



Land Conservation Council Victoria

STRADBROKE

REPORT
ON THE
STRADBROKE AREA

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ACKNOWLEDGEMENTS

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Much of the descriptive information came from the Land Conservation Council's report on the South Gippsland Study Area, District 1, published in 1972.

FOREWORD

The State Electricity Commission (SEC) is purchasing about 5,000 ha of land in the Latrobe valley on which to establish the Loy Yang brown coal open cut mine and a 4,000 MW power station. This, the third major generating station in the system, is planned to meet Victoria's base load electricity demands until well into the 1990s.

Of the 5,000 ha about 500 ha are private softwood plantations.

The Government has directed the Land Conservation Council to investigate about six and a half thousand ha of public land in the Rosedale Shire to determine whether suitable land exists for alienation for private forestry purposes. This is in accordance with section 8(1) of the *Land Conservation Act* 1970 which states:

"Where the Governor in Council is of the opinion that an investigation and recommendation of the Council in relation to any particular district or area of Victoria is necessary or expedient he may require the Council to make such investigation and recommendation within such time as is fixed by the Governor in Council."

The softwood industry is an important source of employment in the Latrobe valley and South Gippsland; it supplies the raw materials for chipboard and a wide range of paper products. To function economically, the industry relies on sources of raw materials in close proximity to the processing area. This includes a sustained supply of wood, adequate water and power supplies for processing, and suitable land for future plantations.

The objective of this study is to establish whether any of the land in the area, which has been termed the Stradbroke area, would be suitable for softwood production, and at the same time to identify the other values and capabilities of the land.

This report provides a factual background to the area, on which members of the community may base their submissions to Council. Individuals, and organizations, with an interest in the future use of the Stradbroke area can obtain and study the basic information, which the Council will itself study, and so contribute informed and constructive suggestions.

Submissions are now invited and should reach the Secretary of the Land Conservation Council within 60 days of the publication of this report as notified in the *Victorian Government Gazette*.

The Council will publish its proposed recommendations for the future use of this area after consideration of the basic information and the public's submissions. The public will be invited to again make submissions which will be considered by the Council before its final recommendations are prepared and presented to the Government. Everyone making a contribution will receive a copy of these final recommendations.



S. G. McL. Dimmick
Chairman

PART 1 - INTRODUCTION

AIMS AND METHODS

This report brings together information that is relevant to decisions regarding the future use of the Stradbroke area. It describes the physical and biological nature of the land, examines the possible forms of land-use and assesses the hazards associated with these uses. To place the Stradbroke area in proper perspective, the report also considers the relationships between the area under study and the adjoining public and privately owned land.

The report does not contain recommendations, but aims at providing a factual basis on which land use recommendations can be formulated. It should be regarded as the first stage in a decision-making process for public land which relies heavily on active public involvement for its successful completion.

The report is divided into four main parts and includes explanatory tables and maps. Part I is an introduction, Part II describes the physical and biological nature of the land, Part III deals with the main forms of land-use, and Part IV summarizes the capabilities of the land.

Information for the report has been supplied from government departments, public authorities, and interested individuals, as well as from published reports.

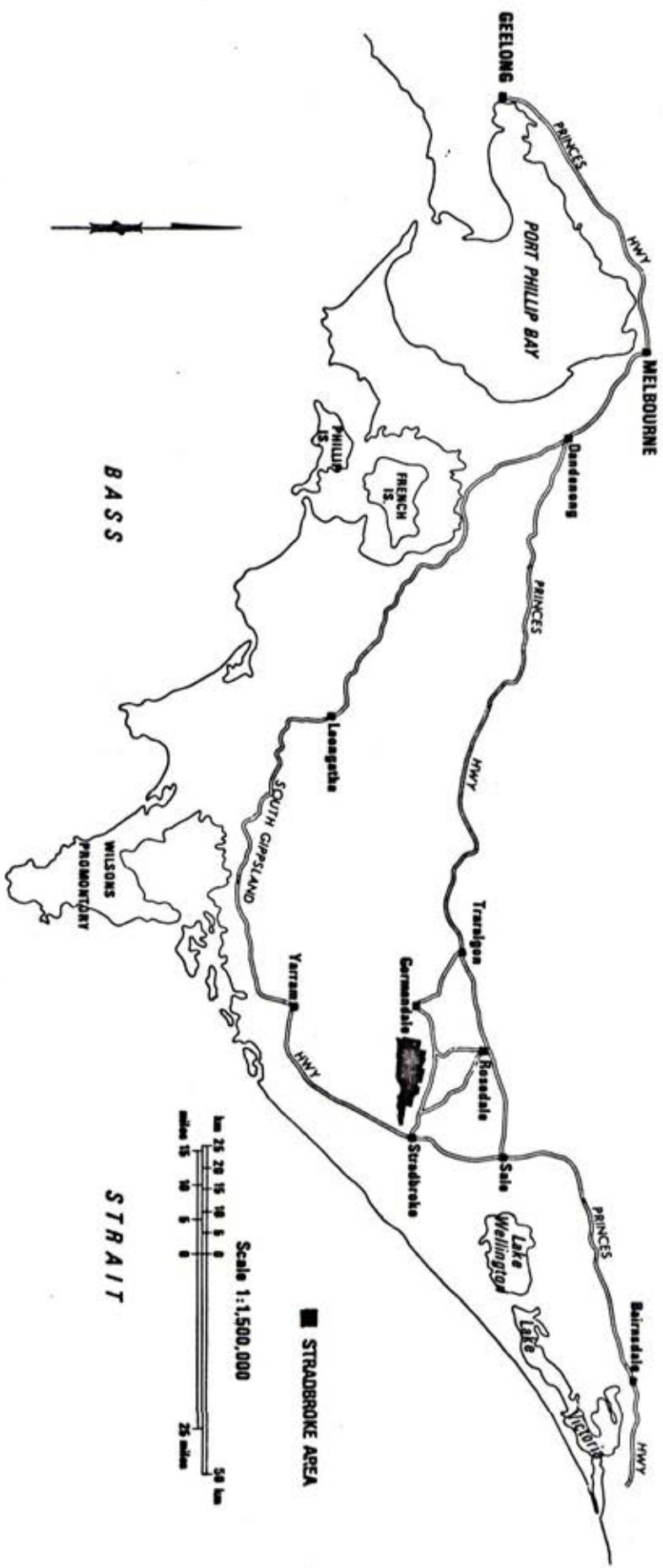
THE STUDY AREA

The Stradbroke area (6,588 ha) is located in the Parishes of Willung and Stradbroke on the southern boundary of the Shire of Rosedale. It is the northern part of a large area of forested public land on the eastern foothills of the Strzelecki ranges. Adjacent population centres are, to the north, Traralgon, Rosedale and Sale, and to the south, Yarram. (Map 1.)

Stradbroke was included in the Land Conservation Council's investigation of the South Gippsland Study Area, District 1. In the final recommendations which were published in 1973, Stradbroke was recommended to be uncommitted land - a flexible use. By order of the Governor in Council, the land-use of this uncommitted area is to be reviewed.

LOCALITY PLAN

LAND CONSERVATION COUNCIL
VICTORIA
STRADBROKE AREA



■ STRADBROKE AREA

Scale 1:1,500,000



STRAIT

BASS

A large block of public land to the north of and similar to the Stradbroke area was recommended as the Holey Plains State Park. These recommendations have since been accepted by Government. Freehold land adjacent to Stradbroke is classified Rural B under the Shire's Planning Scheme, and has been developed for agriculture and private forestry.

References

Parliamentary Public Works Committee. "The Loy Yang Coal Reserves Inquiry." Transcripts of evidence, May 1975 and September 1975.

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Land Conservation Council. "Report on the South Gippsland Study Area, District 1." (Melbourne: 1972)

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PART II - NATURE OF THE LAND

GEOLOGY

The Earth's history of several billion years is divided by geologists into three major time units called eras - the Palaeozoic, Mesozoic, and Cainozoic. The geological history of the Stradbroke region involves events which occurred during the Mesozoic and the more recent Cainozoic eras. The Cretaceous period of the Mesozoic era and the Tertiary period of the Cainozoic era are of particular interest in the region. The Tertiary has been subdivided into 5 epochs - the Paleocene (oldest), Eocene, Oligocene, Miocene, and Pliocene (youngest). Events which occurred in the Quaternary period of the Cainozoic have also affected the region.

