast is about 12°C and declines with distance inland, while in summer the coastal mean temperatures are about 18°C and increase inland.

These conditions may have an influence on the seasonal timing of people's visits to the Denmark Shire and on the nature of activities. In planning coastal recreational facilities, average (normal) weather can be predicted and countered. However, occasional extreme climatic events may cause damage and additional precautions are required.

The normal summer wind pattern for the south coast is easterly winds in the morning followed by strong south-westerlies in the afternoon. The south-westerly winds, with constant, high velocities (often over 40 kph), are very effective in moving sand. Care should be taken to protect south-west facing beaches, to avoid making paths and tracks aligned to the south-west, and to encourage vegetation to regenerate on areas already eroded. In particular, the eastern extremities of embayments are especially prone to wind erosion.

In addition to these prevailing winds, there are occasional westerly storms during winter when winds exceed 50 kph. When these storms coincide with high tides, beaches are often severely eroded.

2.2 Geology and Physiography

The coastal zone of the Shire of Denmark, extending from the South Coast Highway to the shoreline has a varied geology, physiography and soils, all of which have relevance to land management. The gross shape and position of the coastline and the main physical features of the hinterland are determined by the **Precambrian basement** of granites and gneisses. This is evident as a series of hills and headlands (some with a soil mantle and others bare) which have been associated with the coastal environment for millions of years.

During the Tertiary, when the sea level was much higher than now, the granitic hills were islands and reefs around which the sediments of the Plantagenet Group were deposited. These sediments are no longer present in the coastal zone but make up a major part of the Denmark Shire inland from the South Coast Highway. In the late Pleistocene, when sea level was much lower than now and the continental shelf was exposed, shell fragments were blown up into huge dunes linking together the granitic headlands and sometimes covering them. These dunes, often more than 100 m high, were quickly converted to a loose sandy limestone by solution and have become massive limestone barriers. The barriers have accumulated all along the coast with breaks occurring only where drainage from rivers and inlets enter the sea. These breaks in the limestone are now very important since they have allowed development of beaches which are focal points for recreation.

The limestone barriers accumulated from the south-west and the main erosion forces are from the same direction. Wave action has eroded the limestone so that now there is a steep scarp to seaward. Also, there are wave-cut

Table 1 Meteorological Data - Denmark Shire

Mean Rainfall (mm)

Station	Years Record	J	F	M	A	M	J	J	A	S	O	N	D	Year
Nornalup	39	34	35	55	89	168	191	209	178	142	106	58	42	1307
Wet days		8	7	10	14	19	20	22	20	17	15	11	9	172
Kent River	41	31	32	52	86	147	167	186	156	132	100	55	41	1185
Denmark	56	29	33	55	83	139	167	179	157	123	106	49	39	1158
Wet days	9	8	11	14	19	20	22	21	18	17	17	12	20	181
Wilsons Inlet	45	26	25	46	67	125	148	148	131	98	86	40	31	971
Highest Daily Record Denmark	1960	87	66	107	113	71	92	79	65	76	53	48	67	
Highest Daily Record Nornalup	1952	57	86	67	104	75	78	85	53	92	42	68	50	
Mean Temperature ^{o}C														
ALBANY (Over 59 years)														
mean max	23.3	23.3	22.2	21.1	18.9	16.7	16.1	16.7	17.8	18.9	20.6	22.2	20.0	
mean min	15.0	15.0	14.4	12.2	10.0	8.9	7.8	8.3	8.9	10.0	12.2	13.8	11.1	

platforms, above and below present sea level, showing the positions of former sea levels. Thus, the coastline consists of a series of south-west facing scarps interrupted by granitic headlands and sandy beaches (see Photograph 1).

Photograph 1. Denmark Coastline - Granite Outcrop, Sandy Beach and Limestone Scarp.

By the end of the Pleistocene (about 6000 years ago), several important physical features had developed. A narrow poorly-drained coastal plain had formed around the granitic hills, and within this, estuaries and inlets formed connecting basins for drainage systems. Also, at about this time, a series of linear dunes formed on the entire coastal zone over plains and hills.

The dune material, composed largely of broken shell fragments, originated on the beaches and was blown inland to form a complex pattern of parabolic dunes. The dunes now cover most of the immediate coastal zone (coastal plain, granite headlands, and limestone barriers), and in addition to creating a characteristic environment, they have changed drainage, blocked or divided inlets, and formed lakes by blocking valleys.

The dunes, named the **Meerup dunes** have accumulated in four phases of activity with periods of stability between phases (see Photograph 2). The phases are recognised by their shape, relief, soil profile development, and vegetation. Older phases have smooth, gently sloping ridges, a podzol soil profile, and stable woodland vegetation. Younger phases have high relief, steep slopes, minimal soil development, and coastal heath vegetation.

These physical features have been classified and described, and are shown on the accompanying maps of landform-soil units.

2.3 Land Units, Vegetation and Land Capability

The landform-soil maps (Figures 3, 4, 5 and 6) show that those specific areas of the Denmark coastal zone contain several different types of land. The main purpose of this section is to examine known or predicted impacts of recreational developments and activity on the coastal environment. This examination has been described as **Land Capability**, which is defined as the ability of a particular landscape to sustain a proposed land use without incurring unacceptable land degradation.

The coastal environment is very dynamic, often with massive and rapid changes to beaches and foredunes due to natural processes. The human presence can intensify the effects of these events by destroying protective vegetation. However, changes are often gradual and long-term observations are required to identify trends. **Capability Rating** may assist in identification of landscapes prone to degradation so that early signs can be recognised and countered.

Capability Rating is assessed by identifying the constraints and hazards associated with utilisation or development; the rating is given below:

High Capability: Land is able to sustain the proposed use with low risk of landscape damage and a minimum of modification.

Photograph 2. Denmark Coastline - Meerup Dunes south of Peaceful Bay

Medium Capability: Land is able to sustain the proposed use but with specialised management and technology; some risk of degradation.

Low Capability: The land has several physical limitations for development; cost of conservation measures and on-going maintenance would generally be prohibitive; severe risk of land degradation.

2.3.1 Capability of Landform-Soil Units

2.3.1.1 Meerup Dunes

The Meerup Dunes (M) form a complex pattern of parabolic dunes composed of beach sand which was blown inland over any prior landscape. Thus, the dunes cover the coastal plain, granitic hills, or limestone (see Photograph 2). The Meerup Dunes accumulated in four main phases of activity, with periods of stability between phases. Individual phases are identified by their slopes, relief, and soil profile development.

Ms, Mp (the oldest phases)

These phases are considered together because they would have similar response to development or utilisation. Generally, they are further inland than younger phases and so are not so vulnerable to wind erosion. The dune ridges usually have low relief and smooth, gentle slopes; where they occur overlying limestone, often more than 100 m above sea level, the slopes may be steeper and the ridge crests sharper. The soil is a weak podzol with a dark grey surface, a light grey sub-surface, and a light brown subsoil; calcareous sand may occur below about 1.5m.

The vegetation under natural conditions is a woodland of Agonis flexuosa (peppermint), Hakea oleifolia, Banksia spp. and Allocasuarina fraserana with a dense ground cover of shrubs and herbs. Eucalyptus cornuta (Yate) and E. megacarpa (Bullich) may occur in the lower topographic positions. Where the dune vegetation has been grazed and burned over a long period, this diversity is much reduced and mainly non-palatable species are present.

Capability Rating: High-Medium

The main hazard is associated with the occasional steep slope. Off-road vehicles attempting to negotiate such slopes will cause damage; also some crests may erode where vehicle tracks are aligned with the south-westerly wind. These units have high conservation value because of the presence of Banksia woodland which is the habitat for several specialised birds and animals.

Mc (the intermediate phase)

This is a pattern of parabolic dunes which have moderate relief and fairly steep slopes. They form a jagged skyline indicating recent modification by wind. Generally, this system extends only a short distance inland, although at William Bay, two Mc dunes extend from the shore over Tower Hill and almost to the South Coast Highway. The soil consists of brown sandy surface, faintly calcareous, overlying pale brown or white strongly calcareous sand.

The vegetation is a woodland of Agonis flexuosa and Acacia spp., with a dense ground cover of Acacia cuneata, Melaleuca acerosa, Spyridium globulosum, and several sedges.

Capability Rating; Medium - Low

Steep slopes and loose soil cover with high erosion hazard are the main constraints, especially when considered in relation to proximity to the shoreline. These dunes should be avoided for tracks, parking areas and settlements.

. My (the youngest phase)

This unit consists of small parabolic dunes, generally extending only a few hundred metres inland from the shoreline. The dune ridges have high relief, steep slopes, and a very irregular skyline. The soil has no profile development other than slight organic matter staining in the surface and is strongly calcareous throughout. There may be patches of unstable sand.

Vegetation usually includes typical coastal heath communities dominated by Olearia axillaris, Spyridium globulosum, Lepidosperma gladiatum, Acacia cuneata, and Scaevola nitida. Spinifex spp. and Arctotheca populifolia may be seen colonising unstable areas.

Capability Rating: Low

Steepness, relief, and loose soil structure make this unit very prone to wind erosion if disturbed; such areas should be excluded from development. If access paths should traverse these dunes they should be fenced. Unstable areas should be protected from further disturbance.

. Mu (the unstable sand)

These areas should be excluded from any access and measures undertaken to encourage regeneration. The mobile sand is often encroaching on stable vegetation and control measures now will be cheaper in the long term.

Capability Rating - Very Low

. Mf (the interdune depressions)

This unit has low relief and indeed is often quite swampy. The soil is often a humus podzol with a black surface, grey sub-surface, and a dark brown indurated sub-soil (coffee rock); this usually passes into calcareous sand within 2m. Vegetation consists of a woodland of Banksia littoralis, B.attenuata, Eucalyptus cornuta, E.megacarpa, and Agonis flexuosa with a dense shrub layer of Acacia spp., Adenanthos obovata, Xanthorrea preissii (blackboy) Oxylobium lanceolatum, and several sedges and rushes.

Capability Rating: Medium - High

Internal drainage is possibly a constraint for settlements and caravan parks which depend on seepage for effluent disposal. Roads and tracks can be established without any hazard except where the sub-strata is limestone or granite. In some instances this unit would be ideally suited to development of sports fields, golf courses and caravan parks. They also have high conservation value in the natural state because of the presence of Banksia species and a very diverse shrub layer. These landscapes are often used as a day-time refuge by kangaroos.

2.3.1.2 Owingup (OW)

These are flat areas, associated with the inlets, which are either permanently or seasonally inundated. The soils are dominated by organic

matter and are often peaty in the surface; some swamps have layers of diatomaceous earth. The vegetation is a dense stand of Agonis juniperina, Banksia littoralis, Melaleuca preissiana, and ,Oxylobium lanceolatum with an understorey of sedges and reeds.

Capability Rating: **Very Low**

The swampy land and permanent water would preclude any access or development. Artificial drainage would be required. The unit has high conservation value as a habitat for birds and animals.

2.3.1.3 Estuaries

The inlets (Wilson, Parry, Irwin) and their outlets to the ocean are popular for recreation. They also have high conservation value, providing several important habitats for aquatic birds; deep-water; shallow water with reeds; beaches; and Melaleuca heath just above high water.

There is major risk of nutrient pollution from adjacent agricultural land with consequent reduction in the aquatic life. The continuing viability of estuaries is partly dependent on the frequency of opening of the sandy bars at the ocean outlets.

Table 2 shows a summary of capability rating for landform-soil units.

2.3.2 Landform-Soils Units in Specific Areas

2.3.2.1 Ocean/Light's Beaches

The Reserve (see Figure 3) is situated almost entirely on a high limestone barrier which is covered with dune sand (Mp) and which, generally, is fairly well buffered against disturbance. There is a small area of younger sand (Mc) near the beach. There are two depressions (Mf) formed between dunes; the northern one is very wet - and probably has permanent water. There is a small area of coastal plain in the Reserve which is covered by old sand dunes with intervening swampy depressions.

2.3.2.2 Parry's Beach

The Reserve (see Figure 4) consists of a low coastal plain with a massive limestone barrier to the south-west and a small granite hill to the south-east.

This landscape has been blanketed with sand of various ages and from two different directions. The main mass of sand (Mp) came from the south-west and covered the limestone barrier; this is an old system. Then three phases of sand blew in from the southeast. The oldest Mp blends in with the sand from the south-west. The next younger (Mc) extended well up onto the limestone ridge. Then the youngest (My) came in over the granite hill and the edge of the coastal plain. Unstable sand occurs on either side of Parry Inlet opening. The dunes have some flat depressions (Mf) which have external drainage channels; the northern depressions have some large areas of permanent water.

2.3.2.3 Boat Harbour

The Reserve (see Figure 5) consists of a low swampy coastal plain which is sheltered from the south-west by a high limestone barrier connected to a small granite headland; another small granite headland occurs on the east of Boat Harbour.

Table 2

Summary: Capability Ratings for Landform-Soil Units

Landform-Soil Units	Capability Ratings
(i) **Meerup Dunes**	
Ms, Mp (oldest phases)	**High-Medium***
	The main constraint is associated with the occasional steep slope. Off-road vehicles attempting to negotiate such slopes will cause cause damage; also some crests may erode where vehicle tracks are aligned with the south-westerly wind. These units have high conservation value because of the presence of Banksia woodland which is the habitat for several specialised birds and animals.
Mc (intermediate phase)	**Medium-Low***
	Steep slopes and loose soil cover with high erosion hazard are the main constraints, especially when considered in relation to proximity to the shoreline. These dunes should be avoided for tracks, parking areas and settlements.
My (youngest phase)	**Low***
	Steepness, relief, and loose soil structure make this unit very prone to wind erosion if disturbed; such areas should be excluded from development. If access paths should traverse these dunes they should be fenced. Unstable areas should be protected from further disturbance.
Mu (unstable phase)	**Very Low***
	The main constraint is associated with instability of these unconsolidated, often mobile dune sands.
Mf (interdune depressions)	**Medium-High***
	Internal drainage is possibly a constraint for settlements and caravan parks which depend on seepage for effluent disposal. Roads and tracks can be established without any hazard except where the sub-strata is limestone or granite. In some instances the Mf unit would be ideally suited to development of sports fields, golf courses and caravan parks. They also have high conservation value in the natural state because of the presence of Banksia species very diverse shrub layer. These landscapes

	are often used as day-time refuge by kanagroos.
(ii) **Owingup**	**Very Low*** The swampy land and permanent water would preclude any access or development. Artificial drainage would be required. The unhit has high conservation value as a habitat for birds and live animals.
*Capability Rating Definitions	
High Capability:	Land is able to sustain the proposed use with low risk of landscape damage and a minimum of modification.
Medium Capability:	Land is able to sustain the proposed use but with specialised management and technology; some risk of degradation.
Low Capability:	The land has several physical limitations development; cost of conservation measures and on-going maintenance would generally be prohibitive; severe risk of land degradation.

Old sand (Mp) has covered the limestone and granite from the south-west. Young dunes (Mc and My) have come in from the south; the My dunes are still unstable in the central portion. Very old dunes rise above the swampy plain as low-ridges.

2.3.2.4 Peaceful Bay

The Reserve (see Figure 6) is situated on the Coastal Plain, facing east, and protected from the SW by a granite headland and adjacent limestone barrier.

Old dunes (Mp and Ms) have blown over the barrier onto the coastal Plain and one such ridge extends into the Reserve. This dune (Ms) has cut off a low flat area, much of which is swampy, and on which the present settlement is situated. Young dunes (Mc and My) have blown over the headland from the south-west; the My dune has become unstable (Mu) at its eastern end. The northern part of the Reserve is made up of a flat swampy plain with a scatter of low linear dunes. Land to the north-east of Peaceful Bay is made up of low parallel beach ridges.

2.4 Fauna

The Western Australian Museum (1985) has prepared species lists of mammals, reptiles and amphibians in the Denmark region (see Appendix 1). Wildlife research conducted by the Museum shows existing populations of possums, dingoes, foxes, mice, quokka, echidna, native cats, dunnarts, kangaroos, rats, cats and many others. Reptiles are well represented and the most frequently sited are tiger snakes, dugites and skinks. Frogs are abundant.

The main record of birdlife in the study area is a paper published in 1928, 'Birds Observed During the Royal Australasian Ornithological Union Camp-Out Nornalup, South West Australia'. The study examines a specific site but the

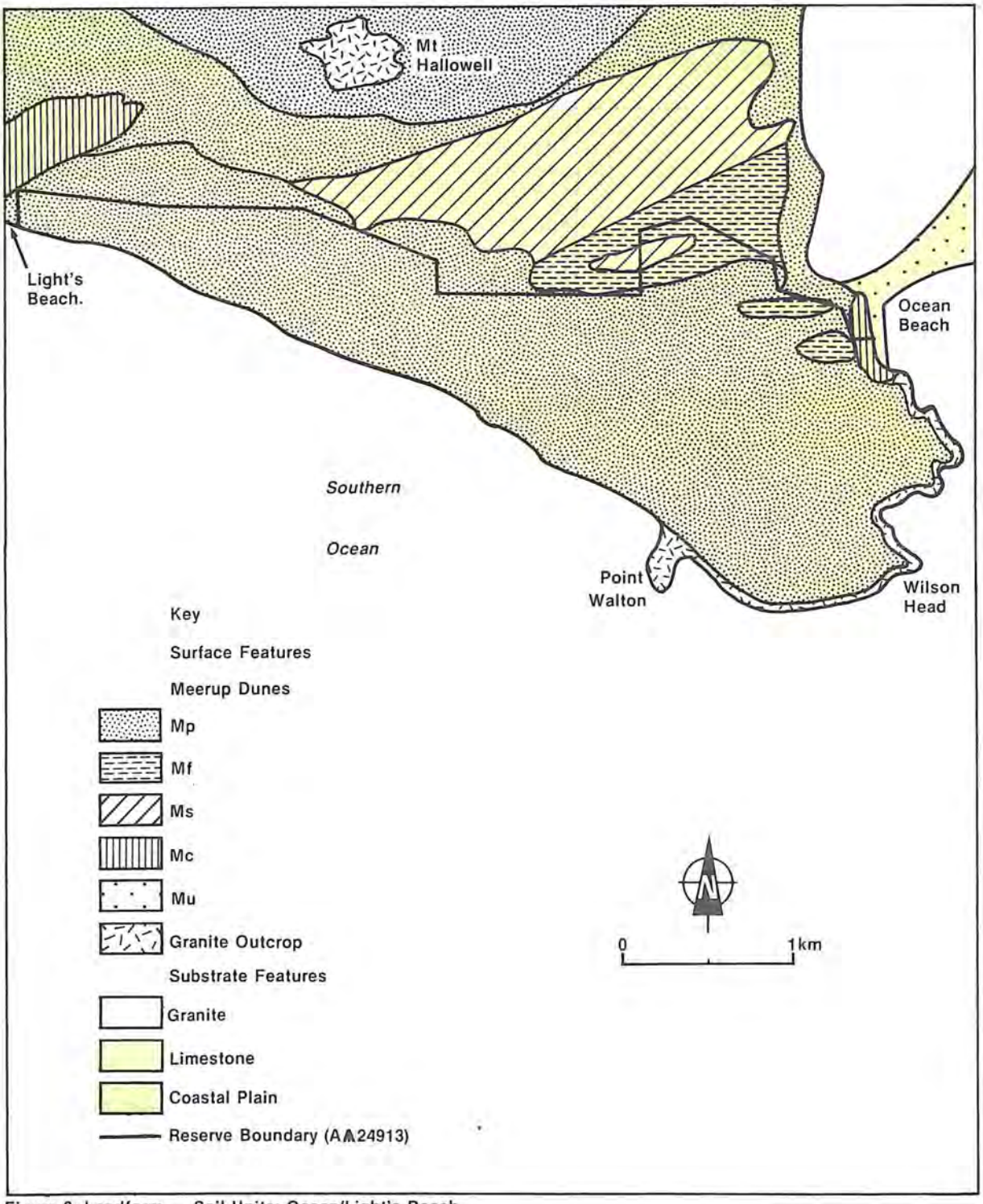


Figure 3. Landform — Soil Units: Ocean/Light's Beach.

birds identified are regarded as representative of the study area as a whole. The study area has consistent environmental features.

Although the observations were made 60 years ago, all the species listed are still thought to exist in the area. Additional species with a preference for open country are now likely to occur in the area because of extensive clearing. A list from the publication (with updated names) is given in Appendix 4.

Birds are abundant in the Shire Reserves. Swamp areas include the dusky moorhen and black-tailed swamp hen, coots and crakes, herons and bitterns, cormorants and grebes, black swan and at least seven species of ducks and

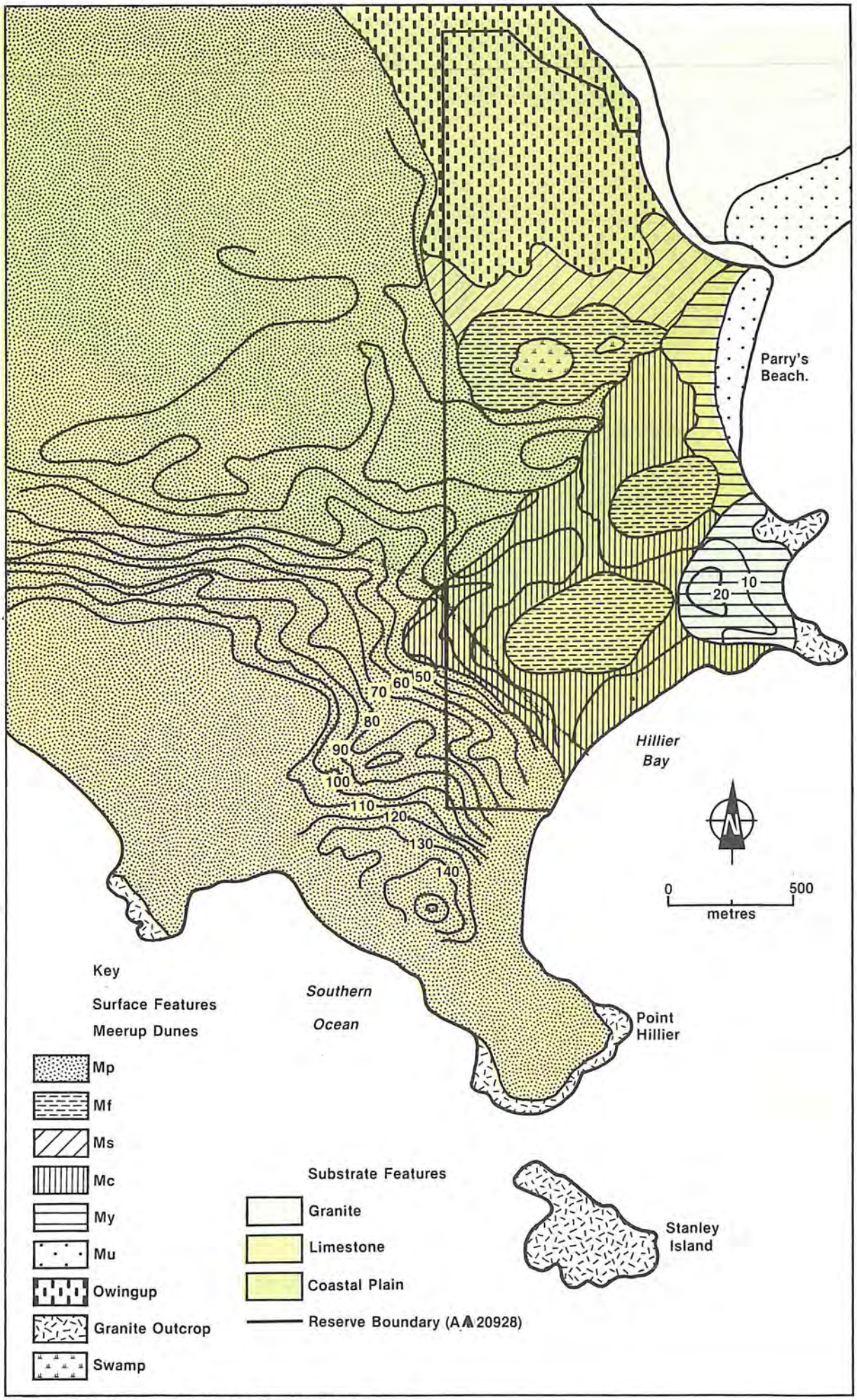


Figure 4. Landform — Soil Units : Parry's Beach.

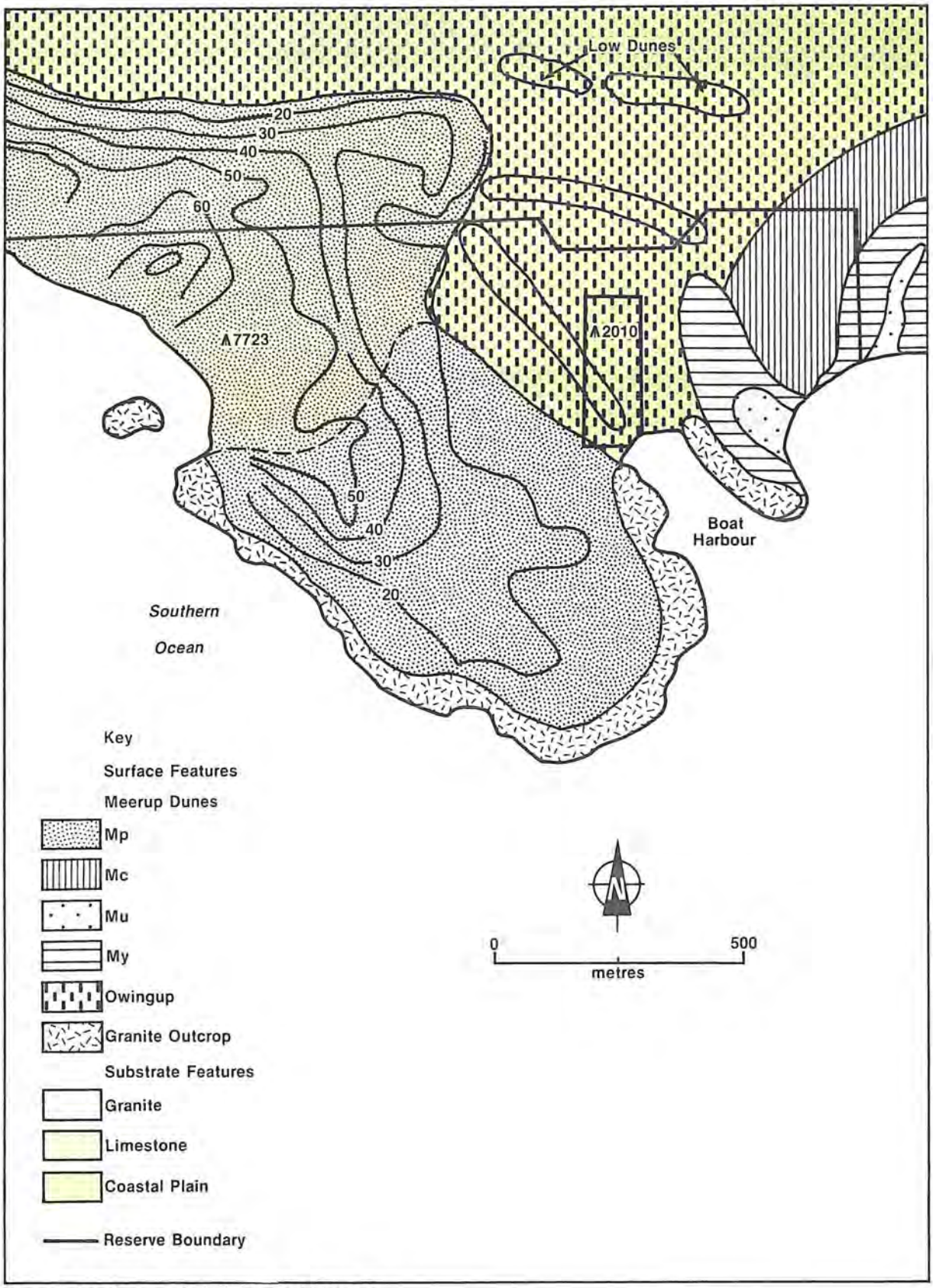


Figure 5. Landform — Soil Units: Boat Harbour.

geese. Small islands close to the beaches are used as nesting sites for fairy terns, penguins, rock parrots, dotterels, oystercatchers and gulls. Two species deserve particular mention: the Red-eared Firetail Finch, which is on the endangered species list and the Fairy Tern, whose nesting sites near Ocean Beach and on an offshore island are occasionally decimated by human vistors.

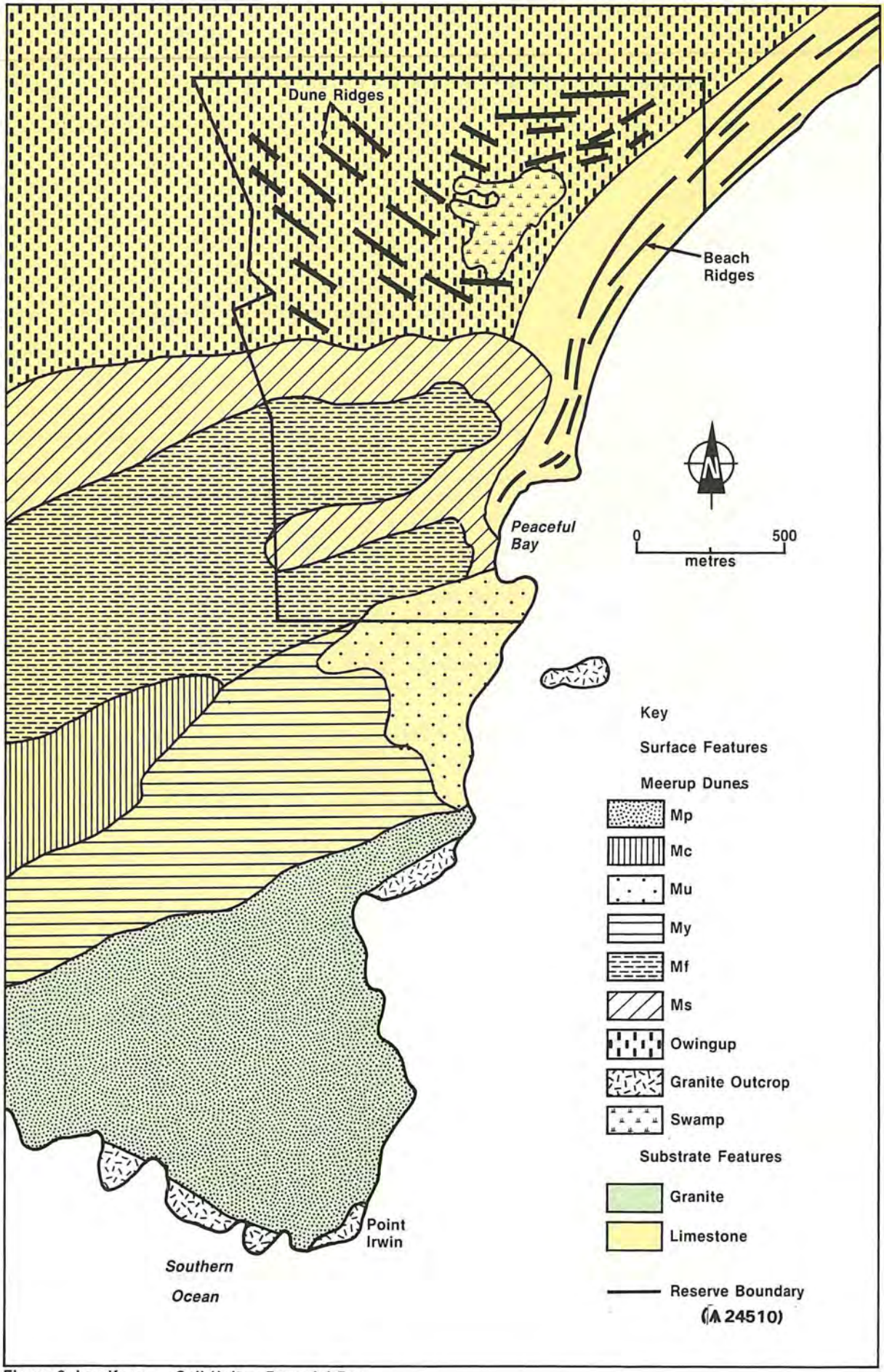


Figure 6. Landform — Soil Units : Peaceful Bay

A few species of mammals found within the district are on the list of protected rare fauna. They are the Western Native Cat (Dasyurus geoffroii); Brushtailed Rat Kangaroo (Bettongia pencillata), Numbat (Myrmecobius fasciatus) and a reptile, Ctenotus delhi (skink). The habitats of these rare fauna should be given high priority for protection in land use considerations. This currently involves the area from Wilson Inlet to Peaceful Bay.

2.5 Estuaries

2.5.1 Wilson Inlet

The Wilson Inlet has an area of 48 square kilometres. The major rivers feeding it are the Denmark, Hay and Sleeman Rivers. The catchment area covers 2263 square kilometres (see Photograph 3).

The Denmark River catchment is dominated by the upland lateric formations of the Darling Range where jarrah forest (Eucalyptus marginata) predominates. Only twenty-two per cent of the catchment has been cleared for agricultural use. The Hay River catchment is in many ways quite dissimilar to the Denmark River catchment. Fifty-three per cent of the Hay River catchment has been cleared for agricultural use. The mouth of the Inlet is at the western end and it is completely blocked by a sand bar for about seven months of the year (usually from December/February/January to July/August). When the bar is open, usually for three to five months, Wilson Inlet is tidal, but the daily tide is so small as not to be measurable. In consequence, the water is poorly flushed, salinity varies from about 10 to 30 ppt (sea-water is 35 ppt) and water level varies in height by about 1 metre. The bar is never allowed to open naturally, but is opened annually when the inlet water level is approximately 1 metre above mean sea level.

The Inlet shows one major symptom of eutrophication: the excessive amount of macrophyte growth, especially Ruppia megacarpa. However, water quality is generally good, as indicated by the low ambient nutrient levels, low levels of phytoplankton in the water and lack of oxygen depletion.

In 1982-83 there was a net retention of phosphorous and loss of nitrogen from the system (DCE, 1984a).

Thirty-eight species of fish have been recorded in Wilson Inlet by Lenanton (1974) and seventeen species of commercial fish are caught.

For the Wilson Inlet area, the Department of Conservation and Environment has compiled comprehensive lists of birds, mammals and vegetation (DCE, 1982).

2.5.2 Irwin Inlet

Irwin Inlet has an area of 14 square kilometres with water depth mostly less than 2 metres. It is fed by the Kent and Bow Rivers, and Karri Creek. The lower case catchment largely consists of agricultural land.

The bar is generally open, but it may be closed for prolonged periods, for example, it was closed between 1968 and 1969. The water varies from fresh in winter to sea-water when the bar is open in summer. There is a fairly diverse estuarine, salt-tolerant fauna and flora.

Photograph 3. Wilson Inlet and Ocean Beach

2.5.3 Parry Inlet

Parry Inlet is the smallest inlet in the Shire of Denmark. It covers 1.5 square kilometres and it is very shallow in all parts with an average depth of less than 1 metre. The bar is closed every summer and opens, or is artificially opened, each winter.

Parry Inlet is fed by the Kordabup River and a few creeks. The catchment is mostly used for agricultural purposes.

The water in the inlet is fresh to mildly hypersaline. A typical vegetation zonation is apparent which includes seagrasses, sedges, paperbarks, swamp and coastal heathlands. The aquatic fauna and flora is similar to that in Irwin Inlet but less diverse.

2.6 **Owingup Swamp**

Part of the swamp is a lake containing permanent freshwater while the western section of about 800 hectares is densely vegetated and low lying. The Kent River runs into the swamp by a well-defined channel.

The open freshwater of the lake provides a refuge for large numbers of waterfowl which move to the coast during the summer. In addition, the rushes and other vegetation around the lake are a breeding habitat for a number of species. A feature of the area is the breeding colony of the Black Cormorant (Phalacrocorax carbo) in trees along the edge of the Kent River, near where it enters the swamp. The Environmental Protection Authority recommends that Owingup Swamp become a Class A Reserve for the conservation of flora and fauna (EPA, 1977b).

3. HUMAN ENVIRONMENT

3.1 History

In order to provide an impression of resource use in the study area within a historical context, this section presents a general description of Aboriginal occupation as well as a brief outline of European exploration and settlement of the area.

3.1.1 Aboriginal Occupation

Aboriginal people are thought to have lived in Australia for the last 40,000 years. During this time, they have coped with changes in both climate and sea levels (the present sea level was reached 6000 years ago), and consequent changes to animal and plant communities upon which they were dependent for food. In response to the changing environment, Aboriginal people evolved a nomadic lifestyle based on 'hunting and gathering', involving systematic, seasonal exploitation of the wide variety of food resources available including marine and terrestrial plants and animals.

Occupation along the coastal plain occurred during the summer and autumn months when many plants were in season. Various archaeological sites have been identified in the region but, except for a midden near Light's Beach, none have been found in the Shire Reserves.

3.1.2 European Exploration and Settlement

Conochie (1979) in 'Denmark, An Outline History' provides an excellent account of the development of the district.

European discovery started from 1622, when the Dutch ship 'Leeuwin' examined the south coast from Cape Leeuwin to King George Sound. Between the 'Leeuwin' visit and December 1826, when British settlement was established at King George Sound, the coastline of the Denmark region became known to explorers. In the 1820's, Thomas Wilson explored the area between Albany (Frederickstown) and Walpole. The town of Denmark was established some 66 years later.

During the 1870's, the farming potential of the Great Southern Region between York and Albany led to the building of railways. This in turn supported industrial development, in particular the establishment of the timber industry. The opening of the Kalgoorlie Goldfields in 1893 brought a new demand for timber. World markets boomed in the late 1890's and the population of Denmark increased to 1000 residents. However, by the end of 1904, the available timber was nearly finished and people left the town.

Assisted immigration from Great Britain brought a steady flow of migrants in the early 1900's. Land was sold cheaply and the town developed an agricultural phase of land use with vegetables, fruit and dairying assuming significance.

Denmark experienced another boom in the 1920's when the Group Settlement Scheme commenced - roads, bridges, locality schools and the town's infrastructure developed. During the late 1920's, it was obvious the scheme was floundering because farms were not economically viable. The 1930's Depression was the final blow. The war-time situation at least provided a regular market and developed tourism, as sailors on leave from Albany visited the district. During the late 1940's the Government settled many ex-servicemen on farms in the district. The result was growth in employment, population and production.

3.2 Existing Planning and Management Controls

3.2.1 Land Tenure

Based on ownership, land tenure may be categorised into two broad groups:

(i) Freehold land, which has been alienated from the Crown.

(ii) Crown land in the Denmark Shire coastal zone can be subdivided into:

- leased Crown land held by lease or licence from the Crown, with ultimate ownership residing in the Crown, eg mining and fishing leases.
- reserved Crown land, held on behalf of the public; the land usually being directed to certain purposes by public authorities (see Table 3 for vested and unvested Crown reserves).

Most of the coastline in the study area is occupied by either National Parks or Conservation Reserves, (vested in the Department of Conservation and Land Management). Reserves vested in, or managed by, the Denmark Shire Council, which are the primary concern of this plan, constitute only a small proportion of the coast. Crown reserves in the study area are shown in Figure 7.

Table 3 Crown Reserves in the Study Area
(see Figure 7)

Reserve No	Area (ha)	Purpose	Vesting
A 31362	17685	Walpole Nornalup National Park	CALM
A 15677	886	Protection of Flora	n.v.
A 24510	281	Camping and Recreation	D.S.C.
31468	99	Recreation and Parklands	n.v.
33842	3825	Conservation of Flora & Fauna	CALM
7723	1	Excepted from Sale	Control D.S.C.
2010	2	Public Utility	n.v.
2009	21	Government Requirements	n.v.
10048	26	Government Requirements	D.S.C.
A 20928	271	Camping and Recreation	D.S.C.
A 24482	1867	William Bay National Park	CALM
A 24913	505	Parklands and Recreation	D.S.C.
14959	242	Recreation	D.S.C.
32861	2	Public Recreation	n.v.
12182	123	Recreation	D.S.C.
A 30883	45	Recreation	n.v.
13825	34	Public Utility	n.v.
2001	40	Public Utility	n.v.