Regional Geology

The "bedrock" of the region consists of Mesozoic sandstones and siltstones (the Strzelecki Group of Lower Cretaceous age) which were deposited in a non-marine environment in narrow rift valleys. Uplift and erosion have exposed these sediments, and they now form the Strzelecki Ranges. These rocks do not outcrop in the Stradbroke area, but occur at depths greater than 100 m.

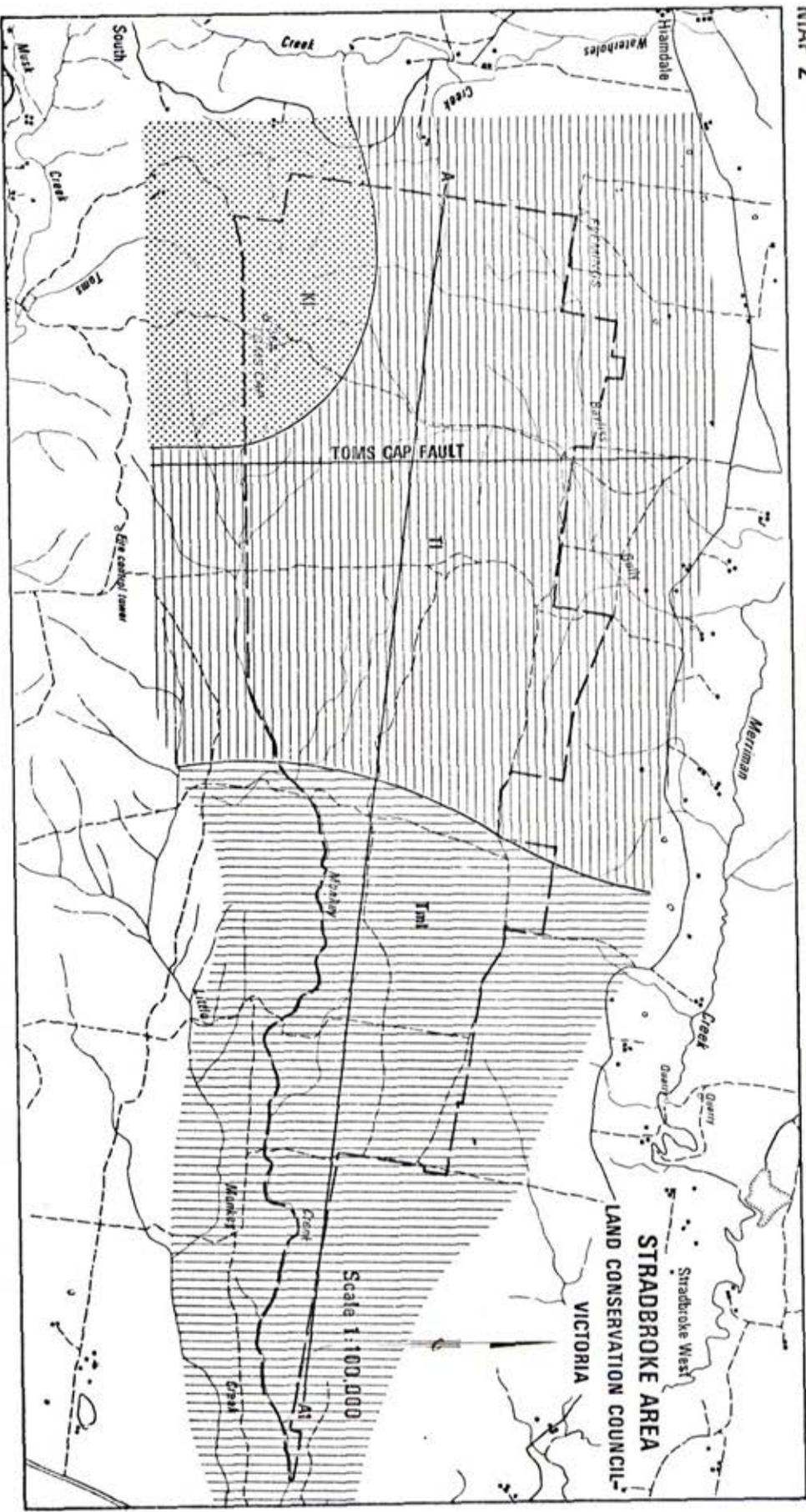
Gippsland Basin

Towards the close of the Mesozoic, crustal downwarping formed a large sedimentary basin - the Gippsland Basin - and a sequence of sedimentary deposits were laid down in a non-marine environment. The first sediments of this sequence are alluvial gravels and sands of Paleocene or Eocene age - the Childers Formation. Volcanic rocks (basalt) - the Thorpdale Volcanics - are associated with this formation. Deposition of sands and clays continued through the early Tertiary and these total some 600 metres in thickness in parts of the Gippsland Basin.

Towards the close of the Eocene, favourable conditions for the growth of vegetation resulted in the widespread accumulation of thick deposits of brown coal. The whole post-Thorpdale Volcanics sequence is referred to as the Latrobe Valley Coal Measures.

Marine transgression

After a period of uplift and erosion, a major marine transgression spread across the Basin during the Oligocene. In some areas sands and clays, which probably represent beach sands, were deposited on the Latrobe Valley



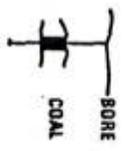
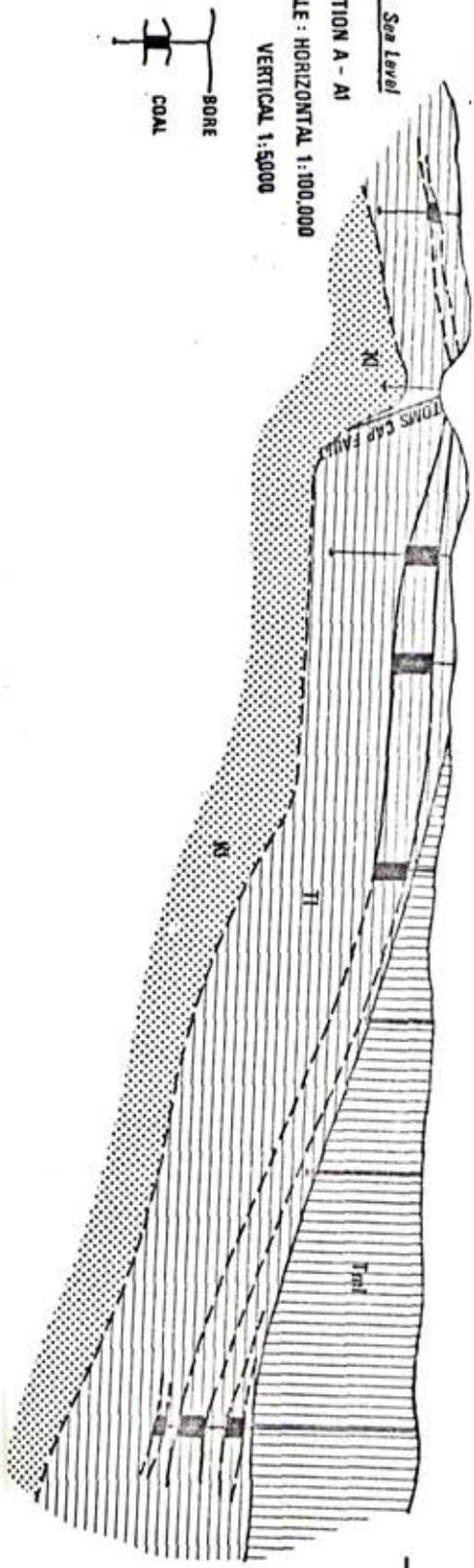
STRADBROKE AREA
LAND CONSERVATION COUNCIL
VICTORIA

Scale 1:100,000

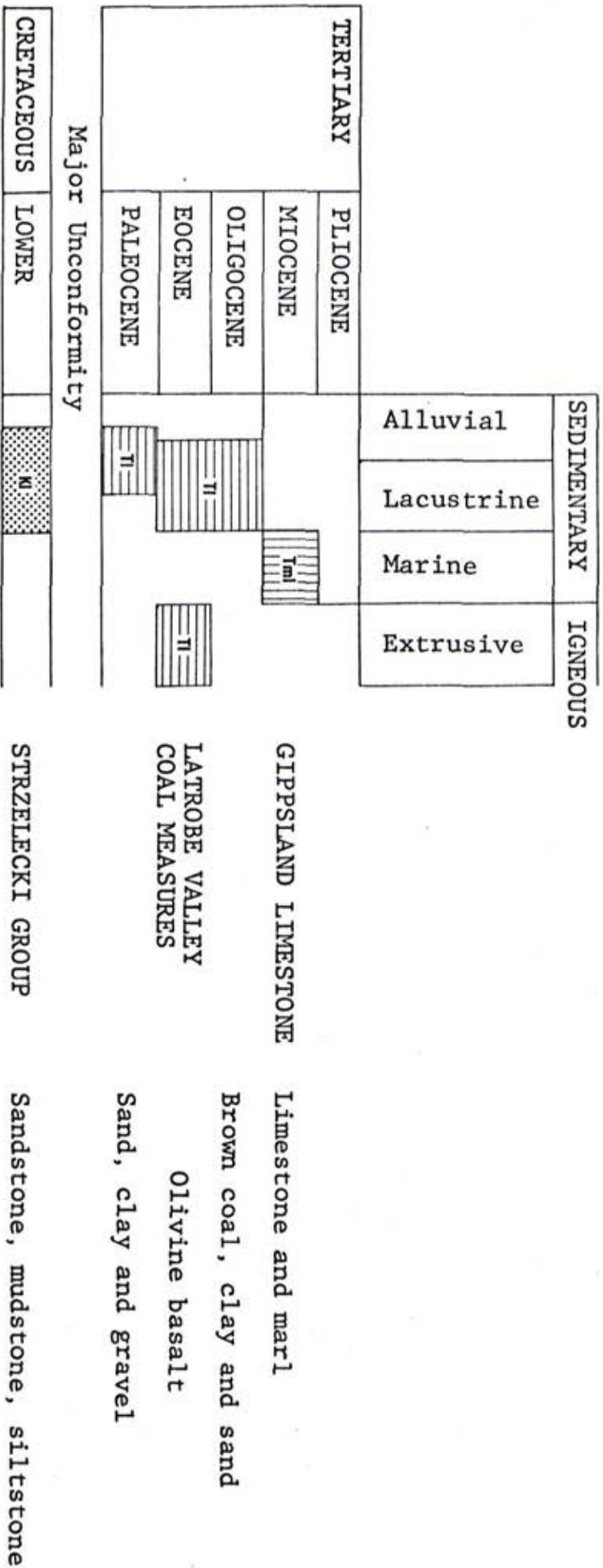
- LEGEND**
-  KI Strzelecki Group
 -  TI Latrobe Valley Coal Measures
 -  Tml Gippsland Limestone

A more detailed legend appears on page 8

SECTION A - A1
SCALE : HORIZONTAL 1:100,000
VERTICAL 1:5,000



Key to Map 8: SUBSURFACE GEOLOGY



Notes:

1. Surface geology is generally Quaternary calcareous and siliceous sands.
2. Geological boundaries are diagrammatic.

Coal Measures. Then a thin sequence of sands and marls - the Lakes Entrance Formation - were deposited, followed by up to 1,000 metres of limestones and marls - the Gippsland Limestone Formation. Local tectonic movements continued during this interval, resulting in the absence of younger marine sediments on some higher areas. Around the edges of the Basin marine sedimentation continued until the Upper Miocene.

Regression of the sea at the close of the Tertiary resulted in a return to deposition under fresh water conditions, and the Boisdale Beds - gravels, sands, and clays - were laid down.

Thin sheets and low dunes of calcareous and siliceous sands were deposited over the area during the Quaternary, and some alluvium was deposited along the streams.

Geology of the Stradbroke Area

The Stradbroke area has few outcrops, as in most places vegetation and thin deposits of sand cover the underlying deposits. The geological sequence has been established by drilling (see Map 2 and key).

The geological succession is one in which the younger marine sediments, the Gippsland Limestone Formation, occur in the eastern part of the block and the sediments near the surface are of increasing geological age towards the west.

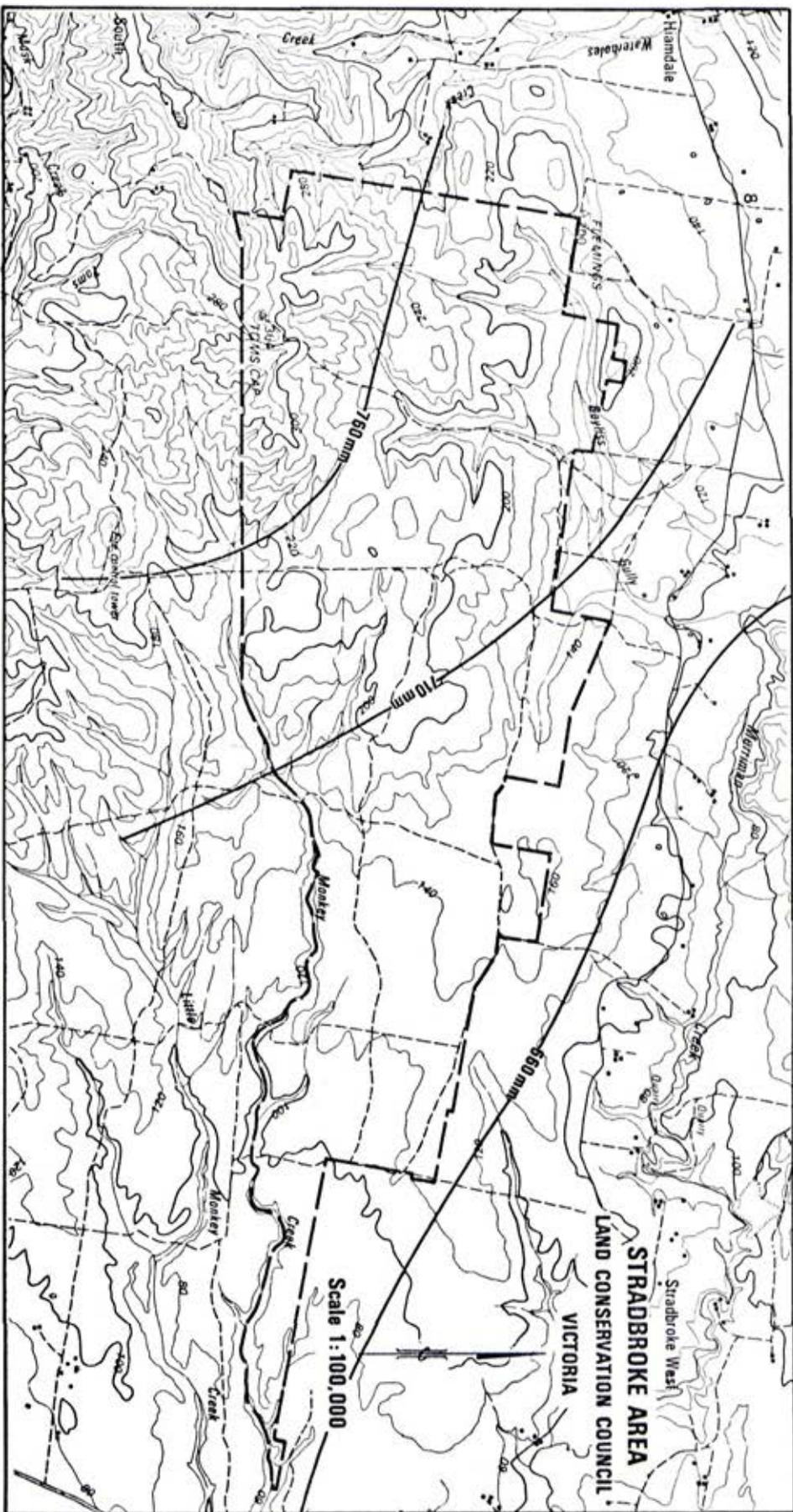
Marine sediments of Lower Miocene age are found at shallow depth in a bore adjacent to Monkey Creek, where they are represented by shelly beach sands.