Abbreviations

CALM : Department of Conservation and Land Management

n.v. : not vested

D.S.C.: Denmark Shire Council

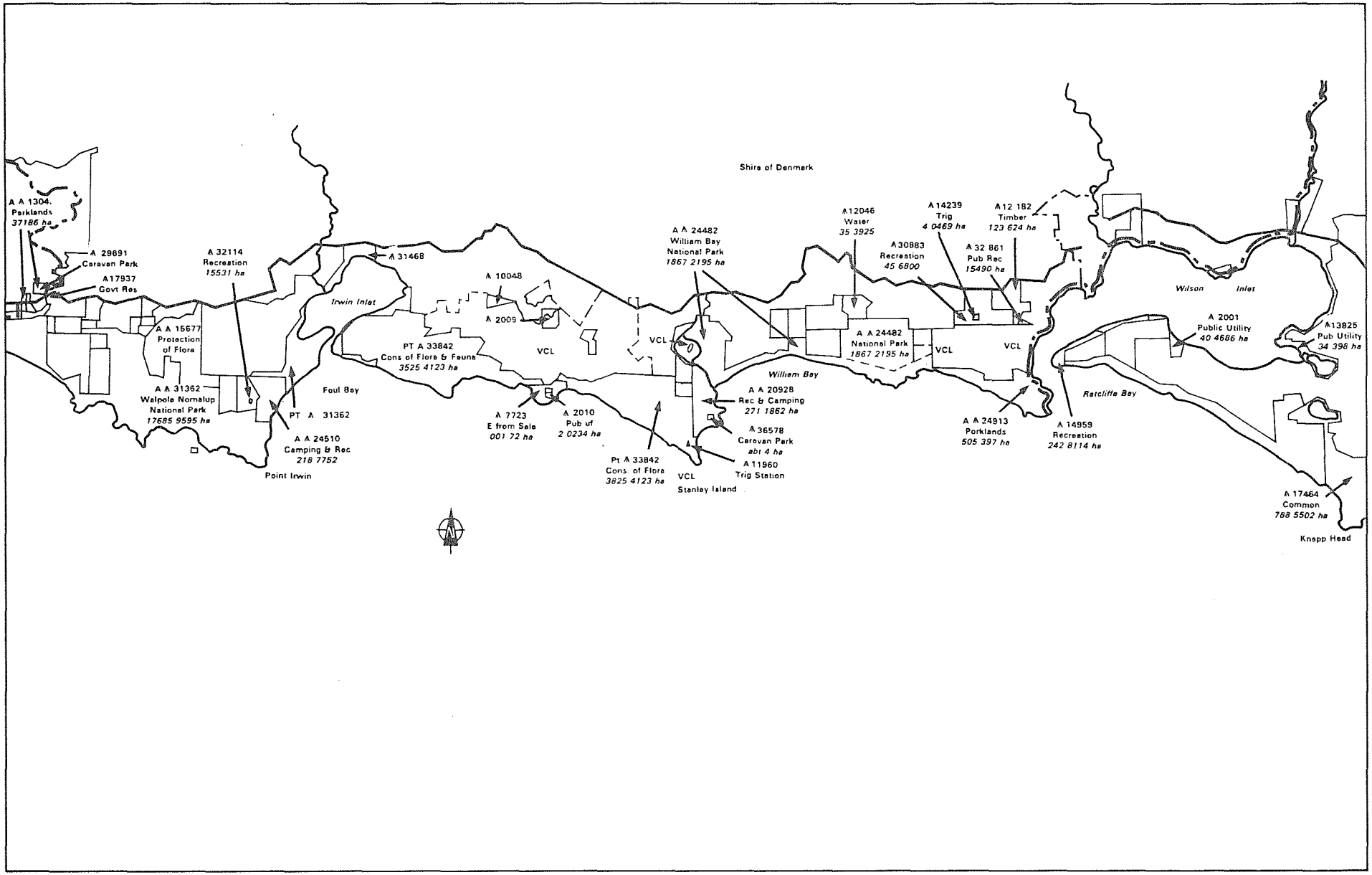


Figure 7. Crown Reserves.

3.2.2 Town Planning Scheme

Under the Denmark Town Planning Scheme, all land immediately adjacent to the coast is reserved for parks and recreation. That includes National Parks, Conservation Reserves and other Crown land including Denmark Shire reserves. Much of the remainder of the study area is zoned rural under this scheme.

3.2.3 Land Management

The Shire of Denmark is responsible for the day-to-day management of Crown reserves vested in Council. Denmark Shire Council presently provides effective management of these reserves and has a strong commitment to coastal management. The Department of Conservation and Land Management is responsible for management of the coast within Conservation Reserves and National Parks.

There appears to be only minimal co-ordination of coastal management within the study area as a whole.

3.2.4 Marine/Estuarine Management

Management of living marine and estuarine resources in the study area is the responsibility of the Department of Fisheries which administers and is responsible for management and regulation of professional and amateur fishing.

Currently there are no Council by-laws prohibiting specific activities in certain areas of the coast eg spearfishing, off-road vehicles etc.

3.2.5 Relevant Legislation

There are a number of Acts of Parliament which may have a direct bearing on coastal planning and management in the study area:

- Conservation and Land Management (CALM) Act 1984.
- Fisheries Act 1905 - 1979 (as amended)
- Local Government Act 1960 -1981 (as amended)
- Marine and Harbours Act 1981 (as amended)
- Soil Conservation Act 1948 - 1982 (as amended)
- Town Planning and Development Act 1928 - 1980 (as amended)
- Public Works Act 1902 - 1979 (as amended)
- Environmental Protection Act 1971 - 1980 (as amended)
- Land Act 1933 - 1980 (as amended)

3.3 Existing Access and Facilities

3.3.1 Roads/Car Parks

The study area is serviced by roads and tracks, providing easy access to various parts of the coast. The South Coast Highway forms the northern boundary of the study area. There are sealed roads linking Denmark with Ocean Beach, William Bay National Park (Green's Pool) and Peaceful Bay.

Secondary roads provide access to attractions around these areas and to Parry's Beach and Conspicuous Cliffs. Access to Boat Harbour is considered only suitable for four-wheel drive vehicles. There are many four-wheel tracks in each reserve and along most of the coast.

3.3.2 Pedestrian Access

Pedestrian access is uncontrolled in much of the study area, except at specific sites eg Green's Pools, Ocean Beach and Peaceful Bay.

3.3.3 Boat Launching

Boat launching occurs at a number of locations in the study area. As yet, there are no formal boat ramps; however, a ramp is currently under construction at the yacht club site on the Western side of Wilson Inlet between the town centre and Ocean Beach.

3.3.4 Accommodation

3.3.4.1 Caravan Parks/Camping Areas

Four caravan parks are sited in the study area:

. Ocean Beach Caravan Park
. Rivermouth Caravan Park (Denmark River)
. Wilson Inlet Holiday Park
. Peaceful Bay Caravan Park

3.3.4.2 Furnished Premises

A variety of chalet accommodation is available at the following locations:

- Denmark Hotel
- Boat Harbour Chalets
- Mt Shadforth Lodge
- Gum-Grove Chalets
- Hillside Holiday Homes
- Ocean Beach Caravan Park
- Riverbend Chalets
- Rudgyard Holiday Resort
- Rivermouth Caravan Park
- Wilson Inlet Holiday Park (includes Youth Hostel accommodation).
- Peaceful Bay Chalets
- Jesmond Dene Lodge, Nornalup

3.4 **Use Pressures**

Pressures have been identified for use of coastal land and the adjacent waters in the study area. Demand for use of resources in the area is unlikely to diminish. Rather, it is likely to grow as the population of the south coast region increases and as the number of visitors increases.

This section provides a description of present use of the study area, and a discussion of probable future use pressures.

3.4.1 Local Population

Generally, the Denmark Shire population remains stable with a birth rate of 1.62% (1.62 live births per thousand of mean population during the same period) (Australian Bureau of Statistics, 1984).

In 1981, Denmark had 985 residents, an increase of 20% since 1976 (or 4%/yr). The demographic prognostics from the Town Planning Department (Albany Region Plan, 1983) suggest three possible rates of population growth for Denmark - 1.6%, 2.2% and 3.0% per year (see Table 4).

Table 4

Denmark : Predicted Population Growth
(Sources: Town Planning Department of WA
Australian Bureau of Statistics)

Local Authority	1976	1981	1991			2001			2011			2021		
	Total	Total	1.6%	2.2%	3.0%	1.6%	2.2%	3.0%	1.6%	2.2%	3.0%	1.6%	2.2%	3.0%
Denmark Shire	1780	2156	2501	2630	2802	2845	3104	3449	3190	3578	4096	3536	4053	4743
Denmark Town	786	985	1143	1202	1280	1300	1418	1576	1458	1635	1872	1615	1852	2167

3.4.2 Visitors

The Denmark area is becoming increasingly popular for visitors. Table 5 only refers to numbers in hotels and caravan parks; however, it gives an indication of the growth in visitor numbers. The estimate of visitor numbers would probably be much higher if the use of private residences and day visitors was included. There is a pronounced seasonality to visitor use with peaks during school holidays and especially during summer.

Increasing numbers of visitors in the study area will most likely put pressure on:

. Access

An increasing number of vehicles will use existing roads and tracks and there will be demand for better access to popular sites and for access to sites presently only accessible by four-wheel drive vehicles.

. Accommodation

At times, there is insufficient accommodation to cater for visitors during peak holiday periods.

. Management

More management will be needed to prevent degradation of tourist attractions including control of vehicle access, maintenance of roads, tracks and facilities etc.

. Funding

More finance will be needed to fund capital works, management works and services etc.

Table 5: Visitors Staying at Hotels/Motels and Caravan Parks (1977-1984)
(Source: Australian Bureau of Statistics)

Year	Hotels	Caravan Parks	Total
1977	4606	19100	23706
1978	5579	23100	28679
1979	6504	18500	25004
1980	6497	18523	25020
1981	7366	18698	26064
1982	8077	20214	28291
1983	8122	22651	30773
1984	7904	20030	27934

3.4.3 Access

The South Coast Highway forms the northern limit of the study area because it provides access to popular coastal sites. The State Government's planning policies support the development of coastal nodes in preference to the construction of continuous foreshore roads and developments. The latter places the fragile foreshore environment under excessive use pressure, requires formidable management effort and detracts from the attraction of

isolated coast, which is one of the most valuable attributes of the Denmark area.

Clearly the grade of road constructed plays a large role in the level of development of a site, especially with regard to the facilities people will expect. Controlling the level of access to a site is a means of establishing a variety of recreation opportunities along the coast.

As mentioned in Section 3.3.1, there are sealed and unsealed roads which provide access through the study area. Also, there are tracks along most of the coast which may increase recreation opportunities; however, off-road vehicle use constitutes one of the major management problems in the study area. The ownership of four-wheel drive vehicles in Western Australia has escalated in recent years and Denmark is no exception.

Probably there are three types of users: the one wanting access to the coast, another wanting to test his skills on the existing sandy tracks, and the one who simply cannot resist the opportunity of exploring a track off the main road. Problems associated with use of these vehicles in the coastal zone include: destruction of vegetation; public safety; creation of noise; and disturbance of a peaceful atmosphere by their presence. With increasing population and number of visitors, their use can be expected to increase and consequent problems will inevitably grow.

3.4.4 Conservation

It is evident from the proportion of the study area that is set aside as National Parks or Conservation Reserves, that the study area has high conservation value. It is clear that the local authority recognizes the need to conserve land vested in the Shire. There has also been considerable effort made by local residents to conserve their coastal land and waters as shown by participation in workshops and beach-management works (see Photograph 4).

Photograph 4. Beach Management Busy Bee - Ocean Beach

3.4.5 Recreation

The study area is a recreational resource of both local, regional and state significance. The variety of features in the area offers opportunities for a wide range of recreational activities.

A survey was conducted over Easter, 1985 to provide information on recreation activities. The interviews were initially apportioned to the various beaches based upon their perceived popularity. Therefore, most attention was focused on Denmark/Ocean Beach followed by Peaceful Bay, Parry Beach and Boat Harbour. Respondents included locals and visitors to the Shire (see Appendix 2 for the questionnaire and results).

The data provide input to management planning and a brief summary is given below.

- Groups interviewed mostly contained four persons travelling in one vehicle. Roughly 25% of those questioned had access to a 4WD vehicle.

- People interviewed were mainly visitors from Perth and towns relatively close to the Denmark Shire. This implies that a large proportion of the beach users are not local ratepayers.

- Day use predominates on beaches close to Denmark but many people stay three to five days on reserves with camping or caravan facilities. The survey result here is largely determined by the five-day Easter public holiday but it implies that many visitors spent their holiday within the district.

- Most respondents were camping or using caravans. This implies a demand for these facilities in contrast to more expensive motels and chalets that attracted proportionally few people. More people were staying in houses than the proportion of local residents interviewed, which implies that people stay with friends or rent. The results indicate that visitors clearly came on a regular basis.

- Their favoured activities are fishing, swimming and walking. Special attention should be given to provide appropriate sites and resources for these activities.

- The number of secluded locations respondents nominated as their favourite spot suggests the attraction of peaceful, uncrowded and undeveloped locations. However, when beaches alone were considered, Peaceful Bay and Parry's Beach were people's favourite beaches followed by William Bay National Park, Ocean and Boat Harbour beaches respectively.

3.4.6 Development

Given the popularity of the Denmark area, it is clear that there will be increasing pressure for development of specific locations in the Shire. Recent proposals include a caravan park and facilities covering 45 hectares at the corner of William Bay Road and South Coast Highway, chalet developments on Ocean Beach Road and time-share developments along Mt Shadford road.

3.4.7 Professional Fishing

Commercial fishing in the Denmark District is carried out in the following areas:

. Wilson Inlet
. Ocean Beach
. Irwin Inlet
. Parry's Beach
. Peaceful Bay

The commercial estuarine fishery of south western Australia is one of the oldest fisheries in the State, traditionally serving pioneering populations. The total catch of all species in the ten years (1975-1984) in Wilson Inlet ranged between 90 and 125 tonnes and in Irwin Inlet between 8 and 18 tonnes (Lenanton, 1984). The most important species, based on quantity and reliability, are Cobbler, Sea and Yellow Eye Mullet, Garfish, Australian Herring and King George Whiting (see Appendix 3). Inlet fisheries are particularly sensitive to fluctuating environmental factors, especially bar closure and pollutants.

Offshore, professional fishermen mainly catch salmon during February and March, herring and tuna from April to May, and shark throughout the year (see Photograph 5). Eight operators work Parry's Beach where the total catch of all species in 1984 was 334 tonnes. At Peaceful Bay, the total catch of all species in 1984 was 179 tonnes.

Photograph 5. Salmon Catch - Parry's Beach

3.4.8 Mineral Extraction

Apart from small deposits of heavy mineral sands, the Denmark Shire does not have any notable mineral industries. Gravel and limestone requirements have traditionally been obtained locally.

The two limestone quarry sites within the Shire are at Ocean Beach and Parry's Beach. Limestone has been extracted from the Ocean Beach pit for agricultural purposes for some 20 years. An illegal extension of the pit using a superficial extraction method caused it to become visually obtrusive. It has since been successfully rehabilitated and the current

method of extraction, a trench system, is more environmentally acceptable.

There is an extensive supply of limestone at Parry's Beach and it is feasible that the resource can be developed under Shire control. To date, the superficial extraction over a wide area has produced a visually unacceptable pit and restoration measures are underway.

3.4.9 National Parks and Conservation Reserves

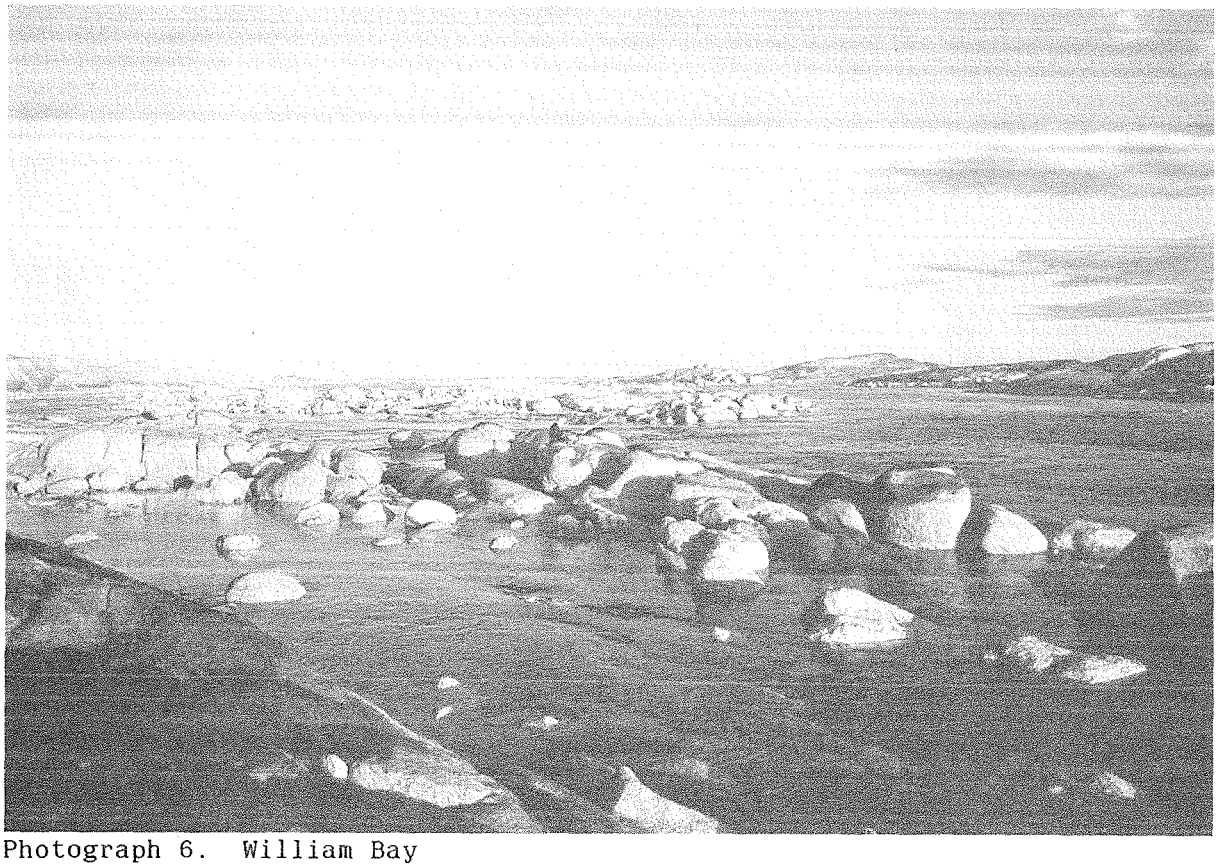
A number of National Parks and Conservation Reserves are located in the study area. Their size is indicative of the outstanding quality of the Denmark coast including attractive landscapes and special areas of flora and fauna associations.

. Mt Hallowell National Park

The relief, granite outcrops and impressive forest are among the Park's features. Recreation opportunities are limited with the high fire risk in this environment requiring special protection measures. The main activity is walking.

. William Bay National Park

The close proximity of Denmark, a popular tourist venue, and access via a short sealed road from the South Coast Highway has placed this Park under pressure for intensive recreation use. It has a wide variety of coastal features in a small area including embayments with diverse marine ecology, offshore islands, bird rookeries, petrified forest, vegetation communities, etc (see Photograph 6).



Photograph 6. William Bay

. Walpole Nornalup National Park

The Park's isolation and significant ecological communities (eg paperbarks and swamps) favour conservation objectives. weed element ?

. Irwin and Nornalup Inlets

Lands adjacent to Irwin and Nornalup Inlets have a high conservation value related to ecological parameters. Boating and walking are the main activities in these reserves. Within the Peaceful Bay section of the Park, secondary road access is restricted to the scenic Conspicuous Cliff area. The Park's conservation values are being threatened by off-road vehicles and bush fires which consequently require management provisions.

. Owingup Swamp and Quarram Nature Reserve

This large reserve was previously vested in the Western Australian Wildlife Authority for conservation of flora and fauna. It is now controlled by the Department of Conservation and Land Management.

The Quarram Reserve has a spectacular cliffed coastline which attracts fishing enthusiasts. Off-road vehicles and wild fires have had an impact on vegetation and the landscape.

4. ASSESSMENT OF PLANNING AND MANAGEMENT NEEDS

4.1 Management Planning Procedure

The following procedure for developing coastal reserve management plans has been recommended by the Environmental Protection Authority and adopted by the Denmark Shire Council.

Management groups were assembled for each Reserve and workshops were held in each of the four management areas (Reserves). In this way, each meeting produced strong local input into the process of formulating specific management plans.

Reports of all meetings were made available for comment or corrections by anyone attending the various meetings or by any person in the Shire. Follow-up trips were made to each reserve to obtain additional information, clarify maps and re-examine some of the issues raised by the management groups in more detail. Finally, this information was incorporated into draft management plans for each reserve.

4.2 Shire Coastal Reserves in Perspective

At each workshop, participants were invited to consider various international or national issues and trends which may affect the south-west region of Western Australia as well as the desired future for the South-West. Discussion of these general issues provided a common perspective to guide workshop participants towards more specific planning and management issues.