Further west the partly truncated sequence of the Latrobe Valley Coal Measures occurs at shallow depth; this includes beds of brown coal up to 120 m thick.

East of Toms Cap Road, faulting has uplifted the pre-coal sequence to the surface and most of the coal has been eroded. Outcrops on Toms Cap are from the early Tertiary sediments.

Thus the geological sequence is an expression of the periodic uplift of the Strzelecki Ranges and subsequent periods of erosion. The structural picture is further complicated by the gentle folding of the Tertiary sediments by compression from the south-east. Parts of the area are covered by thin deposits of sands and clays of Quaternary age.

Uplift and rejuvenation of the streams at the close of the Pliocene has resulted in deposition of recent alluvium and the partly dissected nature of the present topography.



Isohyets are estimates based on rainfall records, topography and vegetation, and are approximate only.

LEGEND

RAINFALL



AVERAGE ANNUAL ISOHYET

TOPOGRAPHY

CONTOURS ARE AT 20m INTERVALS

RAINFALL

Rainfall in the Stradbroke area is evenly distributed throughout the year. The average rainfall varies from about 800 mm at the south-west corner to 600 mm at the eastern end. (Map 3.) Effective rainfall, the amount necessary to initiate and maintain growth, occurs with greater than 50 per cent probability for nine months of the year, March to December.

Severe droughts are relatively rare in the region since the probability of receiving at least 100 mm of rainfall in each season is approximately 90 per cent.

WATER RESOURCES

The only named stream, Monkey Creek, flows intermittently and, as a tributary to Merriman Creek, adds an insignificant volume of water. A number of large permanent swamps are found near the headwaters of Monkey Creek.

Surface runoff varies between approximately 190 mm per annum in the west to approximately 65 mm in the east.

Aquifers containing water of low salinity are associated with the extensive beds of coarse sands underlying the coal deposits. In addition, shallow aquifers, probably related to the permanent swamps of the area, occur on top of the coal deposits. These may show artesian pressures, but are limited in extent.

SOILS

The boundaries of individual soil groups have not been mapped; instead a land systems approach has been employed. Field reconnaissance and interpretation of aerial photographs were used to delineate areas where climate, parent material, topography, and original vegetation are relatively uniform. Two land systems predominate - Holey Plains and Stradbroke. (Map 4.)

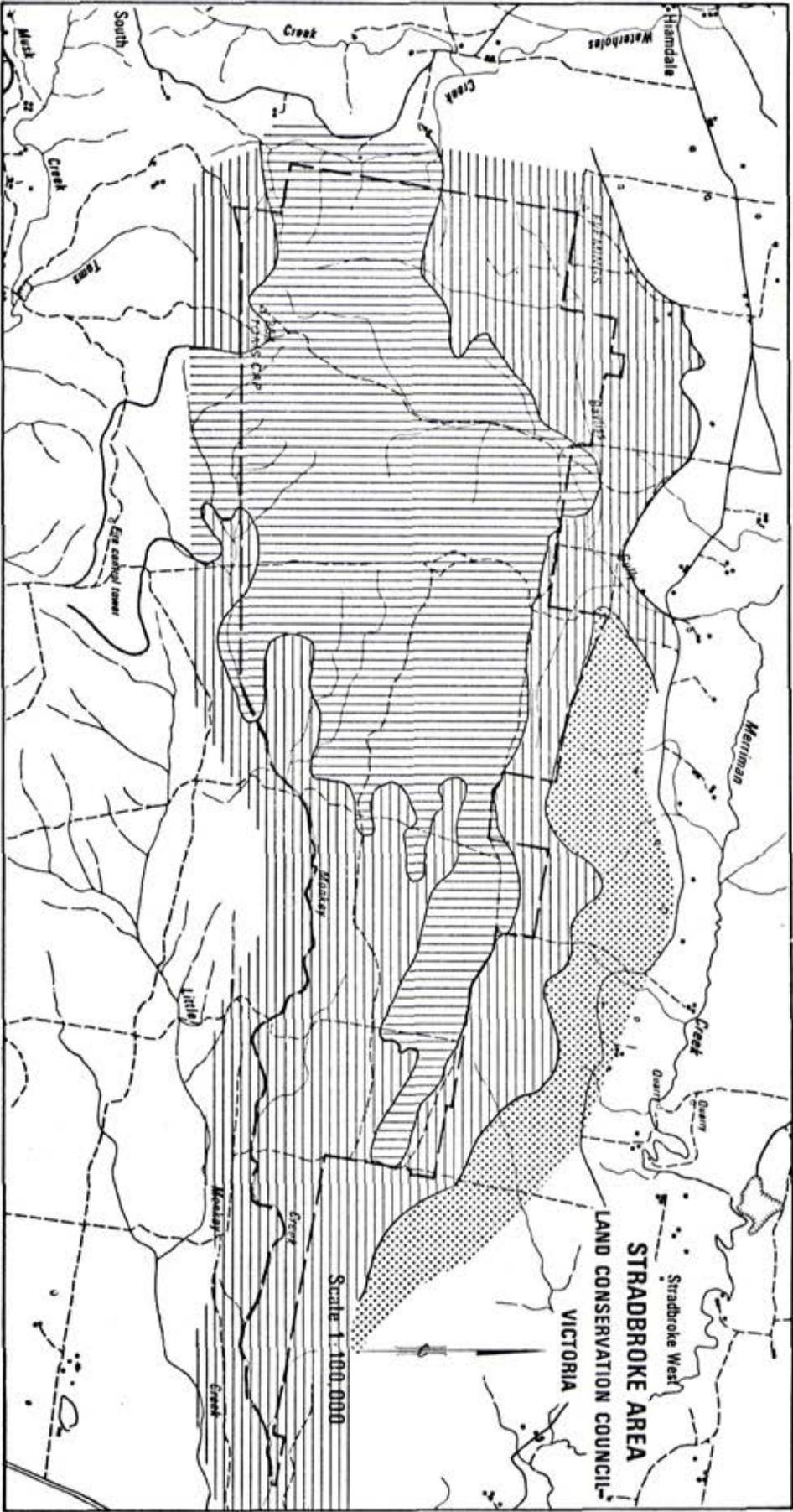
Holey Plains soils occur on the western half of the area on low sandhills with narrow intervening swales, and two groups or subsystems have been distinguished.

1. Yellow-brown sands of uniform texture

These soils occur on the low sandhills. Dark sur-

MAP 4

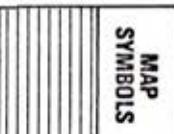
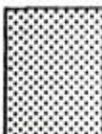
LAND SYSTEMS



STRADBROKE AREA
 LAND CONSERVATION COUNCIL
 VICTORIA

Scale 1:100,000

LEGEND

MAP SYMBOLS	LAND SYSTEM
	STRADBROKE
	HOLLEY PLAINS
	WILLUNG

faces overlie bleached zones which merge with depth into yellow-brown B horizons. Soft sands generally extend below 2 m with free drainage and low water-holding capacity. The A horizons are extremely acid as a result of the leaching of salts and bases. There are small concentrations of nutrients at the surface and in narrow zones of organic matter at the top of B horizons. Fertility is very low.

2. Yellow-brown sands with underlying clay

These occur in the interdune swales and are underlain by clay within 2 m, resulting in higher water-holding capacity, moderate permeability but a tendency to waterlogging. There is a slight increase in nutrient status in the clay subsoil.

Stradbroke soils occupy plateaux with broad depressions and a few narrow sand ridges. This land system predominates in the south-eastern part of the area abutting Monkey Creek. There is limited dissection by Monkey Creek and its tributaries. There are three groups or subsystems.

1. Yellow-brown sands of uniform texture

The deep sands on the ridges are freely drained, with low water-holding capacity, highly acidic reaction, and low fertility. They are similar to Holey Plains sands of uniform texture.

2. Yellow-brown sands with underlying hardpan

These soils occur on the upper slopes of the plateaux. Fertility and water-holding capacity are intermediate between (1) and (3).