4.2.1 Influences and Trends

Three kinds of external influences and trends were recognized at the workshops as relevant:

4.2.1.1 Political

Many Federal and State Government decisions affect the South-West region of WA. Two examples were considered to be important. Firstly, it was felt that, as more land is being controlled by the State Government, more restrictions on use are being applied, which is difficult for locals to appreciate and accept. Secondly, changes in responsibilities of Government departments were seen to have a significant effect on the South-West. In particular, workshop participants were concerned over recent policy changes such as the creation of the Department of Conservation and Land Management.

4.2.1.2 Economic and Social

- An increase in national prosperity, improved living standards and more leisure time have been accompanied by technical changes. In combination, these have many implications for the South-West.

- Economic influences on pensioners and other fixed income persons living in the region are important and these in turn are modified by the rate of inflation.

- Fluctuations in economic prosperity in turn influence tourism and the South-West.

. It was recognized that changes in Australian land values eventually influence local values, particularly coastal land values.

. An increasing demand for recreation.

. The popularity of water sports and the development of new sports.

. Increasing numbers of persons adopting alternative life styles in the form of communal groups, small holdings and hobby farms.

. A movement from extensive to increasingly intensive agriculture is taking place in the South-West and will probably continue.

. An increase in environmental awareness has affected the kinds of demands tourists are making. For example, the demand for lower cost holidays has been increasing. Also changing is the increasing use of off-road vehicles, the different times at which holidays are taken, changing costs of fuel and transport etc.

4.2.1.3 Industrial

. Changes in international and State requirements for timber may affect harvesting of timber in the South-West, for example, the decision to supply woodchips to Japan.

. Changes in international and national fishing agreements and regulations ultimately affect South-West fisheries.

5. OPPORTUNITIES, RESOURCES AND CONSTRAINTS

From the information already provided, it is clear that the study area offers certain characteristics that make it attractive. However, it must be recognised that natural environments have a limited capacity to absorb use pressure before they degrade, and their capacity for regeneration sets limits on the types and levels of use that are permissible. These limits are summarized below as constraints. In order to plan for use of any natural system, the opportunities or resources that exist, and the constraints that limit use, must be appreciated.

5.1 Opportunities or Resources

The study area has the following opportunities or resources:

- outstanding examples of natural features and biotic assemblages;
- attractive coastal scenery;
- a number of safe, sandy beaches;
- large bodies of relatively protected water behind the coast;
- a coastal dune system mostly stabilized by vegetation;
- existing good access to beaches and rocky coast;
- developed beach sites at Ocean Beach, Parry's Beach and Peaceful Bay with facilities including surf club, kiosk, changerooms etc; and
- excellent recreational opportunities for fishing, boating, sightseeing, walking etc.

Considerable areas of State Forests are given over to recreation, watershed protection and the maintenance of water quality and provide the setting for the coastal region. Although these forested lands are mostly outside presently discussed coastal reserves they provide the most attractive environment forming the entrance and exit to and from the coastal zone and provide alternative opportunities for walking and sightseeing by people visiting the coastal zones.

5.2 Constraints

The study area has the following constraints which limit use and development:

- sandy parts of the coast which are susceptible to marine erosion;
- severe weather events which accelerate coastal erosion;
- large areas of relatively fragile sand dune systems which are dependent on vegetation for stability;
- open coastal landscapes, easily degraded either by poorly-sited or by poorly-designed developments;
- sensitive estuarine environments;
- a small, local population and rateable base;
- limited funds for management;
- short peak tourist season which strains management;
- conflict between different users;
- inadequate boat launching facilities; and
- different areas can sustain limited intensities of use,depending on the type of activity undertaken.

The greatest general constraint is that all resources are limited, and, in order to ensure a sustainable yield, careful planning and management are needed.

6. GENERAL POLICY AND OBJECTIVES

6.1 Policy

The **key policy aim** suggested for the region was to maintain existing attractions, as far as possible, in their present comparatively undisturbed state. It was recognized that, with increasing population and increasing tourist demands, including increasing pressure from off-road vehicles, this policy aim will be impossible to implement over the whole region. However, the desire to maintain and enhance existing natural attractions is a major overall policy consideration and this provides an important motivating thrust underlying Shire policy. Local planning groups suggested that future Shire planners should keep in mind the principles of maintaining maximum natural beauty and minimizing environmental impact.

To meet the above-mentioned criteria it is clear that an overall planning exercise covering the whole of the South-West should be undertaken. Such an overview would include an integration of all major aspects of development. An elaboration of this need may seem somewhat outside the scope of considering Denmark Coastal Reserves now and in the near future. However, trends in South-West agriculture, industry, forestry, mining, tourism and National Parks, to mention but six kinds of development, will inevitably have an important impact on these reserves. Any one of these, applied to smaller parts of the South-West and considered in isolation, would result in a piecemeal approach with an inevitable detraction from, and destruction of, the special characteristics which make the South-West Region unique in Australia. Such a piecemeal approach would probably render insecure the long-term future of Denmark Shire coastal reserves.

In considering an expansion of tourism within such an overall integrated plan, special attention should be given to planning for the development of this industry. This is especially important because of the unique combination of attractions in the region. Since coastal reserves, estuaries and National Parks are already major tourist attractions, there is high motivation for managing them with the long-term future in mind.

Ideally, tourist development should be gradual and follow a low profile in this region. It is recognized that eventually, due to increasing demands associated with increased populations, more small settlements may be required to relieve settlements such as Peaceful Bay. It is also recognized that, just as there is a limit to suitable sites in the Peaceful Bay area, there are few additional areas in the Shire that could develop into similar small townships.

A number of kinds of access will probably continue to be in demand along the coast and this further emphasizes the need for careful planning of the use of the southern coastal areas as a whole.

Future development should give priority to improving opportunities for employment for persons living in the South-West, especially for young people; to improving the viability of agricultural industries and to increasing the number of small manufacturing enterprises based on local produce.

As regards National Parks the working groups visualized 'better use without abuse' through, for example, more and better walking trails, barbecue areas and the like. It was considered that, insofar as park policies would permit, existing access to remote areas should be maintained, providing this could be done without accelerating erosion on the fragile dune areas.

The need to communicate and collaborate more closely with the National Park Authority is recognized by the Shire. Ideally management plans for Denmark Shire Coastal Reserves should be closely coordinated with reserves administered by other Government bodies. The chief value of such coordination would be to enable the various kinds of reserves and parks to be recognized as an integrated series, each differing from the rest but in combination each contributing in a different way to enhancing the attractions of the area for both visitors and residents.

Finally, in considering the future of the South-West, the local groups approved of the approach being used by the Shire in the present exercise and hoped that the future would involve similar closer looks at specific local, individual cases before by-laws are made covering these local areas.

6.2 Objectives

From the foregoing it is clear that the study area is important for many reasons, and that an overall management strategy is needed to take advantage of existing opportunities and to avoid ad hoc decision making. In light of the views reached at locally convened workshops, the following objectives are proposed as a guide for management:

- to maintain and restore, where appropriate, terrestrial and marine ecosystems, coastal processes, landscape, groundwater, estuary and seawater quality;

- to provide appropriate facilities for a wide range of recreational activities in the reserves, consistent with the capacity of the natural systems to support them;

- to provide and ensure public access to the coast in such a manner that minimal environmental damage occurs;

- to encourage and plan for low-key tourist development along the coast;

- to encourage development of a management strategy for all coastal land in the Shire, including CALM and Shire reserves; freehold and leasehold land;

- to collaborate closely with the Department of Conservation and Land Management (CALM) in coastal management;

- to develop a public education programme to increase public appreciation, understanding and enjoyment of the natural coastal environment;

- to implement fire management policies and to suppress bushfires where necessary; and

- to encourage further local participation in the coastal planning, management and monitoring processes.

7. MANAGEMENT PLANS FOR DENMARK SHIRE COASTAL RESERVES

The preceding opinions and conclusions were reached by the four local groups interested in developing an appropriate approach to managing the coastal reserve of their special interest. They form a set of shared values against which more detailed policies, objectives and specific suggestions for implementation were developed for each reserve. The following plans include inputs both from meetings of Shire Council and individual managment groups. Each reserve is defined by reserve boundaries as shown in accompanying figures. Specific management proposals are formulated to implement policies and objectives appropriate to each reserve.

7.1 Ocean Beach and Light's Beach

7.1.1 Description

Ocean Beach Reserve extends along the coast from the outlet of Wilson's Inlet to William Bay National Park. The Reserve is a popular tourist attraction. Several viewpoints and access roads offer spectacular views of the sea. Surfing at Ocean Beach is excellent and it is a well-known venue for surfing events. It is a favoured area for fishermen, the beach being good for Herring and Salmon. Mulloway and Salmon are prevalent at high tide, with good fishing in the channel for Silver Bream and Flathead. Sharks and Kingfish, Whiting, Skippy and Herring and a variety of fish can be caught off the rocks.

Wilson's Inlet receives water from Denmark, Hay and Sleeman Rivers and, seasonally, from the sea. The outlet is through a break in the limestone barrier between Wilson Head and Nullaki Peninsula. Meerup dunes have restricted the width of the outlet channel. Ocean Beach is east facing and protected from the south-west by the limestone barrier of Wilson Head. The coast of the Reserve consists of limestone cliffs with some older rocks protruding and a few small gravel beaches, largely inaccessible. Inland from the beach fragile sands overlay much of the underlying limestone, precluding consideration of the reserve for more intensive use.

Light's Beach consists of three small embayments between small granite headlands. Inland from the beaches is a small steep catchment which originally drained out between the granite hill on the west and the beginning of a limestone barrier on the east. Subsequently, dunes have modified the drainage and formed two small lakes in old valleys. From Light's Beach a range of fish similar to Ocean Beach is available off the rocks and an occasional salmon or flathead can be caught from the beach. It is accessible only by off-road vehicle or by walking.

7.1.2 General Policy

The general policy for the Ocean Beach Reserve is to maintain it as a recreational area while ensuring that any future changes in roads or other amenities or facilities do not detract from the natural beauty of the area.

7.1.3 Objectives

To implement this general policy the following objectives are appropriate:

. to upgrade the existing retail facility at the Lifesaving Club, or create a new one;

. to establish signs on roads, warning of king waves rip tides etc;

- to maintain nesting areas of shore birds and to institute better control, for example, to prohibit cars and walking in the Fairy Tern nesting areas;

- to construct a foot and bicycle path between the caravan park and Ocean Beach, both as a recreation facility and as a public safety measure;

- to engage a full-time inspector or Warden for the Coastal Reserves. It is estimated that as much as three-quarters of this person's time may be spent in the Ocean Beach area. It was further recognized that Council by-laws would have to be prepared to assist management;

- to rationalize the road system in the reserve. Among other things this will involve the delineation of existing roads and permissible tracks, the definition of car parks, the closing of off-road vehicle tracks which are no longer necessary. In order to achieve the latter, a survey of present use and evaluation of other management objectives for the reserve may be necessary.

- In the long term, to consider opening up the Back Beach and Light's Beach areas to help relieve pressures which will inevitably increase on Ocean Beach areas already opened up. This implies the need to construct additional public facilities at some time in future;

- to seriously consider the need to control development in some way. (A source of motivation discussed was the realization that, within existing regulations governing a nearby operating caravan park, it would be possible for this park to expand to the point where eight to ten thousand people were present during peak periods);

- to develop a fire management plan; and

- to ascertain the potential of existing areas under present lease conditions as well as the impact of adjacent growing estates on the reserve before developing a policy of limiting maximum tourist use.

7.1.4 Constraints to Management

7.1.4.1 Ocean Beach

- The main problems for management are associated with car parks and paths and with use by off-road vehicles.

- The area is inadequately policed and existing by-laws are inadequate for enforcing legislation.

- Excessive erosion exists on some dune ridges and is associated with some tracks and trails, particularly off-road vehicle tracks to Light's Beach.

- In from the beach, fragile sands overly much of the underlying limestone and this precludes consideration of these areas for more intensive use.

- Finances are limited. In this respect the concern is that, although the numbers of tourist users may extend to 10 000, the burden of the upkeep has to fall on the local resident population of approximately 2500.

- Unusual weather events accelerate coastal erosion.

. The shortness of the peak tourist season strains public facilities, maintenance and policing activities.

. Public awareness is lacking with regard to the impact of various human activities on the environment. This requires a program to develop greater public cooperation in understanding and in caring for the environment.

. Rubbish proliferation is a continuing problem.

7.1.4.1 Light's Beach

. Some of the dunes near Light's Beach are steep and high and are potentially unstable. The track from Ocean Beach is not suitable as an access road to Light's Beach. It crosses some steep, high dunes and already there is damage to dune crests.

7.1.5 Specific Management Proposals

7.1.5.1 Car Parks, Access Roads and Paths

. The small 'lookout' car park near Wilson Inlet mouth needs to be fenced on the inlet side to prevent foot traffic eroding steep slopes. A lookout should be provided but this is not considered an appropriate site for a beach access path because of the cliff steepness and water, the latter often at the cliff base (see Figure 8).

. On the Ocean Beach headland all car parks need to be defined by log rails. Limestone surface treatment is recommended with the car parks gently sloping uphill to prevent erosion from water runoff.

. The use of off-road vehicles along the coastal strip should cease. Many off-road vehicle tracks should be closed, including those to the West, leading toward Madfish Bay (see Figure 9).

. At the main Ocean Beach car park the marking of car bays will ensure more efficient use of the available space (see Figure 10).

. A more appropriate secondary road access should be provided to Light's Beach. Car parks are required for Light's Beach, to be located as shown in Figure 11.

. Beach access paths will be provided from all designated car park areas. Where paths traverse steep slopes and have a high level of use, steps are required. Where paths lead onto rock (eg at several popular fishing sites) a few fence panels are required to channel people's movements. Where paths use tracks made by off-road vehicles, some erosion repair and 'narrowing' of the path is required. Walking trails should remain 'low key' using the natural ground surface and log steps only on the steeper slopes. Funds should be sought from tourist development sources to construct a footpath and bicycle tracks from the Caravan Park to Ocean Beach.

7.1.5.2 Overnight Stay

. The facilities on Ocean Beach reserve are intended for day use only (with no camping permitted). A commercial caravan park is located near the beach. A large proportion of 'local' residents are among beach users. Similarly, camping will be prohibited at Light's Beach.

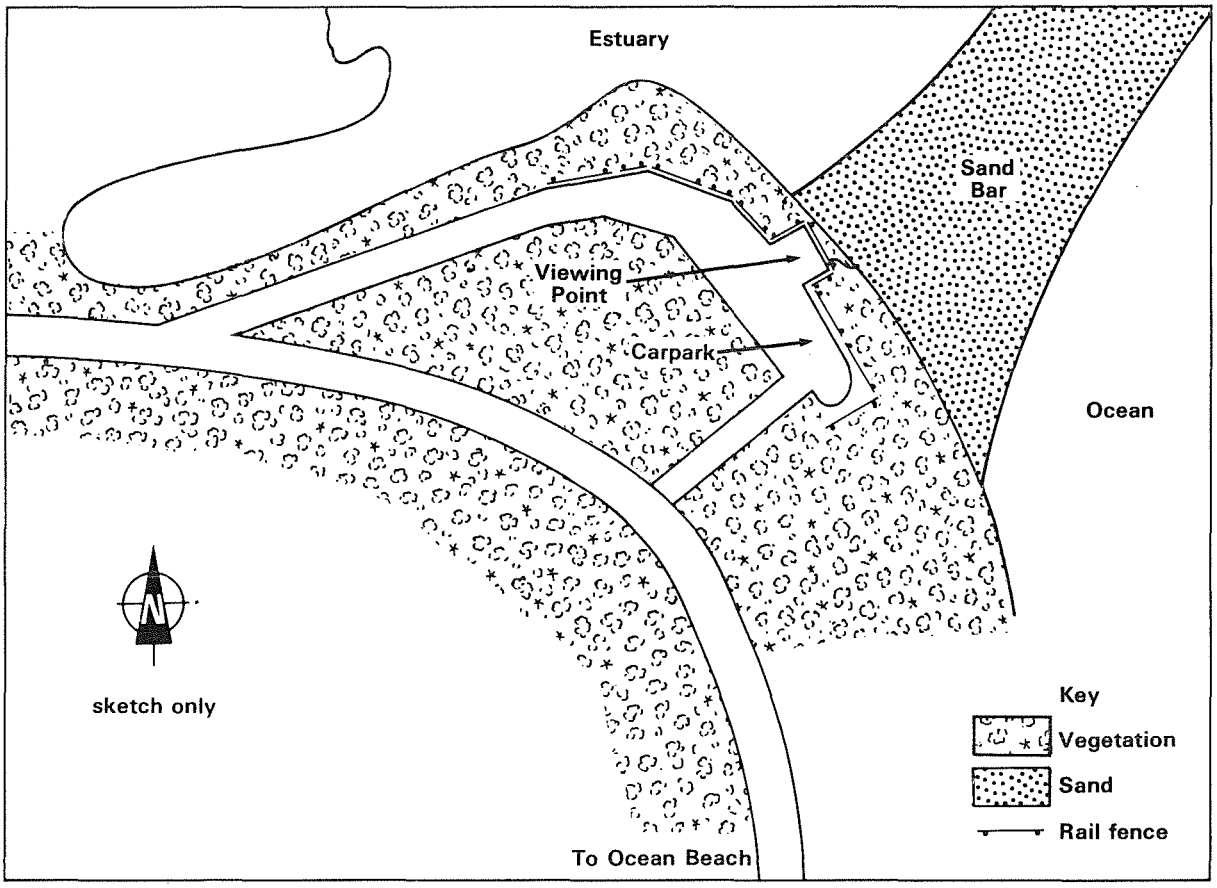


Figure 8. Wilson Inlet Lookout. Management Recommendations.

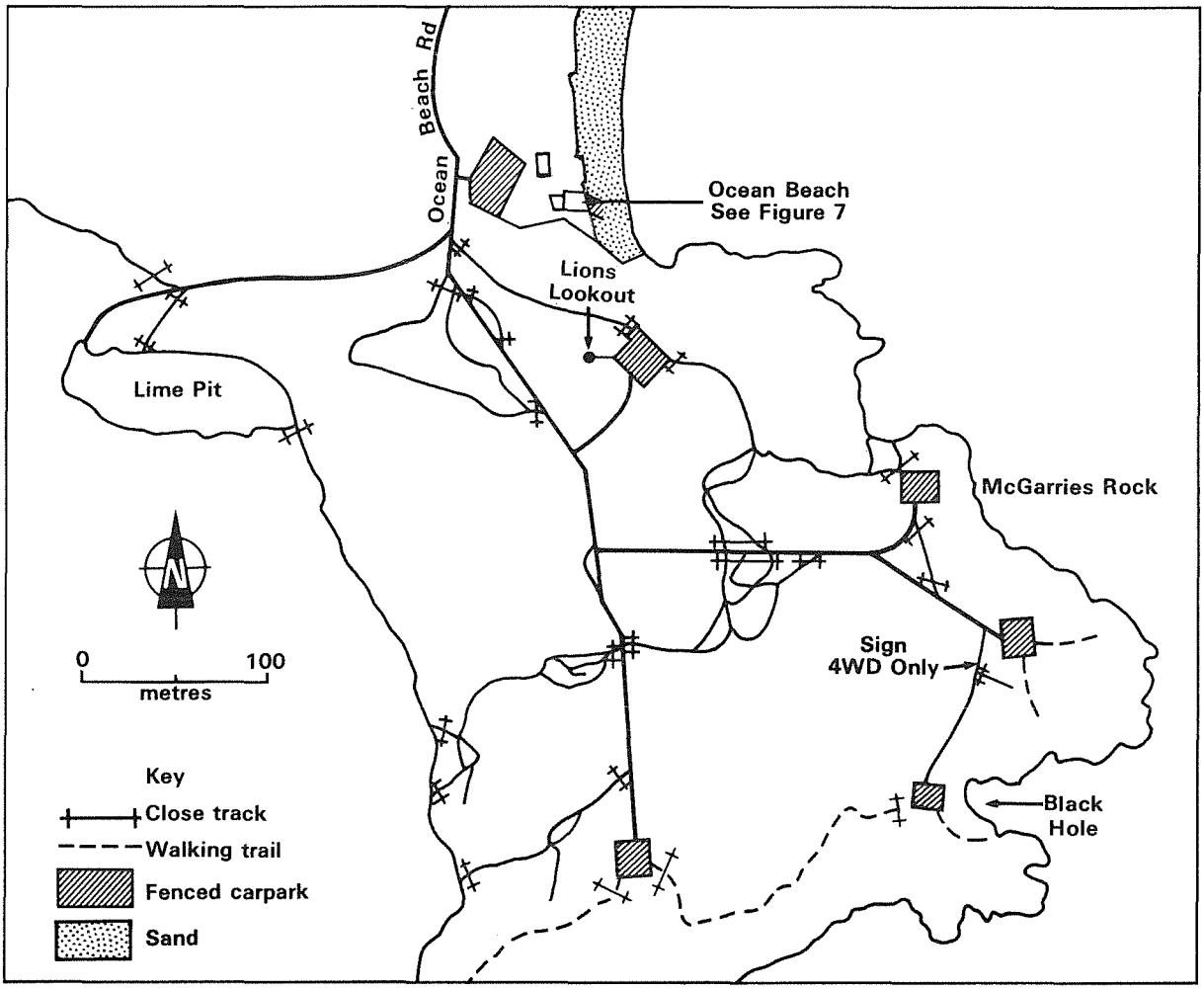


Figure 9. Ocean Beach Headland. Management Recommendations.

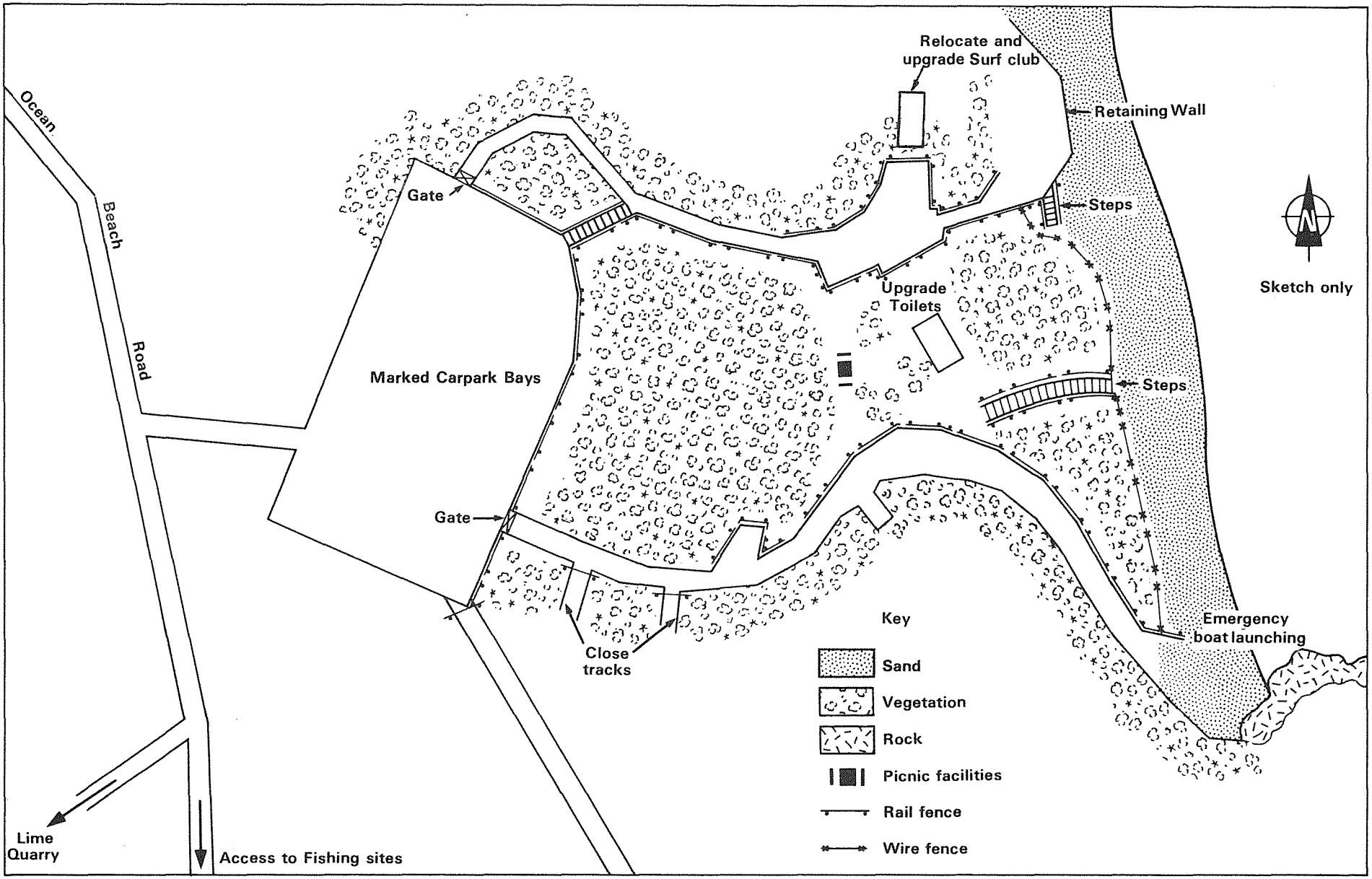


Figure 10. Ocean Beach Foreshore. Management Recommendations.

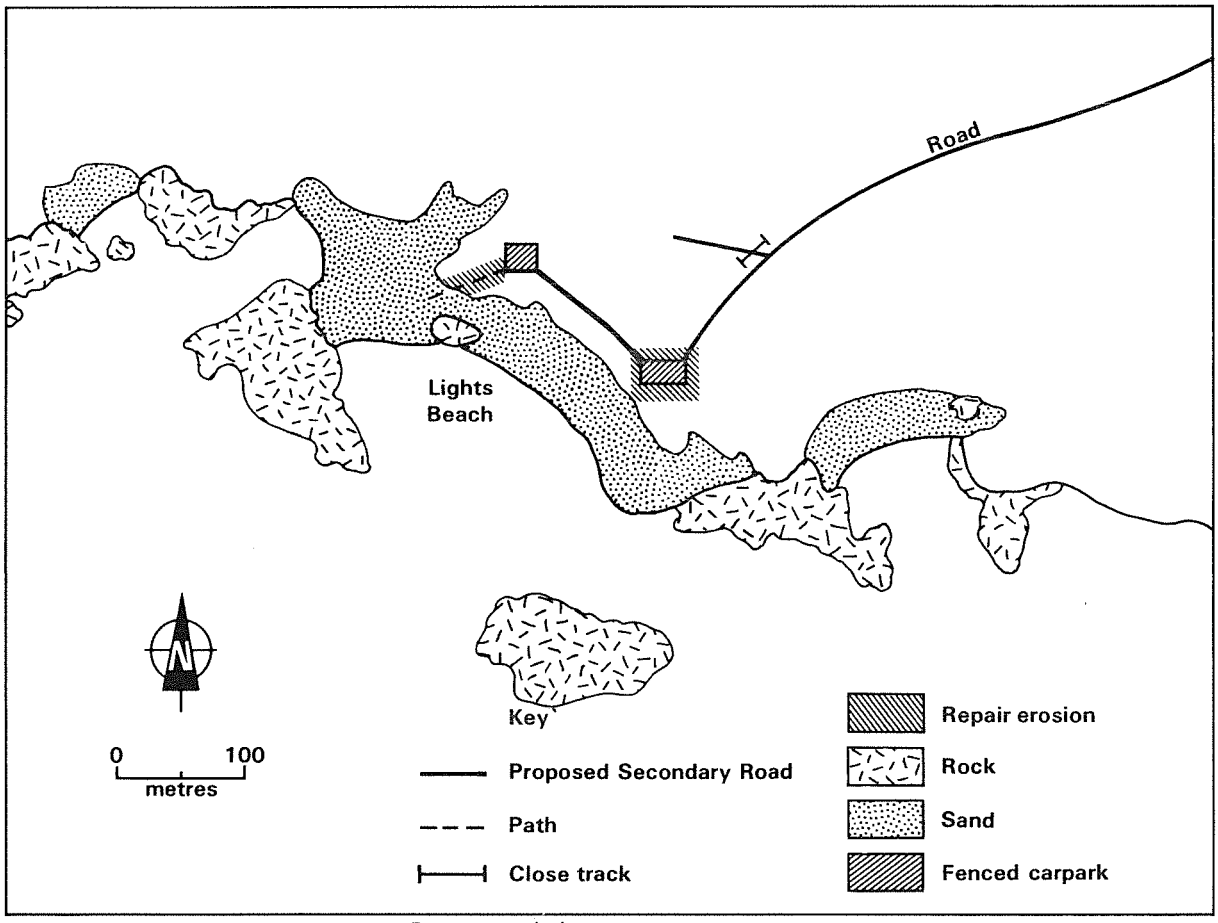


Figure 11. Light's Beach. Management Recommendations.

7.1.5.3 Facilities

. There are no illegal shacks on this reserve. The toilet amenity needs to be upgraded but remains in its existing location. Likewise the kiosk and Surf Club require upgrading and relocating near its present location but further from the beach.

7.1.5.4 Rubbish

. Council now removes rubbish from Ocean Beach and the main car park. This service should be extended to the Inlet Lookout car park. Also needed is a more strategic placing of rubbish bins. The remaining car park sites are mainly used by amateur fishermen as well as a large proportion of local people who are thought to be responsible enough to dispose of their rubbish, as requested by signs.

7.1.5.5 Ranger

. A ranger presence is considered essential to service facilities and, in particular, police off-road vehicle activities on closed tracks.

7.1.5.6 Signs

Directive signs to all car park/beach sites are required. Regulatory signs using a small size, international format should be grouped at any one site eg near a path to a beach. Controls suggested for Ocean Beach include no vehicles except for restricted boat launching purposes and no dogs on the main beach south of the Surf Club. Closed tracks should also have a 'No Vehicles' sign. A display/notice board could be suitably sited near the Surf Club kiosk.

7.1.5.7 Dune Restoration

. The eroded foredune at Ocean Beach is currently being managed by restricting people's movements to paths. This appears adequate provided there is some sand accumulation during summer months. Steps at the end of access roads and leading down to fishing rocks need stabilizing, especially those going through sand.

. The only other dune restoration required relates to damage by off-road vehicle activities. Roads have been upgraded to the most popular sites for beach access and many tracks can be closed to facilitate natural regeneration. However, mulching and seeding is recommended on larger exposed areas and the more environmentally vulnerable sites such as steep slopes and areas exposed to prevailing winds.

7.1.5.8 Zoning

. The extent to which the existing pattern of zoning may be or may become a problem should be investigated.

. The extent to which the existing lime quarry may continue to be useful to the Shire and remain within the policies and objectives of Ocean Beach Reserve should be re-examined.

7.1.5.9 Public Education

. Public awareness is lacking with regard to the impact of various human activities on the environment. This requires a programme to heighten public awareness and to develop greater public cooperation in understanding and in caring for the environment.

7.1.6 Initial Priorities

. Council gives first priority to the appointment of a ranger and honorary rangers. Initially there will be one Council ranger and subsequently an appropriate number of honorary rangers. These would function in close liaison with the Council's Coastal Reserves Ranger.

. Council also gives priority to the need to erect appropriate signs in various places: for example, at the end of each access road to fishing spots. The signs would indicate: parking areas, warning of King Waves, areas to protect Fairy Terns etc.

. Priority should also be given to increasing the awareness of the values of the Shire Coastal Reserves, both to Shire residents and visitors. This would be an ongoing process and initially may involve printed handouts or illustrated brochures for distribution through Tourist Bureau, Caravan Parks etc. Ocean Beach should be the first reserve to be so publicised.

7.2 Parry's Beach

7.2.1 Description

Parry's Beach is already a favourite spot for fishermen, day trippers, surfers and campers not requiring too many amenities. Camping sites are located within a grove of Peppermint trees. Toilet facilities and a small car park already exist although both are inadequate to cope with the number of visitors during the peak tourist seasons. Seasonally the beach is used by a few licensed commercial salmon, herring and shark fishermen and their huts are in one area and located inconspicuously among the trees. For the amateur

William Bay the land is flat and poorly drained. Originally, water from the plain probably drained to the sea in two places, one from the present outlet from Parry Inlet and the other just west of Green's Pool. However, the Meerup dunes have modified the system and while there is still some seepage through the dunes the main outlet is now at Parry's Beach.

Parry's Beach is already a favourite spot for fishermen, day trippers and campers not requiring too many amenities. Camping sites are located within a grove of Peppermint trees. Toilet facilities and a small car park already exist although both are inadequate to cope with the number of visitors during the peak tourist seasons. Seasonally the beach is used by a few licensed commercial salmon, herring and shark fishermen and their huts are in one area and located inconspicuously among the trees. For the amateur fisherman the beach will yield Mulloway and Salmon at high tide and in the evening, together with most varieties of local fish. Good fishing is available from the rocks.

7.2.2 General Policy

The overall policy is to maintain Parry's Beach as near as possible in its present state and without commercial developments. Council recognizes that this policy forms an important part of the basis for the great interest shown and commitments already demonstrated by local people and returning visitors.

7.2.3 Objectives

The following objectives are consistent with this policy.

- to maintain tent camping facilities and amenities in such a way as to make best use of available resources, while maintaining scenic amenities such as trees and dunes;

- to extend the camping area to accommodate a limited number of caravans;

- to encourage amateur fishing as a tourist attraction;

- to maintain current levels of access, insofar as this can be done without destroying the natural character of the area which is one of its chief attractions for visitors and locals alike;

- to increase local involvement in such management as may be required. Close liaison with the Coastal Reserves Ranger will be essential; and

- to ensure that leases should remain available to licensed commercial fishermen and selected Shire approved community-based organizations with preference given to permanent commercial fishermen.

7.2.4 Constraints to Management

A range of different kinds of problems have been identified by Parry's Beach Management Committee.

- Bureaucratic red tape (the length of time Government takes to respond) and lack of communication between local government, State and Federal Government departments and the Denmark community has been a problem.

- Another issue in this reserve, which sustains several different uses, is the problem of balancing the right levels or intensities of use between different areas and between different users in the same area.

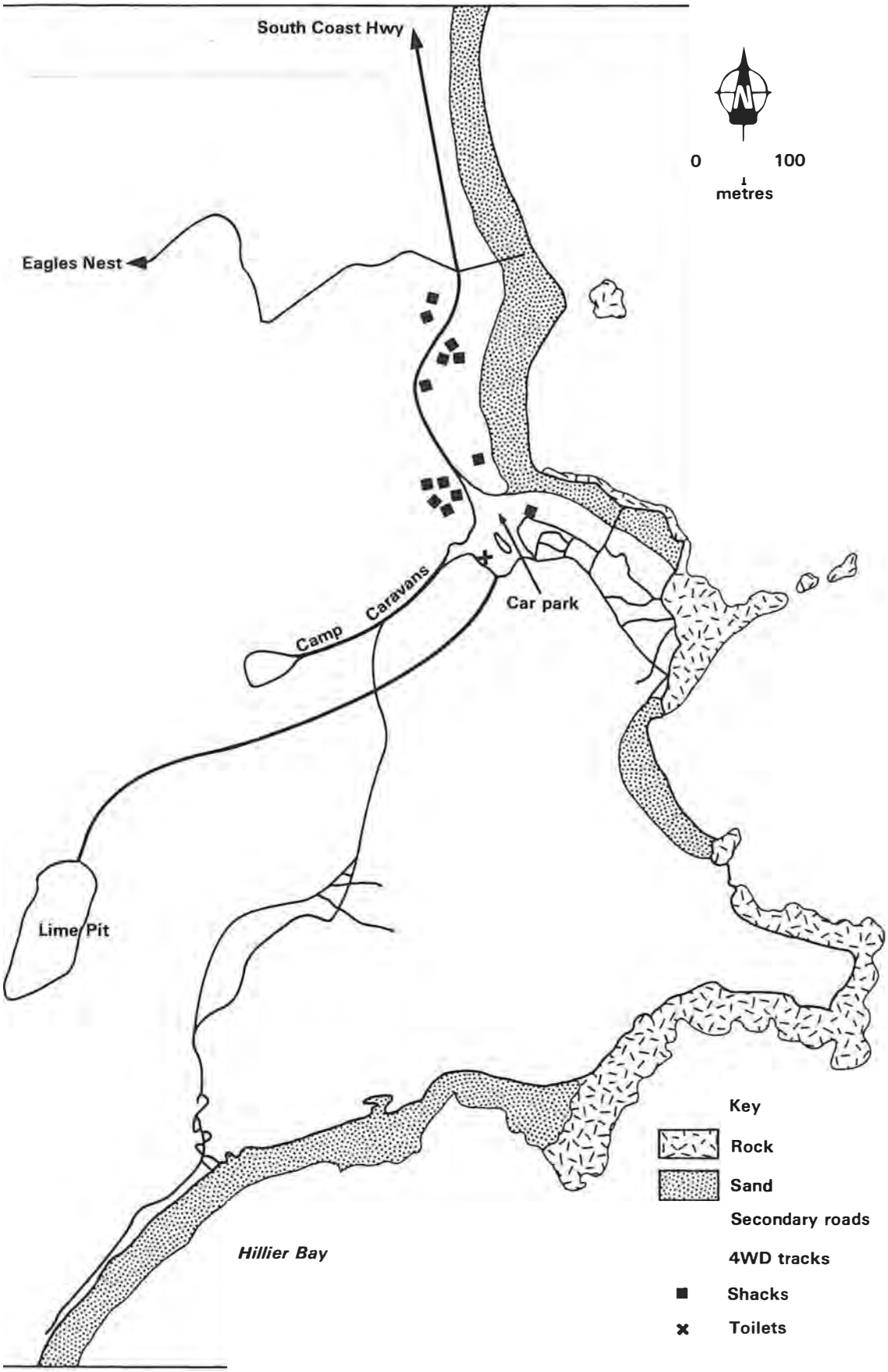


Figure 12. Parry's Beach. Existing Situation.

Photograph 7. Parry's Beach

- Other specific constraints include inadequate toilet facilities and the drainage facilities for caravan users, an unsightly lime quarry which needs reclamation and camouflage, rubbish disposal and indiscriminate use of off-road vehicles.

- Vehicle tracks to the limestone pit and beyond cross some steep high dunes and already some damage shows on crests.

7.2.5 Specific Management Proposals

7.2.5.1 Car Parks and Picnic Site

- The main car park will be located as shown in Figure 14. This should ease traffic congestion and provide easy access to the beach, trails to fishing rocks and is close to amenities.

- Restrict traffic movement over the central parking site by erecting a low log rail fence. A similar fence is required in front of the toilets and to define a picnic area. Establish grass, landscape and provide tables and bins. The establishment of this picnic site will also require the caravan/camping site to adopt a new entrance, and its existing road access be restricted to pedestrian use.

- At Hillier Bay foreshore a small car park for four or five vehicles needs to be defined by log rails and surfaced with limestone (see Figure 13). It is best located behind the dunes where off-road vehicles should stop.

- Two sites on the 'fishing lease access road' require the construction of small car parks for two vehicles. Surface compaction of the car parks is essential to prevent continuing erosion of sandy tracks.

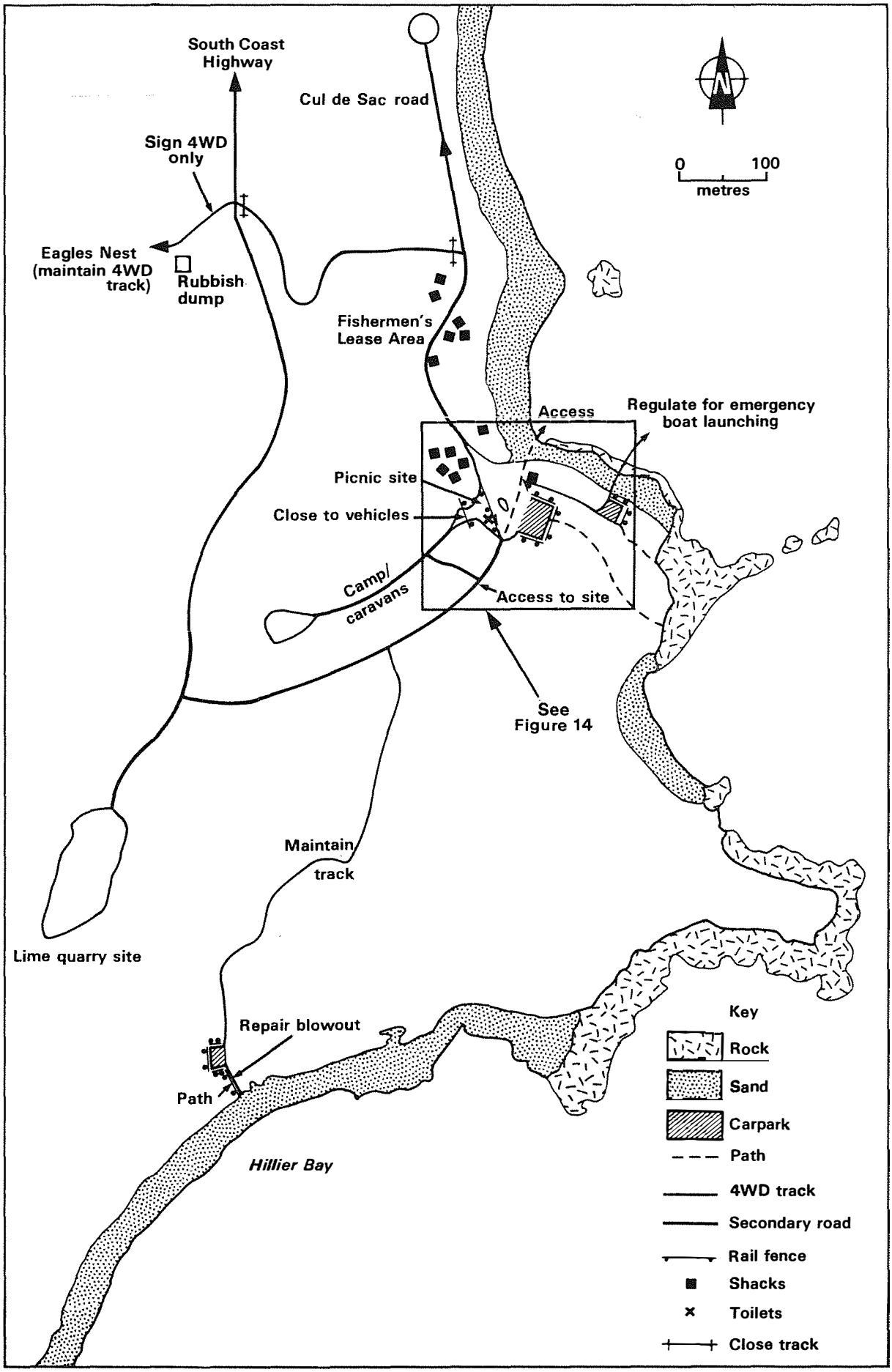


Figure 13. Parry's Beach. Management Recommendations.