3. Brown sands with underlying clay

These soils occur on lower slopes and in broad depressions. They are somewhat more fertile than the Holey Plains soils but can become waterlogged in the depressions.

VEGETATION

The vegetation of the area has been mapped according to a structural classification developed by Specht but modified to suit local conditions. Structural groupings based on the height of the tallest vegetation and the per cent projected crown cover have been determined from aerial photos and field inspections. Within each group-

ing or unit, the presence and abundance of trees, shrubs, and herbs has been recorded. These are useful indications of the suitability of the land for various purposes.

Four structural units have been determined and mapped.

1. Open Forest II 15--28 m, >30% projected crown cover
2. Open Forest I 5--15 m, >30% projected crown cover
3. Woodland 5--15 m, <30% projected crown cover
4. Closed Scrub 2--8 m, 50% projected crown cover

(Closed Scrub includes swamplands and drainage lines.)

These units can be readily recognized in the field. (Table 1, Map 5.)

Open Forest II

Within this unit four vegetation types have been mapped.

- 1a Open forests of yertchuk (*Eucalyptus consideniensis*) grow generally west of Toms Cap Road, on soils of the Holey Plains land system. The shrub layer is sparse; however saw banksia (*Banksia serrata*) often occurs in conjunction with the clay hardpan. Bracken fern (*Pteridium esculentum*) grows profusely in recently burnt areas, whereas in later successional stages, epacrids such as prickly broom heath (*Monotoca scoparia*), pink heath (*Epacris impressa*), and pink beard heath (*Leucopogon ericoides*) predominate. Bushy clubmoss (*Lycopodium deuterodensum*) grows in gullies of the south-west.

Three other open forest types occur in small localized areas on soils that show some textural development. On these more fertile soils the understorey flora is more diverse and includes a larger range of herbaceous, rather than heathland species.

The three types are:

- 1b White stringybark (*E. globoidea*) open forest is associated with yertchuk and but-but (*E. bridgesiana*) on well drained slopes adjacent to Monkey Creek.
- 1c The open forest association of narrow-leaf peppermint (*E. radiata*) and manna gum (*E. viminalis* var. *racemosa*) occurs adjacent to freehold land in the north of the block.
- 1d An isolated area of mixed stringybark open forest occurs in the south-east. Tree species are yertchuk, messmate (*E. obliqua*), and occasionally yellow stringybark (*E. muelleriana*).

Open Forest I

2. Silver-leaf stringybark (*E. cephalocarpa*) grows in pure stands on broad depressions of the Stradbroke land system where clay underlies brown sand soils. The understorey comprises dense rushes and sedges such as slender twine rush (*Leptocarpus tenax*), common scale rush (*Lepyrodia muelleri*), and zig-zag bog rush (*Schoenus brevifolius*). On wetter sites, where the type tends to woodland, scrub sheoak (*Casuarina paludosa*) also occurs.

Woodland

- 3a Woodlands of shining peppermint (*E. nitida*) and saw banksia occupy a large proportion of the area, generally on sand soils with an impervious clay hardpan within 50 cm of the surface. The two species occur in a varying mixture probably related to soils of the dune and swale topography. This topography provides a continuum of plant habitats with wet heath-scrub understorey in low lying areas, dense bracken on dune tops and dryer heaths in between. Typical heathland species are pink heath, prickly broom heath, furze hakea (*Hakea ulcina*), spike wattle (*Acacia oxycedrus*), showy bossiaea (*Bossiaea cinerea*), as well as numerous species of mat rush (*Lomandra* spp.), and small grasstree (*Xanthorrhoea minor*). Species composition and structure is closely related to fire history.
- 3b Yertchuk woodland, a stunted and floristically poorer version of the yertchuk open forest, occurs where an impeding horizon is close to the surface of the soil.

Closed Scrub

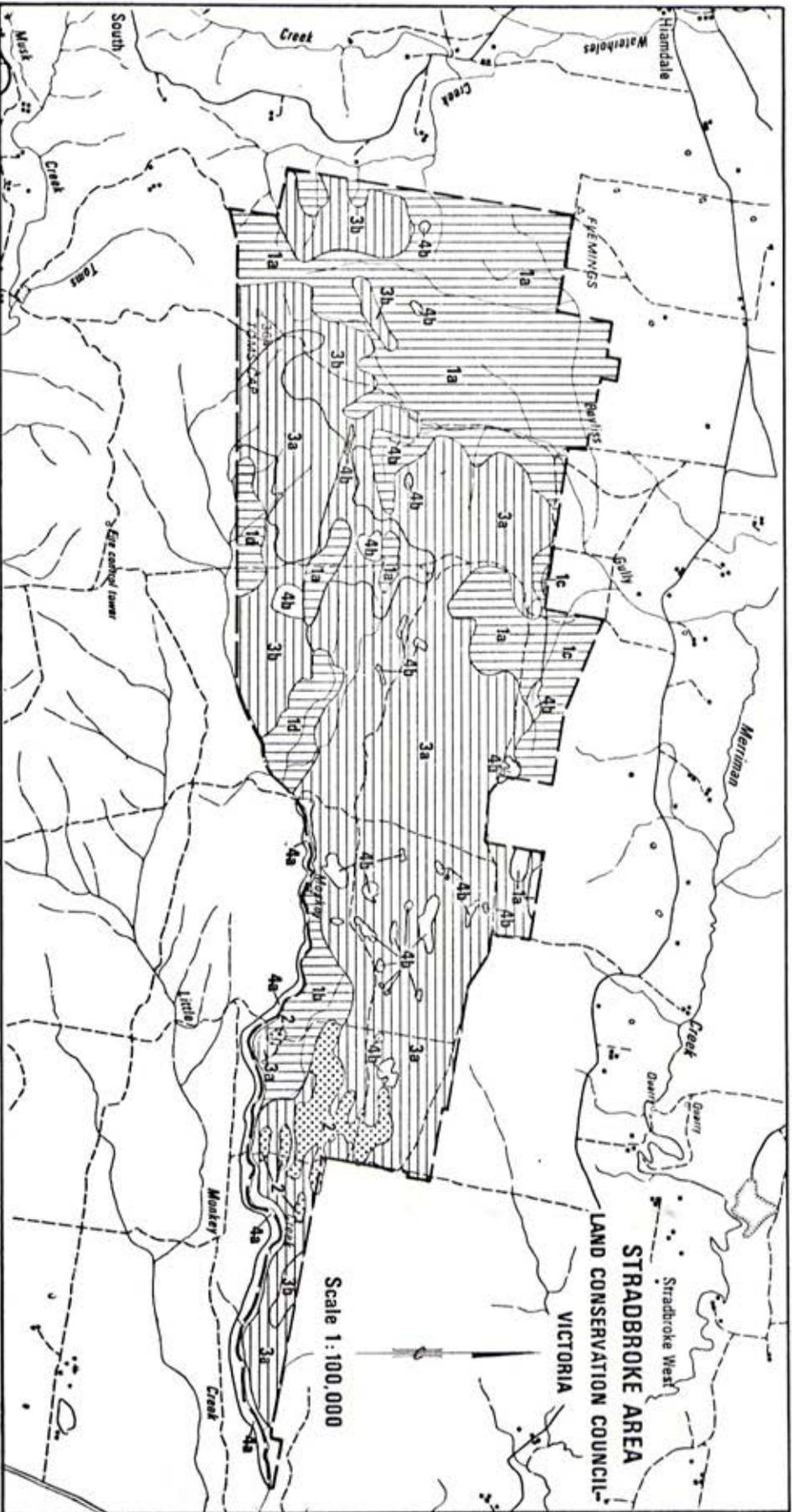
- 4a Monkey Creek is a drainage line up to 200 m wide on which grows vegetation with a distinctive structure and composition. The structure is impenetrable scrub; common plants are scented paperbark (*Melaleuca squarrosa*), woolly tea-tree (*Leptospermum lanigerum*), prickly tea-tree (*Leptospermum juniperinum*), coral fern (*Gleichenia circinnata*), and many sedges, rushes and grasses. Occasional eucalypts include scent-bark (*E. aromaphloia*), swamp gum (*E. ovata*), and silver-leaf stringybark (*E. cephalocarpa*).
- 4b Permanent swamps are fringed with dense scented paperbark and prickly tea-tree with a thick ground mat of sphagnum moss (*Sphagnum subsecundum*). Commonly, the areas of deeper water are congested with sword-sedge (*Lepidosperma longitudinale*), bulrush (*Typha* spp.), and other emergent rushes and reeds. In shallow open water, water milfoil (*Myriophyllum propinquum*) and erect marsh flower (*Villarsia*