7.2.5.2 Road Access/Tracks

. The main road access from the South Coast Highway will be diverted from the secondary gravel road along the inlet to use the 'back road' associated with the limestone quarry (see Figure 13).

. Recognize the necessary traffic movements by professional fishermen and cater for beach access by maintaining a gently sloped road linking the beach and new Parry Inlet access and a thoroughfare from the fishing lease area to the beach.

. A track to the camping/caravan site would turn off the proposed main road.

. A detailed site plan should be prepared,providing for traffic and parking bays in the caravan/camping site.

. The off-road vehicle track to Hillier Bay requires maintenance by surface treatment on wet and sandy sections and closing of the several by-pass tracks.

. Likewise, the off-road vehicle tracks to Eagles Nest needs surface treatment, particularly on dune slopes where several by-pass tracks have been created.

. The maze of tracks on the headland to the south of the beach require management. One vehicle track will remain open for emergency boat launching use by professional fishermen only. All remaining tracks should be closed to vehicles and a circuit walking trail established instead.
. Provide an alternative access track for professional fishermen in the event of seas being high: otherwise the tracks would be closed.

7.2.5.3 Paths

. Paths are not considered necessary for people parking within the central foreshore area as there is easy beach access over existing tracks and rock outcrops.

. A walking trail circuit is recommended to upgrade and minimize tracks on the headland south of the beach.

. The best location for the path at Hillier Bay is through a small dune blowout. Management required includes repair of the blowout (mulching and seeding) and fencing to define the path.

7.2.5.4 Overnight Stay

. Camping is only permitted in the designated site. A detailed plan will accompany upgrading of this facility. One more toilet block is required for the camping site. There is strong local interest to manage and lease this site from Council which is being encouraged by Council as the profits will be used to further improve the reserve.

7.2.5.5 Water Supply

. Increase the water supply and improve its distribution to cater for visitors.

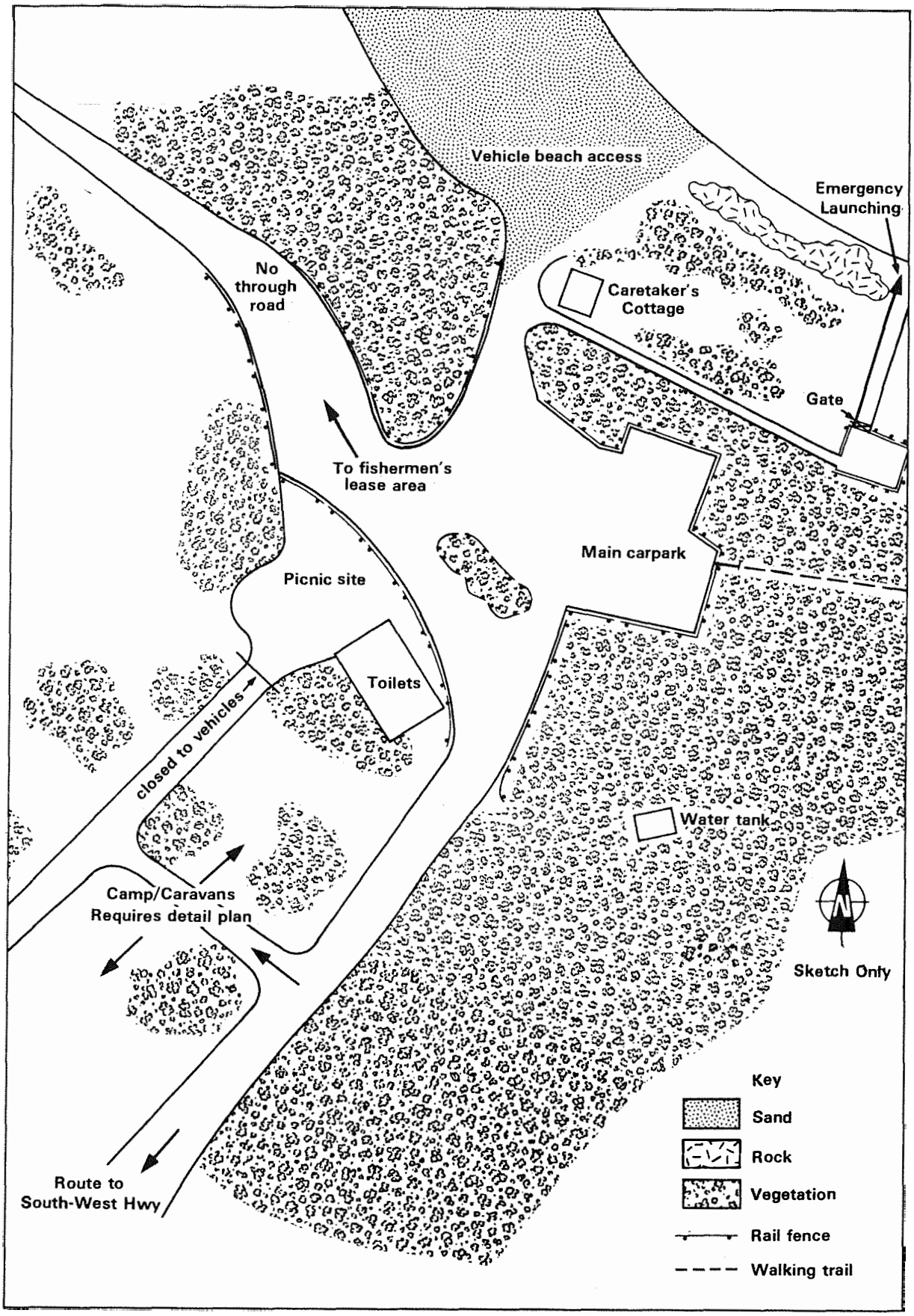


Figure 14. Parry's Beach Foreshore. Management Recommendations.

7.2.5.6 Firewood

. Firewood should be provided to reduce destruction of local trees.

7.2.5.7 Shacks

. There are currently nine shacks on the reserve. Although the majority of owners are engaged in professional fishing, formal lease areas have not been defined and approved by the Minister for Lands. Present leases are on a year-to-year basis and the possibility of securing longer-term leases for commerical fishermen should be investigated. Occupation of some of the existing huts needs legalizing. The shacks require legal tenure arrangements which may be issued only to persons with a current professional fishing licence and to one caretaker.

. Consideration is being given to allocating to the local boating and angling club permission to construct a clubhouse, and develop facilities and amenity areas. For this and from similar arrangements with other organizations, contracts for use will be conditional on members cooperating in abiding by regulations set by the Shire.

7.2.5.8 Rubbish

• The existing rubbish tip will be relocated to a location convenient to departing campers, near the access road to the South Coast Highway, as shown in Figure 13.

• The central foreshore areas, picnic sites and caravan/camping facility all require a rubbish bin service. The local rubbish tip is managed by Council and aims to meet necessary health regulations. Visitors to outer beaches are required to return with their rubbish.

7.2.5.9 Ranger

. A ranger presence is considered essential to manage this large and popular reserve. A local management group will be encouraged to provide advice to Council and to undertake some of the management recommendations in organized 'busy bees'. Honorary rangers, to be appointed, will function in close liaison with the Coastal Reserves Ranger.

7.2.5.10 Signs

. General directional signs are recommended on maintained tracks; small international signs for regulatory controls. A general information board should be placed at the car park.

7.2.5.11 Dune Restoration

. The small blowout at Hillier Beach (see Paths) constitutes the main restoration work currently required. Several other small exposed sand areas also require attention.

. When road vehicle tracks are closed dune revegetation may occur naturally. This will need to be monitored and mulching or seeding undertaken if necessary.

. A small area of unstable sand in a narrow break in the limestone barrier west of Stanley Island is showing signs of regeneration and should be protected from further disturbance.

7.2.5.12 Lime Quarry

. Council has recognized the problem of the lime quarry and is planning and budgeting accordingly. A management group will be formed to attend to the rehabilitation of the large hillside scar.

7.2.5.13 Facilities Needed

. Arrange for the installation of a public telephone.

. In the long term a sea rescue facility should be developed.

. A first-aid post should be established during peak seasons.

7.2.5.14 Fire Control

. Improve fire control by incorporating into the Parry Fire Brigade.

. A fire plan should be developed with recognition of the new entrance road as an integral part of this plan.

7.2.6 Initial Priorities

7.2.6.1 Visitors and Tourists

. Rationalize car park and camping and caravan areas and amenities as well as picnic grounds and rubbish facilities with a view to protecting the dune environment.

. Rationalize access tracks used by off-road vehicles.

. Stabilize open sandy area at end of access road to Hillier Bay.

7.2.6.2 Commercial Fishermen

. Set in order legal tenure arrangements of all occupiers of existing shacks.

7.3 Boat Harbour

7.3.1 Description

Boat Harbour lies between two wildlife reserves which in turn adjoin Peaceful Bay and Parry's Beach Reserves (see Photograph 8 and Figure 15). This is the smallest, least accessible Shire coastal reserve. It has least amenities and is least visited, as during much of the year it is accessible only to off-road vehicles. However, with increasing numbers of such vehicles numbers of visitors to Boat Harbour are also increasing and some form of management is desirable.

Off-road vehicle tracks lead from Boat Harbour toward Irwin Inlet and remote bays and beaches in between. The area is popular with local fishermen. Fishing is similar to Parry's Beach and, in addition, south of Boat Harbour (on calm days) there is good access to deep water from the rocks, although fishing there can be extremely dangerous.

7.3.2 General Policy

As far as possible Boat Harbour is to be maintained in its existing nearly natural state. The intention is for it to remain comparatively unspoiled and untouched; in no way commercialized. The general level of development

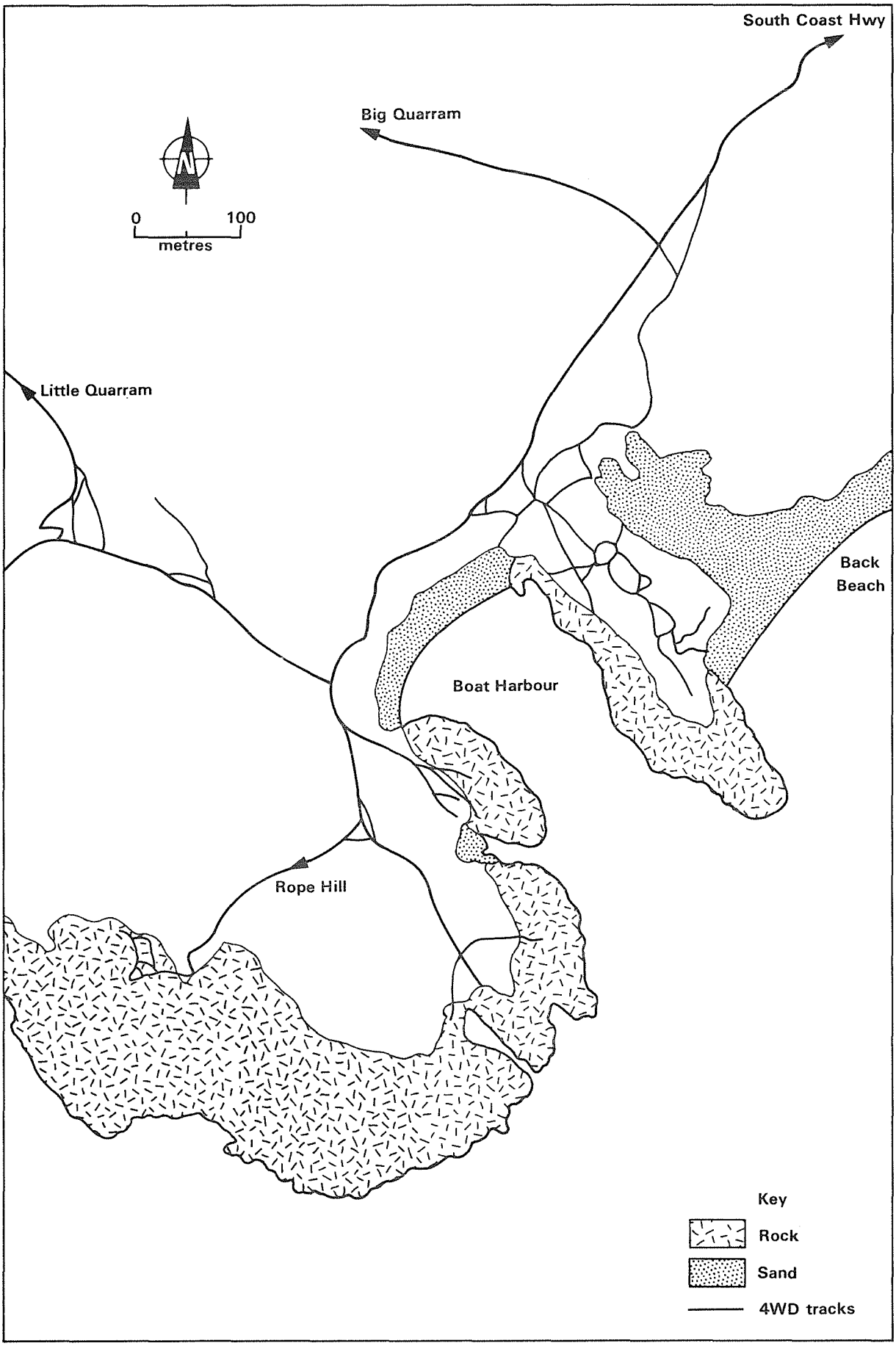


Figure 15. Boat Harbour. Existing Situation.

Photograph 8. Boat Harbour

will be restricted to day trippers and simple camping. While commercial salmon fishing will not take place, amateur fishing access and access for trampers and others with little impact on the environment will be retained.

Because of its comparative remoteness and difficulty of access, the policy will be to retain one on-site accommodation for an honorary warden.

7.3.3 Objectives

The following objectives are consistent with the above policy.

to rationalize the picnic and camping areas;

to rehabilitate areas where damage is already present;

to take whatever steps may be necessary to reduce the considerable continuing damage to the reserve by off-road vehicles and to ensure that livestock remains outside the reserve;

to retain one hut for warden accommodation; and

to ensure that an appropriate part of the duties of the proposed Shire Ranger for coastal reserves be allocated to the Boat Harbour area, working in close liaison with Boat Harbour honorary wardens.

7.3.4 Constraints to Management

A number of problems are important to overcome before the policies and objectives mentioned above can be effectively implemented. The following problems are recognized.

- Disposal of rubbish, which at present is entirely voluntary.
- Signs are lacking to indicate camping prohibitions and penalties for littering.
- Public toilet facilites are lacking. During peak periods this problem becomes acute.
- Damage to the Boat Harbour environment occurs usually by vehicles.
- How best to stabilize shifting, sand-blown areas and dunes is a problem.
- Enforcement of existing regulations is lacking.
- Actions of irresponsible people need controlling.

7.3.5 Specific Management Proposals

7.3.5.1 Survey

- Council gives highest priority to arranging for a survey of the existing use in the Boat Harbour area at a peak use period. This is considered to be the first logical step towards developing a realistic plan as many of the specific considerations regarding implementation will depend on the results of such a survey.

7.3.5.2 Car Parks

- Provide a day-users car park associated with the boat launching facility (see Figure 16). A capacity for twelve cars is required with possible extensions onto grassed areas.
- Provide small car parks at popular fishing sites around the coastline adjacent to Boat Harbour with capacities for three to four cars. Note the provision of these facilities is aimed at reducing unnecessary tracks and erosion.
- Car parks need to be delineated by rails or rock borders. A limestone surface is suitable over sand. Grassed surfaces could also be encouraged to minimize the visual impact of the car park. The underlying rock on many of the headland car parks provides a suitable natural surface material.
- Car parks are intended for day use only. However, landscaping and provision of picnic sites is recommended especially at the main foreshore facility.

7.3.5.3 Tracks

- The numerous existing off-road vehicle tracks need to be minimized to those providing access to specific popular locations. This involves maintenance of the best route to ensure it is usable all year so that by-passes, especially on slopes and swampy/sandy sections, do not occur.

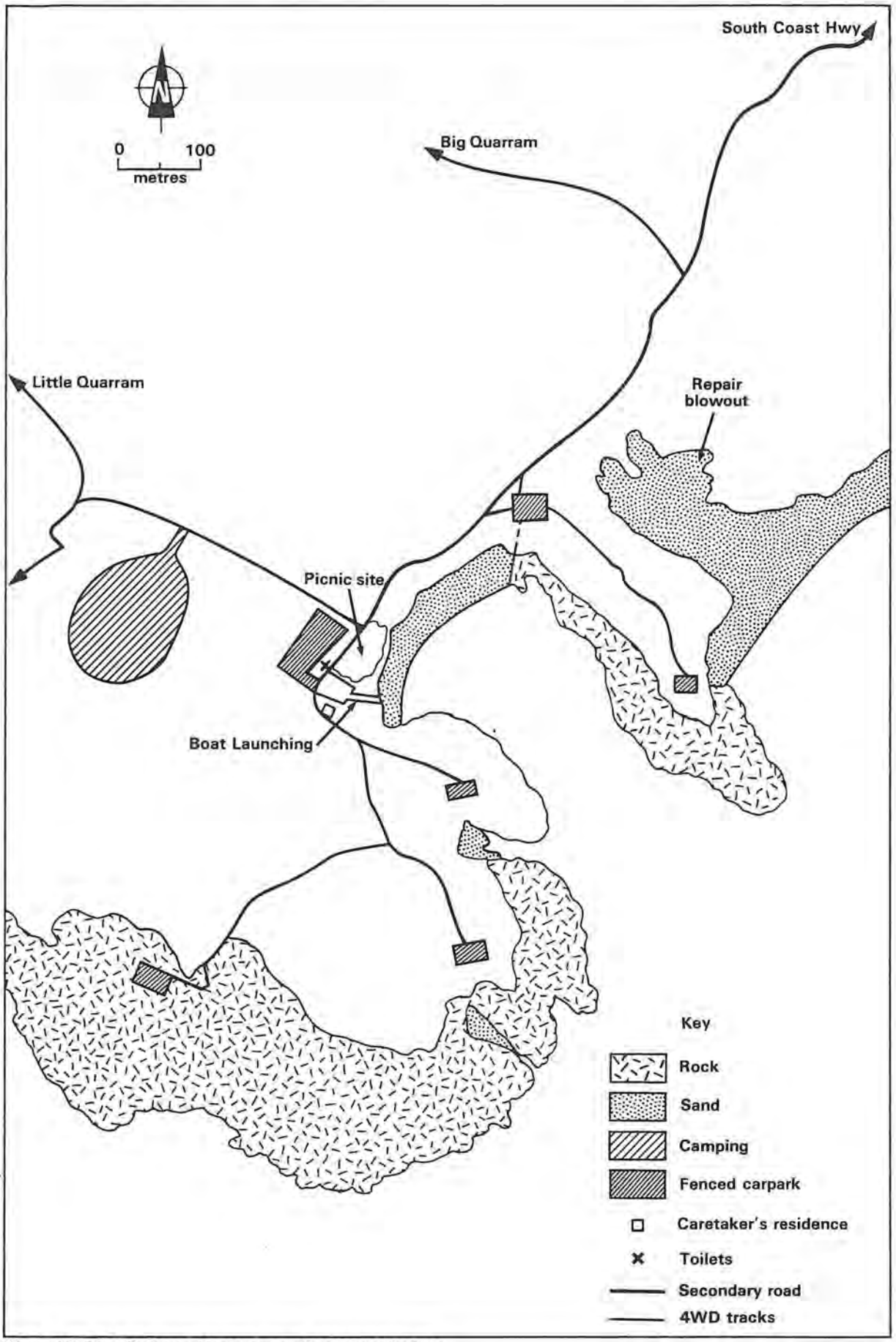


Figure 16. Boat Harbour. Management Recommendations.

The existing eroded or unnecessary tracks should be closed to permit vegetation to regenerate. Tracks in prominent locations (eg beach foreshore) require restoration treatment, such as use of brush mulch and native shrub seeds.

. It is considered desirable to retain four-wheel drive level of access to Boat Harbour over the next five years as a means of limiting numbers and ensuring it remains a low-key facility, focusing on the natural environment.

. Initial priority on maintenance of tracks should be given to the main foreshore area. Other specific priorities include the need to:

a) rationalize the access road to one all weather track;

b) close tracks near the blowout to prevent its use and the use of the adjacent beach as an off-road vehicle playground; and

c) examine all steep slope sections on off-road vehicle tracks to: where possible use a more gentle alternative route, or to consolidate the tracks surface with limestone and close an adjacent by-pass tracks.

. Signpost the tracks to beaches.

7.3.5.4 Paths

. Beach paths need to be associated with the main car park and picnic area.

. Paths should lead from car parks at the outer beaches where people need to cross terrain that is susceptible to erosion.

7.3.5.5 Overnight Stay

. A camp site needs to be established. Figure 16 shows a recommended site, sufficiently above the water table and meeting health requirements for bore-hole toilets. Once approved, landscaping and layout need close attention and should be commenced as soon as possible. Water and toilets will need to be provided and consideration should be given to provision of a barbecue facility.

. All overnight stays should be restricted to the formal camping/caravan site once it is established. This needs to be policed by an honorary ranger.

. Bush camps will be tolerated while there is no alternative facility; however, this is on a 'bring your own wood' and tidy up basis. Note no fires are permitted on total fire, ban days and a chalk board sign at the caretakers office could be used to indicate this and other notices.

7.3.5.6 Shacks

. The three existing shacks have been established for some 20 to 30 years; however, they are illegal. One shack's owner in particular has assisted in management of the Reserve and the retention of a permanent volunteer caretaker service needs to be assessed to determine accommodation/office needs.

Details of a proposed honorary ranger service needs to be determined.

7.3.5.7 Rubbish

Bins should be serviced within the camping/caravan site and foreshore car park/picnic area. Elsewhere people should be requested to return with their rubbish.

7.3.5.8 Signs

General directional signs are recommended on maintained tracks. Small international signs are suitable for regulatory controls. An information board on fragile coastal environments and the current events relating to the reserve are desirable to develop communications between users and the necessary management presence.

7.3.5.9 Dune Restoration

The blowout just to the north of Boat Harbour should be repaired (see Figure 16).

In addition to repairing of eroded tracks, the extensive blowout behind Little Quarram Beach needs to be stabilized.

7.3.6 Initial Priorities

Several of the above-mentioned proposed actions have priority. These are:

Mounting a detailed survey from which a more detailed management plan can be prepared, hopefully in collaboaration with wildlife officers responsible for adjacent reserves.

Appointing a ranger is essential for many of the follow-up actions.

Dune restoration is urgent.

Clear signs need erecting at strategic picnic and camping sites and at the entrance to controlled roads.

A rubbish tip is essential.

7.4 Peaceful Bay

7.4.1 Description

Peaceful Bay is the westernmost Shire Coastal Reserve. It is situated between a National Park and a Conservation Reserve (see Photograph 9 and Figure 17). It is the only Shire Reserve with a small village and a resident population, although most houses are only seasonally occupied. The village features a caravan park, general store, local fire brigade, public toilets and picnic ground. A nearby area is being developed for freehold residences.

Both the village and the new development are on land with inherent drainage problems as it is flat land enclosed between dune ridges.

A small protected bay harbours the boat of the single resident professional fisherman and provides access for licensed deep sea fishermen. To the east of the village an excellent beach extends to Irwin Inlet and is accessible to vehicles.

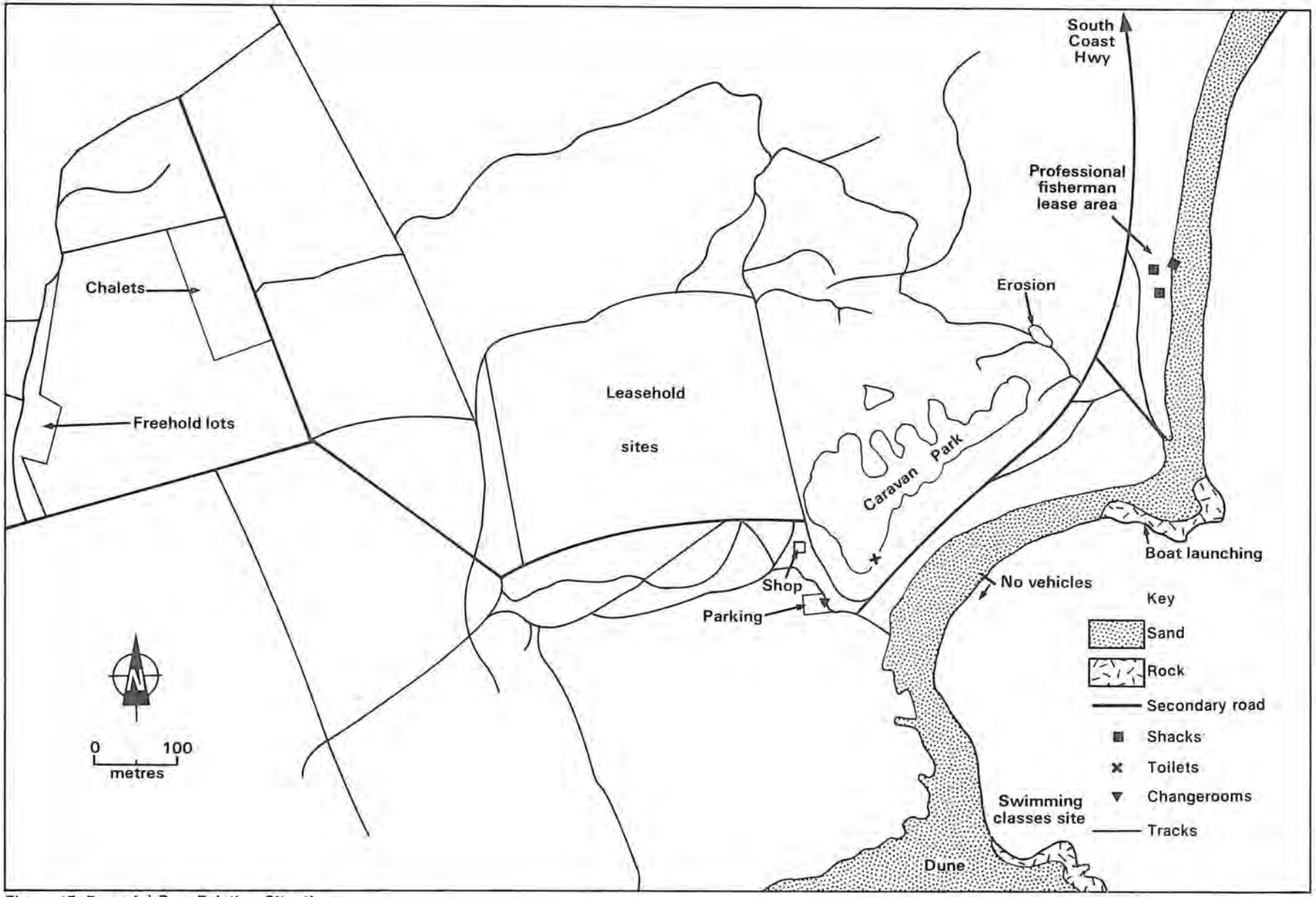


Figure 17. Peaceful Bay. Existing Situation.

Photograph 9. Peaceful Bay

As at Parry's Beach, professional fishermen catch Salmon during February and March; Herring in April and May; and Shark throughout the year. Amateur fishermen find good, all round fishing both from beach and rocks, although caution must be exercised on the rocks.

7.4.2 General Policy

Whilst it is recognized that ultimately there will be a limit to the numbers of both people and dwellings, Peaceful Bay can still support more development. Any future development should ensure that as much of the natural beauty of the Peaceful Bay Reserve be retained as is possible.

7.4.3 Objectives

The main objectives for implementing the above policies are:

- to increase the viability of the local community by encouraging the development of crafts and other local cottage industries;

- to expand housing when necessary to the freehold area;

  to expand tourist facilities (the Caravan Park now occupies but 12 of 30 acres allotted);

- to rationalize existing road access to residential areas, to upgrade or rehabilitate selected off-road vehicle tracks and to improve parking facilities; and

- to retain existing horse riding facilities.

7.4.4 Constraints to Management

A number of constraints were identified which would need to be overcome before management could move closer to achieving the above objectives. Some problems involve the upgrading of public facilities, some arise from existing uses within the Reserve and, finally, a few problems involving planning and implementation were identified.

. As regards public facilities it was considered that the following were inadequate:

  - public access to the beach,
  - public conveniences,
  - picnic facilities,
  - rubbish disposal.

. An inappropriate through-flow of traffic needs controlling to improve the safety of children on public roads.

. Control of irresponsible people exceeding speeds on roads is needed.

. The current most serious erosion problems are caused by off-road vehicles which must be controlled.

. The lack of on-ground, coastal surveillance is considered a problem.

Several more general problems involving planning and implementation were:

. Lack of appropriate communication with State and Shire authorities.

. Looking to the future, with populations increasing, lack of potable water may become a problem. Before this happens efforts should be made to reduce the amount of water wasted.

. The problem of enforcing legislation is an issue linked to several other above-mentioned problems.

. Another problem with broad general implications is lack of funds.

7.4.5 Specific Management Proposals

7.4.5.1 Car Parks

. Extend the day-use car park, locating it away from drainage lines and retaining existing trees for a landscaped picnic area (see Figure 18). Facilities for picnics should be improved. Remove existing change rooms to gain space.

. Permit vehicles and trailers to park on the northern position of the beach. Regulation of the mode of parking by facing cars seawards may be necessary as numbers increase.

7.4.5.2 Access Road and Tracks

. Re-align southern bend of main access road as shown in Figure 18.

. Eventually an alternative access route to the freehold lots will be needed to reduce traffic thoroughfare of the townsite's southern route.

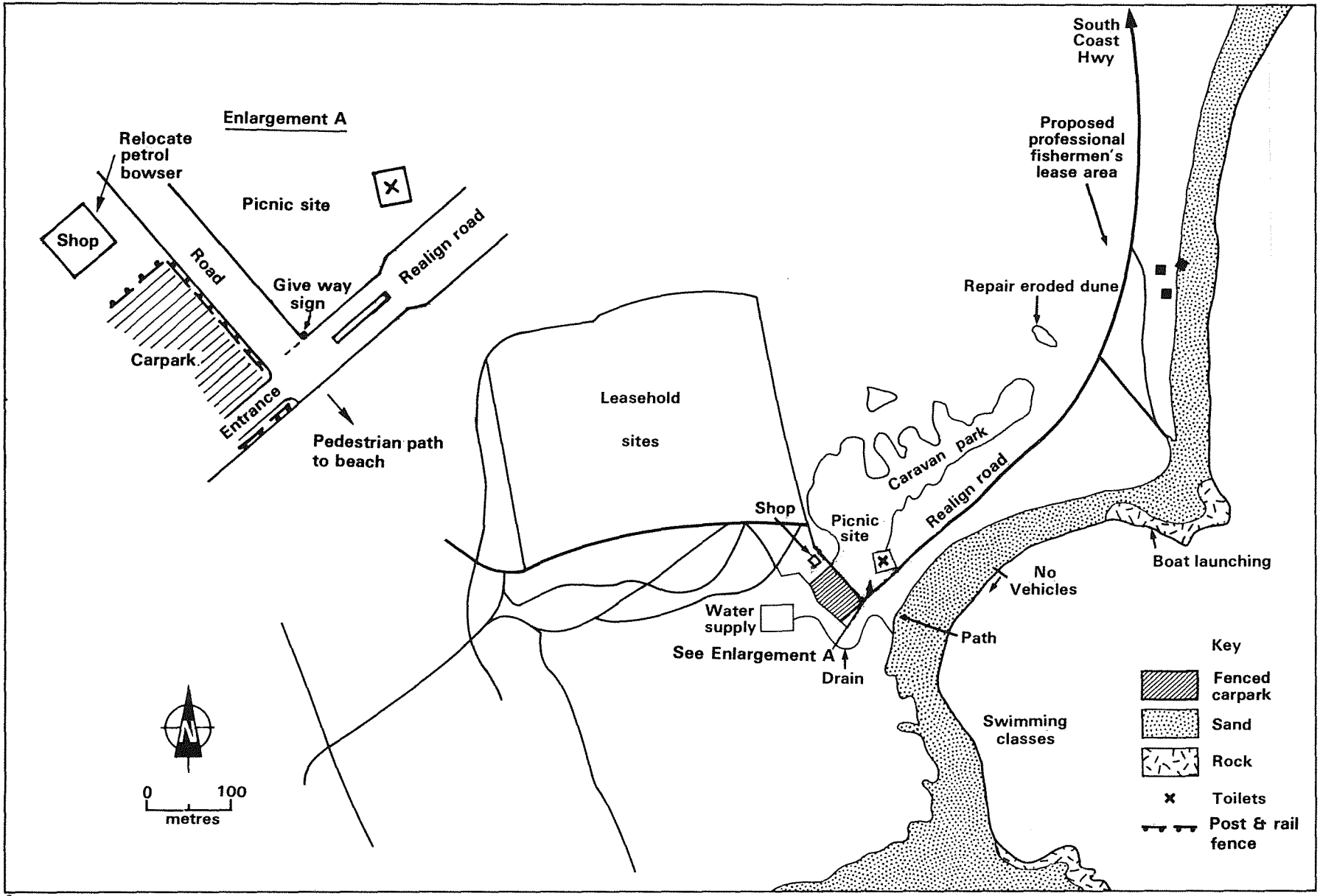


Figure 18. Peaceful Bay. Management Recommendations.

. Close unnecessary tracks and employ a Ranger (or honorary ranger) to police the Reserve. Downgrade motorcycle tracks to walking trails where they traverse dunes causing erosion.

7.4.5.3 Paths

. One additional path to the beach is proposed in association with the car park extension and picnic site. It should lead towards the 'swimming classes beach'. The existing path is well located for use by caravan park clients.

7.4.5.4 Overnight Stay

A commercial camping/caravan park caters for all short-term stay and consequently camping is illegal elsewhere on the Reserve. Less than half the caravan park lease area has actually been developed leaving space for future demand.

7.4.5.5 Public Conveniences

Upgrade or replace public conveniences and include toilets and showers in one block. See Figure 18.

7.4.5.6 Leasehold Townsite Development and Shacks

Peaceful Bay is gazetted as a townsite and supports 163 leasehold titles which represent the ceiling to this form of development. The nearby freehold title land has not been developed to its capacity and the provision of specific access to it is a necessary requirement for future expansion.

. A shack and caravans which belong to the professional fishermen are located on the foreshore and should be permitted only in conjunction with their current fishing licences.

7.4.5.7 Rubbish

. Local residents are expected to dispose of their own rubbish at the local tip. The public facilities eg day-use car parks, picnic site and beach should have rubbish bins serviced by Council.

7.4.5.8 Ranger

. A part-time Ranger presence is considered essential to work closely with honorary rangers and to oversee management controls and service the public facilities.

. A local management committee is recommended to advise Council on the effectiveness of its controls and in general planning for use and development of facilities for the Reserve.

7.4.5.9 Signs

. The main directive signs required are to the boat launching facility, car park and chalets. Regulatory signs should be placed strategically by path signs to the beach, at car parks etc. The shop is the best central point for a notice board. Prepare notices regarding rubbish disposal and place these in appropriate places with penalties listed.

7.4.5.10 Dune Restoration

. Work on the massive dune blowout located to the south-west of Peaceful Bay was commenced by the Department of Agriculture some seven to eight years ago to test sea-water irrigation techniques. The trials were extremely successful in establishing dune ridges grassed with Marram Grass and in initially stabilising the blowout from encroaching landward. Management is now required to restrict off-road vehicle traffic from damaging vegetated dune slopes; however, an access road to Tom's Rock (fishing spot) which follows valley contours is not causing any damage. It is recommended that the site is monitored to check the progress of introduced vegetation. Liaison with the Department of Agriculture should be maintained.

. Two eroded dune ridges urgently require re-vegetation. They are noticeably increasing in size from the erosion by onshore winds and increasing pedestrian traffic. As they are located behind the swimming beach, management of people will also be required.

. The eroded dune ridge located on the west side of the beach access road needs to be repaired (see Figure 18). This has been caused by motorbike traffic tracks and exacerbated by wind erosion. Management required involves fill, mulch, seed, a fence and a sign to indicate erosion repair and the prohibition of motorcycles and four-wheel drive vehicles. A Ranger or Honorary Ranger presence will be required to police these controls.

7.4.5.11 Fire Management

. An overall fire management plan needs to be developed in close coordination with procedures applied in the adjoining National Park and Conservation Reserve. This does not imply that the policies should be the same for all areas but it seems essential that fire management be closely linked between the two adjoining areas.

7.4.5.12 Irwin Inlet Channel

. The existing natural channel should be retained to allow the natural cycle of seasonal events to continue with as little disturbance as possible.

7.4.6 Initial Priorities

. To devise ways and means of providing alternative access to the freehold area. This is suggested as the chief means of rationalizing the flow of traffic in the settled area to improve the safety of pedestrians, particularly children.

. To reclaim the soil erosion on Flag Hill; to restrict motorcycles and to re-align tracks, banning access to the south side.

. To develop an overall fire management plan.

. To retain the existing channel to Irwin Inlet in its natural state.

8. GENERAL MANAGEMENT PROPOSALS FOR DENMARK SHIRE COASTAL RESERVES

8.1 Access

. Uncontrolled vehicle and pedestrain access often leads to vegetation damage and erosion. This detracts from natural landscape quality and produces management problems for the local authority. Therefore, it is proposed that vehicle use be confined to designated roads, tracks and car parks, and pedestrian access to designated paths. Rationalization of vehicle access will play an important part in the implementation of this plan.

. Limit off-road vehicle tracks to those providing access to popular sites.

. Close unnecessary tracks, and where necessary cover with brush to assist rehabilitation.

. Provide all weather tracks to popular sites if not already present.

. Control vehicles at certain sites by the provision of car parks with log barriers.

. Permit public vehicle beach access for boat launching and recreational fishing only at Peaceful Bay and Parry's Beach. Limit access at Boat Harbour and Ocean Beach to sea rescue only.

. Council request that the Ministerial Advisory Committee on off-road vehicles declare certain sections of the Shire Coastal Reserves as prohibited areas under the Control of Vehicles (off-road areas) Act, 1978. These areas would include, for example, all land at popular locations with the exception of designated roads, tracks and parking areas.

. Council inform the above-mentioned Committee that:

  - road registered and unregistered vehicles are creating environmental problems and are a nuisance and danger to the public;

  - council would like to have control over vehicles in these areas; and

  - council staff will be available to inform the public and enforce provisions of the Act.

. Council liaise with officers of the Department of Conservation and Land Management to reach a suitable arrangement to control vehicle movements along the coast.

8.2 Soil Conservation

Accelerated soil erosion may result from vehicle, pedestrian or domestic stock movement through dunes; from development or management involving clearing and/or recontouring or from too frequent fires, or from unusual natural phenomenon such as high seas coupled with unusually strong winds. Erosion can be prevented if vegetation cover is maintained and roads, tracks, car parks and paths are well located, well designed and carefully constructed.

- When vegetation is removed, encourage recovery by surfacing sandy roads with limestone, or revegetation areas of bare soil.

- Where pedestrians require access from car parks or camping areas to beaches, construct clearly-defined pathways.

- Make every effort to ensure that sand in dune areas is stabilized beneath a vegetative cover and that minimal disturbance of natural areas takes place.

8.3 Landscape

Coastal landscape is an attractive visual resource and susceptible to degradation. Therefore, it is important that landscape in the Coastal Reserves be protected and enhanced where necessary.