Table 1
VEGETATION UNITS

Map symbol	Structural form	Major tree species	Form & species of lower strata
1a	Open Forest II	Yertchuk; sporadic saw banksia	Lack of shrubs, dense ground cover of bracken, showy bossiaea, tussock grass and prickly monotoca
1b		White stringybark; associated yertchuk and but-but	Scattered spreading wattle, prickly tea-tree; herbaceous ground flora
1c		Narrow-leaf peppermint; manna gum	Sparse and prickly heath tea-tree; silver banksia; herbaceous ground flora
1d		Yertchuk--messmate; yellow stringybark	Scattered, silver banksia, prickly tea-tree; understorey of sedges, small grasstree, mat rush
2	Open Forest I	Mealy stringybark	Dense understorey of sedges occasionally scrub sheoak
3a	Woodland	Shining peppermint; saw banksia	Sporadic scrub layer of heath tea-tree; spike wattle; heath and sedge understorey
3b		Yertchuk	Woodland version of 1b although floristically poorer
4a	Closed Scrub	Sporadic swamp gum; scentbark	Impenetrable thickets of scented paper bark, prickly and heath tea-tree; rushes, sedges
4b		Permanently wet swamps are surrounded by scented paperbark, prickly and heath tea-tree, sedges and coral fern. Open water has pithy sword-sedge and bulrush. Shallow water has water milfoil and erect marsh flower. Shallow water has margins of sphagnum moss.	

MAP 5

VEGETATION



STRADBROKE AREA
LAND CONSERVATION COUNCIL
VICTORIA

Scale 1:100,000

LEGEND
VEGETATION UNITS

MAP SYMBOL	STRUCTURAL FORM
1a 1b 1c 1d	OPEN FOREST II
2	OPEN FOREST I
3a 3b	WOODLAND
4a 4b	CLOSED SCRUB

exaltata) grow in profusion.

Appendix 1 is a two-way table listing common species and the units in which they occur. A more detailed plant list may be found in the Council's report of the South Gippsland Area, District 1.

FAUNA

The vertebrate animals require differing habitats and these are related to the major vegetation units. The kinds and numbers of the animals have been recorded by trapping, spotlighting, and observation. Little is known about the insects and non-vertebrate animals of the area.

Mammals

Forest--Woodland

Because of their mobility and broader habitat requirements, a number of mammals are widely distributed in both open forest and woodland. These include the bush rat (*Rattus fuscipes*), brown antechinus (*Antechinus stuartii*), echidna (*Tachyglossus aculeatus*), wombat (*Vombatus ursinus*), and the introduced fox (*Vulpes vulpes*) and rabbit (*Oryctolagus cuniculus*).

The grey kangaroo (*Macropus giganteus*) and black wallaby (*Wallabia bicolor*) occur throughout the area. The red-necked wallaby (*Macropus rufogriseus*) has been sighted sporadically just south of Monkey Creek. The smaller arboreal mammals such as the sugar glider (*Petaurus breviceps*), feathertail glider (*Acrobates pigmaeus*), and the eastern pigmy possum (*Cercartetus nanus*) occur in both woodland and open forest. These species are both insectivorous and nectar feeding. The brush-tail possum (*Trichosurus vulpecula*) is found where suitable nesting sites occur in trees and stumps.

Open Forest II

The koala (*Phascolarctos cinereus*) is found in forests of narrow-leaf peppermint, manna gum and various stringybarks. Where suitable nesting hollows occur, these forests also support the greater glider (*Schoinobates volans*). Neither of these herbivores occurs in yertchuk forests.

Open Forest I

Dense sedgelands occurring beneath silver-leaf stringybark forests support populations of swamp rat (*Rattus lutreolus*) and bush rat.

Woodland

The New Holland mouse (*Pseudomys novaehollandiae*) was trapped in wet heathland communities growing in some of the inter-dune swales. In these sites, shining peppermint woodland gives way to stunted scent-bark with an understorey of spike wattle, prickly and heath tea-tree, and a variety of heaths belonging to the family Epacridaceae. Until 1967 the New Holland mouse was thought to be extinct, however the animal is apparently widespread and, in Victoria, occurs in coastal scrub where fairly specific, fire induced vegetation communities exist.

Closed Scrub

Dense thickets of prickly tea-tree and scented paper-bark provide suitable nest sites for the ringtail possum (*Pseudocheirus peregrinus*). The swamp rat, bush rat, introduced black rat (*Rattus rattus*), and house mouse (*Mus musculus*), have been trapped in the sedge understorey and the long-nosed bandicoot (*Perameles nasuta*) was seen in thickets of burgan (*Leptospermum phyllicoides*).

The lesser long-eared bat (*Nyctophilus geoffroyi*) and Gould's wattled bat (*Chalinolobus gouldii*) were observed in the area.

Birds

1. Forest--Woodland habitats

The structure and composition of the ground vegetation varies depending on topography and fire history. The following birds are commonly associated with this habitat - red-browed finch, beautiful firetail, common bronzewing, white-throated nightjar, brown quail, Australian ground-thrush, spotted quail-thrush, and buff-rumped thornbill.

In the shrub layer occur silver-eye, southern emu-wren, grey shrike-thrush, rufous whistler, spotted pardalote, yellow robin, and white-throated tree-creeper.

The flowers in the outer foliage of eucalypts and banksias are visited by mostly nomadic honeyeaters such as red wattle bird, yellow-faced honeyeater, white-eared honeyeater, eastern spinebill, crimson rosella, gang-gang, and yellow-tailed black cockatoo.

Emus are occasionally seen throughout the area and in adjacent cleared land.

2. Swamp habitats

There are about fifteen swamps in the area, but while their total area is small, their considerable margins are important to such species as magpie lark, welcome swallow, fairy martin, spur-winged plover, and swamp harrier. The swamps themselves do not support much birdlife, however white-

faced heron, white-necked heron, eastern swamphen, reed warbler, black duck, grey teal, black and pied cormorant and the yellow-billed spoonbill have been observed.

Reptiles and Amphibians

A total of 16 reptiles and 7 amphibians were recently recorded in the area. The survey extended the known range of the yellow spotted toadlet (*Uperoleia marmorata*), Coventry's skink (*Leiolopisma coventryi*), and the small-eyed snake (*Cryptophis nigrescens*).

The tree dragon (*Amphibolurus muricatus*) is a heliothermic or basking reptile commonly found in heathy woodland sites. An example of the thigmothermic or non-basking reptiles is the mourning skink (*Ergenia luctuosa*) which burrows under litter in swampy areas.

The swamplands of the Stradbroke area provide habitat for Haswell's frog (*Geocrinia haswelli*) commonly seen floating in the larger swamps, and the bullfrog (*Limnodynastes dumerilii*).

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PART III - LAND USE

NATURE CONSERVATION

This chapter discusses those aspects concerned with the native species, communities and landscapes of the area which are commonly grouped under the collective heading "nature conservation".

In the past, our society has grown, and the economic welfare of the people improved through mining, farming, timber production, and industrial development. These industries have been given prime importance, and the use of natural resources has often been decided in relation to short-term advantage when conflict arose. The deleterious effects that this type of development can have are now recognized and there is a popular demand for attention to the total long-term needs of the community. These include the preservation and conservation of plants and animals.

A number of types of land are required to satisfy the needs of nature conservation, and each requires different levels of management and manipulation. Their "naturalness" can vary considerably, being greatest in large areas used for reference and least in those intensively managed to preserve some endangered species or the remnants of a former landscape, and in areas that people are encouraged to visit for education and recreation.

The nature conservation values of the Stradbroke area are generally similar to the Holey Plains State Park to the north, and the Lakes Coastal Reserve to the east. However, the large permanent swamps, the proliferation of smaller swamps and the silver-leaf stringybark forests are not well represented in those areas.