- Where possible, locate developments on the edge of spaces which may be defined, for example, by hills, stable sand dunes or clumps of tall vegetation.

- Insofar as possible, do not locate structures in open spaces and not in central or highest points in any area. They are best located away from the foreshore and screened by natural vegetation or by planting native shrubs or trees.

8.4 Historic Sites

The Aboriginal Heritage Act, 1972 -1980, provides for the preservation of places and objects customarily used by, or traditional to, Aborigines.

Request the Aboriginal Sites Department of the Western Australian Museum to specify the sites and substantiate their aboriginal significance where they may be affected within the boundaries of the Denmark Shire Coastal Reserves.

8.5 Professional Fishermen's Shacks

An important aspect of planning for management of foreshore areas is rationalization of the location and tenure of professional fishermen's shacks. A number of such shacks have been constructed at Parry's Beach and Peaceful Bay. Shacks have usually been sited ad hoc and in dunes immediately behind beaches. Leases to licencees have operated on a year-to-year basis.

- Locate formal Professional Fishermen's lease areas at or near existing informal areas at the two locations mentioned above (see Figures 13 and 18).

- Lease portions of each formal area only to licensed professional fishermen, such that each lease lasts during the working period of the individual lessee, providing the number of leases for professional fishermen is not diminished.

8.6 Fire Management

The vegetation of Australia has evolved in the presence of fire, and plants use a variety of strategies to survive burning. Some plants regenerate vegetatively from parts of their roots and stems, while others recover by means of seeds stored on the plant or in the soil.

Differences in the frequency of burning can result in different types of coastal environment, each with natural vegetation but each maintained by a particular burning policy. The susceptibility to fire and the rate of recovery after burning differs markedly with different natural communities. Sand dune communities generally recover slowly after fire and the erosion risk is high until the vegetation is well established, which may take several years. The danger of erosion is even higher if the area is subjected to intensive public use.

These considerations emphasize the importance of developing appropriate fire management plans for each coastal reserve. Different fire regimes can arrest, hold or be instrumental in developing different plant communities. Therefore, in developing fire management plans, full account must be taken of the particular plant communities desired as a contribution to implementing the policy and objectives of each reserve.

. Prepare a fire management plan for the Coastal District and for each Shire reserve in collaboration with the managers of adjacent National Parks and Conservation Reserves.

8.7 Management Staff

In order to manage Shire Coastal Reserves and implement aspects of the management plan, it is important that a suitably qualified ranger be appointed. The Shire Ranger should be capable of communicating effectively with the public, implementing the management programme and assisting with surveys. It would be beneficial to appoint an additional number of honorary rangers, based at various locations around the district, to assist the Shire Ranger.

. Council appoint a professionally-qualified, full-time ranger to undertake the required management duties in Shire Coastal Reserves.

. Council appoint a sufficient number of honorary rangers to assist the Shire Ranger in coastal management.

. Prepare by-laws to give the ranger authority to manage coastal reserves.

8.8 Public Education

Education of the public is an important management tool as well as an informative process for the public. An important part of the education process is an interpretation of the natural features and processes of the coast so that local people and visitors may have a greater understanding of the coastal environment and an increased sympathy for, and awareness of, the need for its conservation.

. Encourage the involvement of schools and local organizations in both landscape improvements and dune protection and restoration programmes.

. Encourage the Shire Ranger to develop interpretative skills to assist in his public education role.

8.9 Estuaries

Inlets and adjacent environments are ecological systems that are subjected to continual stress by activities in their contributing catchments and in the inlets themselves. The physical and biological equilibrium of inlets can be severely disrupted by human interference. This can severely reduce the food-producing potential of estuaries and their attractiveness in recreational and aesthetic terms.

There are five inlets in or adjacent to, Denmark Shire Coastal Reserves: one for approximately each twenty kilometres. Planning for their management is thus of prime importance. However, the scale of such an exercise is too large to warrant inclusion in this draft plan.

. Prepare or have prepared management plans for each inlet in Denmark Shire.

9. IMPLEMENTATION

Implementation of this plan is primarily the responsibility of The Shire of Denmark, although various State Government agencies may provide further advice or assistance.

The first step in implementation is to consider this draft plan. The second is to process further comments from Council, residents and other interested bodies so that a final management plan may be prepared. The third step is to adopt the final management plan. The fourth step is for the Denmark Shire Council to develop a staged works programme projecting five years ahead including proposed works, more detailed plans and costings for particular areas.

10. REVIEW

Coastal Management Plans are intended to provide a consistent, publicly-agreed framework for future management. Accordingly, they should be reviewed on a continuing basis with public comment where necessary, as works programmes are developed and undertaken. They should be comprehensively reviewed and updated at least every five years.

REFERENCES

ANON (1833) Report of an excursion in a whale boat, from six miles to the eastward and Rame Point to six miles to the NW to Point d'Entrecasteax, and from thence to the Murray River by land. In Cross, J.,ed. Journals of several expeditions made in Western Australia during the years 1829, 1831, and 1832: under the sanction of the Governor, Sir James Stirling, containing the latest authentic information relative to that country. London

AUSTRALIAN BUREAU OF STATISTICS (1984) Western Australian Year Book. Perth

CONOCHIE, I (1979) Denmark. An outline history. 150th Celebrations Committee. Albany

DEPARTMENT OF CONSERVATION AND ENVIRONMENT (1982) A Resource inventory and management information system for Wilson Inlet, Western Australia. DCE Bulletin 132. Perth

DEPARTMENT OF CONSERVATION AND ENVIRONMENT (1984,a) The nutrient status of Wilson Inlet 1982 -1983, DCE Bulletin 159. Perth

DEPARTMENT OF CONSERVATION AND ENVIRONMENT (1984,b) Estuarine Environments of the Southern Hemisphere. DCE Bulletin 161. Perth.

DORTCH, D.E., KENDRICK, G.W. and MORSE, K. (1984) Aboriginal mollusc exploitation in south-western Australia. Archaeology in Oceania volume 19 pp 81-104

ENVIRONMENTAL PROTECTION AUTHORITY (1977) Conservation Reserves for Western Australia - Systems 1 - 5 EPA Perth

ENVIRONMENTAL PROTECTION AUTHORITY (1977) Draft Guidelines for and Environmental Protection Policy on the coastal zone in Western Australia EPA Perth

ENVIRONMENTAL PROTECTION AUTHORITY (1984) Report of the Working Group on EPA Red Book Recommendation 2.14 Albany - Denmark Shires. EPA meeting Number 282

LENANTON, R. (1974) Wilson Inlet. A seasonally-closed Western Australia south coast estuary. Department of Fisheries and Wildlife Western Australia, Report Number 14

LENANTON, R. (1984) The commercial fisheries of temperate Western Australian estuaries: early settlement to 1975. Department of Fisheries and Wildlife Western Australia, Report Number 62

KENNEDY, V.S. (1980) Estuarine Perspective
Academic Press.

STATE GOVERNMENT (1983) Coastal Planning and Management in Western Australia; A Government Position Paper

TOWN PLANNING DEPARTMENT (1978) Shire of Denmark Town Planning Scheme TPD Perth

TOWN PLANNING DEPARTMENT (1983) Albany Region Plan Interim Report TPD Perth

TOWN PLANNING DEPARTMENT (1984) Shire of Denmark, special rural strategy study TPD Perth

TOURISM COMMISSION (1984) Denmark brochure TC Perth

WESTERN AUSTRALIAN MUSEUM (1985) Data print-out of mammals and reptiles collected from the Denmark Coastal District

APPENDIX 1 (continued)

Amphibians

Litoria adelaidensis	-	Slender Tree Frog
Litoria moorei	-	Moore's Tree Frog
Crinia georgiana	-	Red-groined Frog
Geocrinia leai	-	Lea's Frog
Heleioporus eyrei	-	Moaning Frog
Heleioporus inornatus	-	Unadorned Frog
Limnodynastes dorsalis	-	Banjo Frog
Pseudophryne guentheri	-	Guenther's Frog
Pseudophryne nichollsi	-	Nicholl's Frog

APPENDIX 2

RESULTS OF SHIRE OF DENMARK COASTAL LAND USE SURVEY

1. Number of People in group (as a percentage)

Number of People	Percent
1	5
2	13
3	12
4	20
5	10
6	9
7	3
8	13
9	5
10	10

2. No of vehicles in each group

Number of Vehicles	Percent
1	38
2	28
3	14
4	4
5	3
6	4
7	7
8	2

3. Town or area people came from (%)

Town/District	Percent
Perth	43.1
Albany	16.2
Denmark	10.2
Katanning District	8.1
Mt Barker District	7.6
Manjimup District	5.6
Bunbury District	2.6
Narrogin	1.5
Kalgoorlie	0.5
Mt Newman	0.5
Interstate	3.1
Overseas	1.0

4. Type of Vehicles (%)

Vehicle	Percent
2 W D	68
4 W D	23
Motorcycle	9

5. Length of stay at particular beaches (%)

Days	Percent
Less than 1/2 day	19.3
1/2 day	9.4
1 day	8.0
2 days	1.2
3 days	5.2
4 days	25.5
5 days	11.3
6 days	1.2
7 days	8.0
8 days	1.2
more than 10 days	8.7

6(a) Place where people are staying (%)

Place	Percent
Denmark	35.6
Peaceful Bay	27.6
Parry's	18.9
Boat Harbour	11.5
Albany	4.6
Mt Barker	0.6
Cranbrook	0.6
Walpole	0.6

(b) Type of accommodation (%)

Accommodation	Percent
Tent	33.0
House	32.3
Caravan park	23.7
Chalet	5.5
Camp	4.7
Motel	0.8

7. Frequency of visits (%)

Category	Percent
Regular visitor	64
1st visit	18
Infrequent	18

8. People's activities (Number of responses)

Activity	Number of Responses
Swimming	159
Beach/Rock Fishing	135
Walking	125
Surfing	70
Boat fishing	68
Diving	46
Picnicking	41
Offroad vehicles	40

Sail/Windsurfing	32
Trail bikes/Buggies	27
Others	22

9. People's favourite beach in the Denmark Shire (%)

Beach	Percent
Peaceful Bay	21.2
Parry Beach	20.8
William Bay	17.4
Ocean Beach	16.1
Boat Harbour	10.2
Conspicuous Cliff Beach	8.9
Walpole/Woonalup	3.4
Point Hillier/Eagles Nest	1.7
Back Beach	0.3

Q.10 COMMENTS ON THE DESIRABLE FUTURE OF BEACHES

	Parry's Beach	Ocean Beach	William Bay	Peaceful Bay	Boat Harbour	Generally
Leave Uncommercialised	7	20	2	4	7	4
Environmental Protection/Control Off road-Vehicles	2	5		4	2	
Caravan Park/ camping facilities	7	7	2	8	2	
Improve toilet facilities	15	6		23	11	1
Caretaker/Manager	1	1		5		
Public telephone/post	3					
Upgrade/improve roads/ 4WD tracks	5	3	2	2	12	4
Boat Ramp		4	1	5		1
Improve Signs	1	3		22		1
Prohibition/limitation of vehicles on the beach		24		1	1	
Remove rubbish	1			7	3	2
New access to the beach		12				
Provide hire facilities		6	1			
Allow dogs in parks and on Beaches		1		1		1

No Dogs	4	1	1

*Numbers represent the number of times each comment was mentioned by respondents.

APPENDIX 3

Seasonal Records of Commercial Fish Species Caught in Wilson Inlet
(from Lenanton 1984)

FISH SPECIES		J	F	M	A	M	J	J	A	S	O	N	D
Yelloweye mullet	Aldrichett forsteri	x	x	x	x	x	x	x	x	x	x	x	x
Sea mullet	Mugil cephalus	x	x	x	x	x	x	x	x	x	x	x	x
King George whiting	Sillago punctata	x	x	x	x	xx=	x	x	x	x	x	x	x
Western sand whiting	S. schomburgkii			x		x	x						x
Cobbler	Cnidoglanis macrocephalus	x	x	x	x	x	x	x	x	x	x	x	x
Ruff	Arripis georgianus	x	x	x	x	x	x	x	xx	x	x	x	x
Australian salmon	A. trutta esper		x		x	x	x	x			x	x	x
Dusky sea garfish	Hyporhamphus melanochir	x	x	x	x	x	x	x	x	x	x	x	x
Snapper	Chrysophrys auratus	x	x	x		x							
Black bream	Acanthopagrus butcheri							x					x
Tarwhine	Rhabodosargus sarba				x	x	x					x	x
Dusky flathead	Platycephalus fuscus	x	x	x	x	x	x	x	x	x	x	x	x
Trevally	Caranx georgianus	x	x	x	x	x	x	x					x
Tailor	Pomatomus saltator	x	x	x	x	x	x	x		x	x	x	x
Long snouted flounder	Ammotretis rostratus	x	x		x	x	x		x	x	x	x	x
Six spined leather jacket	Navadon australis			x	x			x	x		x	x	x
Blue groper	Achoerodus gouldii	x	x										x

APPENDIX 4

Bird observation made during the period 1981-1986 within the Denmark Shire Coastal Reserves Study Area. (Compiled by L M Broadhurst member of ROAU, BOC, ABSA)

Common (vernacular) names used follow those recommended by the Royal Australasian Ornithologists Union, THE EMU, Vol. 77 (1978).

Podiceps cristatus	Great Crested Grebe
Poliocephalus poliocephalus	Hoary-headed Grebe
Tachybaptus novaehollandiae	Australasian Grebe
Pelecanus conspicillatus	Australian Pelican
Anhinga melanogaster	Darter
Phalacrocorax varius	Pied Cormorant
Phalacrocorax melanoleucos	Little Pied Cormorant
Phalacrocorax carbo	Great Cormorant
Phalacrocorax sulcirostris	Little Black Cormorant
Ardea pacifica	Pacific Heron
Ardea novaehollandiae	White-faced Heron
Ardeola ibis	Cattle Egret
Egretta alba	Great Egret
Egretta garzetta	Little Egret
Egretta sacra	Eastern Reef Egret
Nycticorax caledonicus	Rufous Night Heron
Botaurus poiciloptilus	Australian Bittern
Threskiornis aethiopica	Sacred Ibis
Threskiornis spinicollis	Straw-necked Ibis
Platalea flavipes	Yellow-billed Spoonbill
Cygnus atratus	Black Swan
Tadorna tadornoides	Australian Shelduck
Anas superciliosa	Pacific Black Duck
Anas gibberifrons	Grey Teal
Anas castanea	Chestnut Teal
Anas rhynchotis	Australasian Shoveler
Malacorhynchus membranaceus	Pink-eared Duck
Aythya australis	Hardhead
Chenonetta jubata	Maned Duck
Oxyura australis	Blue-billed Duck
Biziura lobata	Musk Duck
Pandion haliaetus	Osprey
Elanus notatus	Black-shouldered Kite
Haliastur sphenurus	Whistling Kite
Accipiter cirrhocephalus	Collared Sparrowhawk
Haliaeetus leucogaster	White-bellied Sea-Eagle
Aquila audax	Wedge-tailed Eagle
Circus aeruginosus	Marsh Harrier
Falco peregrinus	Peregrine Falcon
Falco longipennis	Australian Hobby
Falco berigora	Brown Falcon
Falco cenchroides	Australian Kestrel
Conturnix pectoralis	*Stubble Quail
Conturnix australis	Brown Quail
Turnix varia	Painted Button-quail
Rallus philippensis	*Buff-banded Rail
Porzana fluminea	Australian Crake
Porzana tabuensis	Spotless Crake
Gallinula ventralis	*Black-tailed Native-hen
Gallinula tenebrosa	Dusky Moorhen
Porphyrio porphyrio	Purple Swamphen
Fulica atra	Eurasian Coot
Haematopus ostalegus	Pied Oystercatcher
Haemotopus fuliginosus	Sooty Oystercatcher
Vanellus tricolor	*Banded Lapwing
Pluvialis squatarola	Grey Plover
Erythrogonys cinctus	*Red-kneed Dotterel
Charadrius rubricollis	Hooded Plover
Charadrius leschenaultii	Large Sand Plover
Charadrius ruficapillus	Red-capped Plover
Charadrius melanops	Black-fronted Plover
Himantopus himantopus	Black-winged Stilt
Cladorhyncus leucocephalus	Banded Stilt
Recurvirostra novaehollandiae	Red-necked Avocet
Arenaria interpres	Ruddy Turnstone
Tringa brevipes	Grey-tailed Tattler
Tringa hypoleucos	Common Sandpiper
Tringa nebularia	Greenshank
Tringa stagnatilis	Marsh Sandpiper
Limosa limosa	Black-tailed Godwit
Limosa lapponica	Bar-tailed Godwit
Calidris canutis	Red Knot
Calidris acuminata	Sharp-tailed Sandpiper
Calidris ruficollis	Red-necked Stint

Calidris ferruginea	Curlew Sandpiper
Calidris alba	Sanderling
Larus novaehollandiae	Silver Gull
Larus pacificus	Pacific Gull
Hydroprogne caspia	Caspian Tern
Sterna nereis	Fairy Tern
Sterna bergii	Crested Tern
Phaps chalcoptera	Common Bronzewing
Phaps elegans	Brush Bronzewing
Ocyphaps lophotes	Crested Pigeon
Calyptorhynchus magnificus	Red-tailed Black-Cockatoo
Calyptorhynchus baudinii	Long-billed Black-Cockatoo
Glossopsitta porphyrocephala	Purple-crowned Lorikeet
Purpureicephalus spurius	Red-capped Parrot
Platycercus icterotis	Western Rosella
Barnardius zonarius	Port Lincoln Ringneck
Neophema elegans	Elegant Parrot
Neophema petrophila	Rock Parrot
Cuculus pallidus	Pallid Cuckoo
Cuculus pyrrhophanus	Fan-tailed Cuckoo
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo
Chrysococcyx lucidis	Shining Bronze-Cuckoo
Ninox novaeseelandiae	Southern Boobook
Tyto alba	Barn Owl
Podargus strigoides	Tawny Frogmout
Dacelo novaeguineae	Laughing Kookaburra
Halcyon sancta	Sacred Kingfisher
Merops ornatus	Rainbow Bee-eater
Hirundo neoxena	Welcome Swallow
Cecropis nigricans	Tree Martin
Anthus novaeseelandiae	Richard's Pipit
Motacilla flava	+Yellow Wagtail
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Lalage sueurii	White-winged Triller
Petroica multicolor	Scarlet Robin
Eopsaltria georgiana	White-breasted Robin
Eopsaltria griseogularis	Western Yellow Robin
Falcunculus frontatus	Crested Shrike-tit
Pachycephala pectoralis	Golden Whistler
Colluricincla harmonica	Grey Shrike-thrush
Myiagra inquieta	Restless Flycatcher
Rhipidura fuliginosa	Grey Fantail
Rhipidura leucophrys	Willie Wagtail
Pomatostomus superciliosus	White-browed Babbler
Acrocephalus stentoreus	Clamorous Reed-warbler
Megalurus gramineus	Little Grassbird
Cinclorhamphus mathewsi	Rufous Songlark
Malurus splendens	Splendid Fairy-wren
Malurus elegans	Red-winged Fairy-wren
Stipiturus malachurus	Southern Emu-wren
Sericornis frontalis	White-browed Scrubwren
Gerygone fusca	Western Greygone
Acanthiza apicalis	Inland Thornbill
Acanthiza inornata	Western Thornbill
Daphoenositta chrysoptera	Varied Sittella
Climacteris rufa	Rufous Treecreeper
Anthochaera carunculata	Red Wattlebird
Anthochaera chrysoptera	Little Wattlebird
Lichenostomus virescens	Singing Honeyeater
Melithreptus brevirostris	Brown-headed Honeyeater
Melithreptus lunatus	White-naped Honeyeater
Lichmera indistincta	Brown Honeyeater
Phylidonyris melanops	Tawny-crowned Honeyeater
Phylidonyris novaehollandiae	New Holland Honeyeater
Phylidonyris nigra	White-cheeked Honeyeater
Acanthorhynchus superciliosus	Western Spinebill
Ephthianura albifrons	White-fronted Chat
Dicaeum hirundinaceum	Mistletoebird
Pardalotus punctatus	Spotted Pardalote
Pardalotus striatus	Striated Pardalote
Zosterops lateralis	Silvereye
Emblema oculatum	Red-eared Firetail
Grallina cyanoleuca	Australian Magpie-lark
Artamus cyanopterus	Dusky Woodswallow
Cracticus torquatus	Grey Butcherbird
Gymnorhina tibicen	Australian Magpie
Stepera versicolor	Grey Currawong
Corvus coronoides	Australian Raven

* Additional sightings contributed by Geoff Rogerson

\+ Sighting at Ocean Beach, May 1984

(152 species!)