Nature conservation aspects of Stradbroke are considered in three north-south segments.

1. From the western boundary to Toms Cap Road, the vegetation structure is yertchuk open forest and woodland. These vegetation units are structurally less diverse than the woodlands further east, and habitat diversity is lower. There are no permanent swamps, waterways, or riparian vegetation and considerable areas exist without a marked change in flora. To the south, around Toms Cap, where topography is more rugged and rainfall higher, floristic diversity increases and plants such as the primitive bushy club moss (*Lycopodium deuterodensum*) may be found.

2. The central portion, Toms Cap Road to Harrap Road has a high capability for nature conservation. It contains a range of relatively undisturbed vegetation types and animal habitats. The shining peppermint--saw banksia woodland is interspersed with pockets of peppermint--manna gum, stringybark and yertchuk forests. Two large swamps along the Old Rosedale Road add further biological diversity. In the dune swales, the presence of underlying clay results in the development of many small swamp communities. These vary in floristic composition depending on their size and the permanence of water. When dry, they provide the cover and a range of plant species which are extensively browsed by kangaroos and wallabies. The pockets of open forest are inhabited by arboreal marsupials such as the greater glider and koala.

3. East of Harrap Road are woodlands similarly interspersed with pockets of open forest, which have a high capability for nature conservation. A large number of permanent and semi-permanent swamps occupy the swales while the major drainage line, Monkey Creek, with its dense vegetation provides habitats for small ground mammals. Silver-leaf stringybark, a particularly attractive species, grows in pure stands in areas that are low lying but not permanently wet. Macropod and small mammal use of the sedge understorey is high. The New Holland mouse occurs in certain restricted areas; these are low lying heathlands where the structure and floristics of the habitat are related to fire history. This native mouse is no longer considered rare, however its biology and dependence on fire disclimaxes is of much interest to scientists.

The shining peppermint woodlands produce high spring and summer flows of nectar - in particular the saw banksia, spike acacia and the woody heathland plants - which are utilized by the nomadic honeyeaters. The permanent swamps throughout the area do not appear to be heavily used by waterbirds, except in times of drought, when swamps in neighbouring areas have dried up.

Landscape values are not particularly high, due to the low relief, however views outside the area towards Corner Inlet may be obtained from Toms Cap.

RECREATION

The Stradbroke Area offers a range of passive recreation opportunities similar to those available in the Holey Plains State Park to the north. The existing level of recreational use in this park is low but it has the capability to absorb far greater numbers of users.

Pleasure driving in the Stradbroke area is uncommon, reflecting a lack of signposted access, and other recreation attractions. There are no formal facilities for picnicking and few sites lend themselves to development as picnic grounds. The drainage pattern, swamps and scrubby understorey make the area unsuitable for cross-country walking or orienteering; however, the sandy tracks provide good foot access to many areas. There is evidence of some duck hunting although the open water swamps are not a favoured bird habitat. Camping and fishing are not undertaken in the area, however the colourful wildflower displays and an interesting heathland and swampland flora are appreciated by nature lovers prepared to accept the lack of facilities. The track network is used for occasional car rallies.

An attraction of some historical significance is the memorial cairn to Angus McMillan at Toms Cap. This elevated area provides restricted views of the surrounding forest land and some distant landscapes of coastline and rural country to the south. The memorial is difficult to reach by conventional vehicles and although occasionally visited by local historical societies, other visitors are few.

HARDWOOD PRODUCTION

The area has a generally low capability for hardwood production, being mainly woodland forests that rarely exceed 20 m in height. The commonly occurring species yertchuk, shining peppermint, and but-but are, in the main, non-commercial species in this general locality.

In the last 15 years some forest produce has been cut from the white stringybark and narrow leaf peppermint forests. Several thousand fence posts including some taken from yertchuk, a limited number of transmission poles, mainly from white stringybark, and about 1,500 cubic metres of sawlogs were cut on a single tree selection basis. In addition, ti-tree stakes have been obtained to satisfy a minor domestic market.

The potential productivity of the stringybark forest for sawlogs is low. Scattered pockets of regeneration, resulting mainly from fire, are evident but their growth potential would not exceed 3 m³ per ha per annum.

SOFTWOOD PRODUCTION

Regional perspective

Both State and private forestry organizations have plantations in the region, covering areas in the Latrobe Valley and the Strzelecki ranges. Forests Commission plantations are confined to the higher rainfall areas, particularly in the eastern Strzeleckis where scrub covered public land and purchased marginal farmland is being converted to softwood and hardwood plantations.

In the Commission's Latrobe development zone, 8,700 ha has been planted to softwoods and the current planting rate is 700 ha per annum. The resource is managed to provide a supply of sawlogs, pulpwood, and round timbers such as posts and poles.

The largest private organization, A.P.M. Forests Pty. Ltd., is a subsidiary of Australian Paper Manufacturers Limited. This company, which has plantations on its own land and on land leased from the Crown is engaged in large-scale industrial forestry operations producing pulpwood for paper manufacture and sawlogs for milling. It supplies pulpwood to the company mill at Maryvale and to a chip-board factory at Rosedale, owned jointly by A.P.M. Ltd. and C.S.R. Ltd.

To facilitate long-term planning in the industry, the Forests Commission has entered into an agreement with A.P.M. Ltd. to supply softwood from State forests. The agreement, ratified by the *Forests (Wood Pulp Agreements) Act 1974*, provides for the supply of pulpwood in specified annual quantities until the year 2004. A.P.M. Forests Pty. Ltd. also cuts pulpwood from its own forests and intends purchasing land and establishing further softwood plantations.

Requirements for softwood growth

The following requirements define a broad ecological range in which radiata pine may be grown and harvested economically. These criteria apply to plantations managed by the Forests Commission on a 35 to 40 year rotation.

- * a minimum annual rainfall of 760 mm
- * an acid soil of at least moderate fertility
- * good drainage and adequate water holding capacity
- * an optimum of 0.75 m and a minimum of 0.5 m of topsoil over any root or water-impeding layer
- * freedom from heavy snow falls

In these terms, the Stradbroke area has a capability for softwoods well below average due to soils of low fertility

- the presence of an impeding horizon in some areas and a rainfall pattern ranging from 800 mm in the south-west to 650 mm in the east.

Site preparation, fertilizer application and crop tending can compensate for deficiencies in these requirements, and in particular circumstances may be economically sound.

Site quality

The capability of land for growing radiata pine can be expressed in terms of site quality (S.Q.), a measure of the total volume of timber a site is capable of producing in a given time. Site quality can be estimated from the height of a sample of pines at age 20 years, but it is impossible to classify any site accurately until a stand of pines has actually grown on it. However, the form and composition of the native vegetation and soils together with topographic and climatic factors are useful indicators of the suitability of a site for radiata pine, particularly when compared with similar sites elsewhere on which pine has been established. Table 2 broadly categorizes these factors and assigns site quality ratings. These ratings may be improved by comprehensive site preparation procedures which are discussed later. Seven site qualities are generally recognized. Site quality I has the highest capability for timber production and S.Q. VII has the lowest capability.

A number of economic factors determine whether it is feasible to grow pines on areas of low site quality. These include the size of the plantations and their proximity to mills and markets, ease of using mechanical establishment and harvesting methods, age of the plantations at harvesting, as well as consumer demand for the finished product.

While the Forests Commission tends to favour areas with a higher inherent site quality, private forestry organizations have shown that it is possible to produce an economic crop of softwoods on areas of lower site quality. Economies are achieved by establishing plantations in large compact blocks as close as possible to the mill. Haulage costs, currently 5 cents per cubic metre per kilometre are an important factor in determining the economic distance from mill to plantation.

Improved site quality

Site quality may be improved by site preparation, fertilizer application, weed control and silvicultural techniques.

Both State and private forestry organizations use plantation establishment practices which involve clearing the

Table 2: CAPABILITY FOR RADATA PINE

Vegetation units	Soils and topography	Productivity			
		No treatment		Treatment*	
		Site Quality	MAI ⁺	Site Quality	MAI ⁺
1c: manna gum-- narrow-leaf pepp- ermint Open Forest	Gently sloping sites with duplex soils with moderate nutrient status	IV - V	18 - 22	III	25
1b, 1d: mixed stringybark Open Forest	Flat to gently sloping ridge tops with shallow duplex soils	V - VI	13 - 17	IV - V	18 - 22
1a: yertchuk Open Forest	On slightly elevated sites with some surface drainage. Soils are leached sands of low nutrient status	VII	8	VI	12
3a: shining pepp- ermint--saw banksia Woodland	On poorly drained sites with gentle slopes. Leached sandy soils with a hardpan generally within 50 cm of the surface	Not suitable	-	VI - VII	8 - 12
2: mealy stringy- bark Open Forest	Low lying, poorly drained leached sands with numerous per- manent and semi-permanent swamps	Not suitable	-	Not suitable	-

* Includes ploughing, ridging, fertilizer application and weed control.

+ MAI (mean annual increment) m³/ha/year = total volume production to a 10 cm small-end diameter underbark, divided by the number of years in the rotation.

existing vegetation, heaping, burning, ploughing, fertilizing, and weed control. Cost-benefit analyses generally determine the techniques to be used in a given situation.

On leached sand soils, in the Stradbroke region, the establishment procedures include double ploughing, or ploughing followed by ridging plus the application of 120 g of superphosphate per tree at planting. Later applications of superphosphate at age 5 years produce a significant growth response.

Moisture stress, resulting in death or dead growing tips can be reduced by thinning at regular intervals to maintain the basal area of the stand within the range of 13.8 to 18.4 square metres per hectare.

Site quality distribution in the Stradbroke area

Site quality IV--V

Small areas of medium site quality occur within the Stradbroke area, generally on duplex soils which have a moderate nutrient status and lack root impeding horizons. These sites at present carry open forests of narrow-leaf peppermint, manna gum, yellow stringybark, white stringybark, and messmate. Under softwood production, they are capable of being raised, by suitable preparation techniques, to S.Q. III--IV.

Site quality V--VI and VII

These sites are generally yertchuk open forests and shining peppermint - saw banksia woodland. Soils are leached sands of low fertility belonging to both the Holey Plains and Stradbroke land systems. Though chemical analyses indicate severe deficiencies of phosphorus, potassium and nitrogen, additions of phosphorus alone are sufficient to promote increased growth rates. Physical properties such as low moisture storage capacity and the presence of an impeding horizon are important limitations to plant growth.

Leached sands have a low moisture storage capacity. At field capacity, the soil contains about 13% water, and at wilting point 3%.

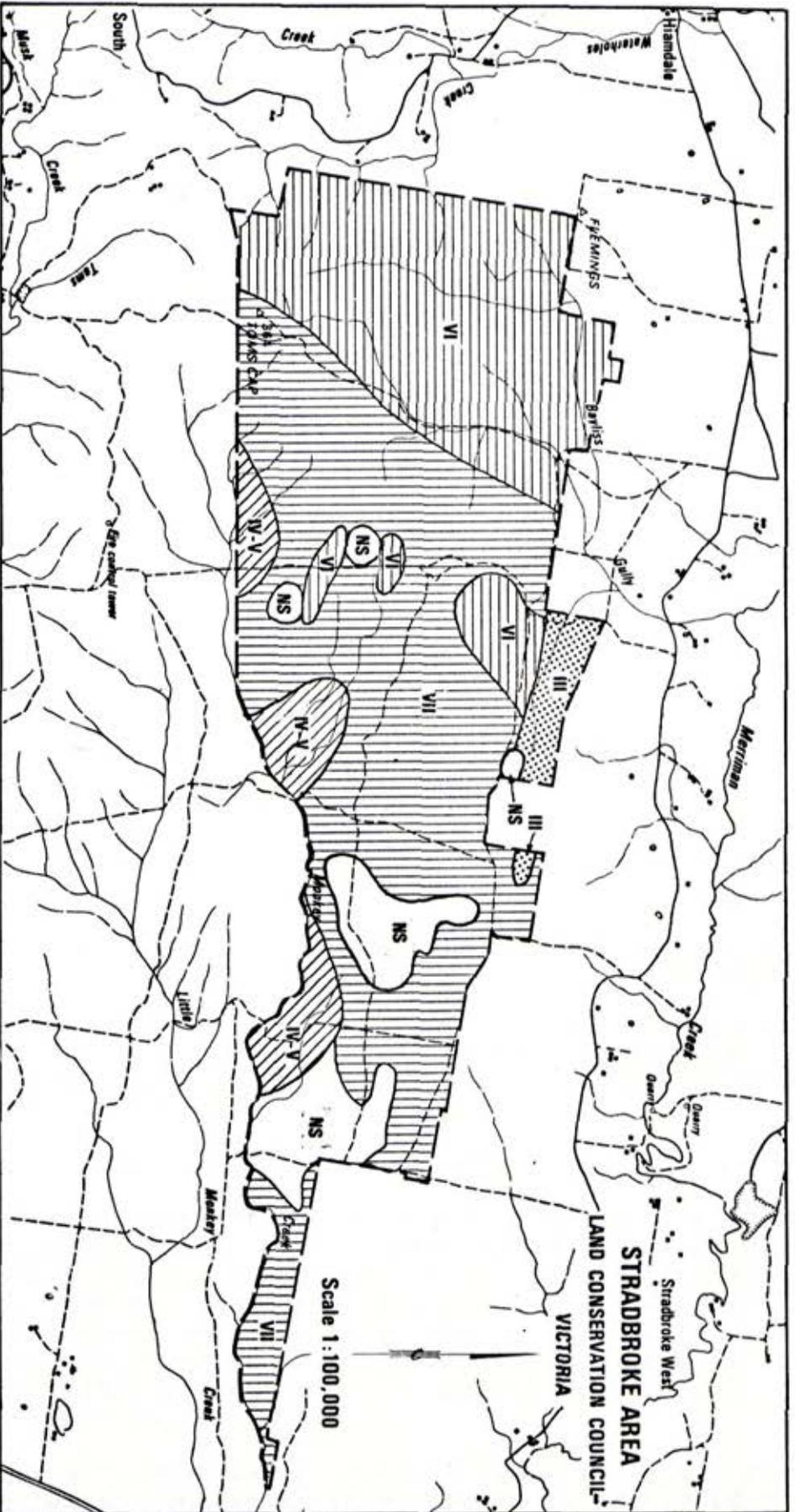
Profiles often contain a clay hardpan and, depending on depth from the surface, hardness and thickness, may impede the downward movement of water or hinder root penetration.

Woodlands of shining peppermint and saw banksia have a hardpan within 50 cm of the surface of the soil. For softwood production they can be raised to S.Q. VII. Impeding hardpans do not occur extensively beneath yertchuk open forests and these can be raised to S.Q. VI.

Silver-leaf stringybark open forests are found in low

MAP 6

IMPROVED SITE QUALITY



LEGEND

	SQ III
	SQ IV-V
	SQ VI
	SQ VII
	Non Stradbroke NS

lying poorly drained sites which are considered unsuitable for the establishment of softwood plantations.

Map 6 shows the distribution of (improved) site qualities.

Species other than radiata pine

Experience has shown that stands of radiata pine growing on sands where an impeding horizon is close to the surface are inclined to a "spindle" condition (sparse narrow crowns) in spite of reapplication of fertilizer. Maritime pine *Pinus pinaster* appears healthier on these poorer sites, and can produce a useful crop with less intensive silviculture.

ECONOMIC GEOLOGY

Brown Coal

The uplifted and partially eroded lower Tertiary sequence, containing thick beds of brown coal, occupies the central portion of the Stradbroke area. The deposits - the Stradbroke coalfield - are located in the Parishes of Stradbroke, Mullungdung (to the south of the area), and partly in the Parish of Willung (see Map 7).

The thickest coal seam intersected in drilling operations occurs within the Stradbroke area, below the Monkey Creek flats - 120 metres of coal at a depth of 7 metres. The coal has a lower moisture content than the Morwell deposits and thus a higher calorific value. It is stratigraphically equivalent to the Traralgon seam and is potentially easier to mine.

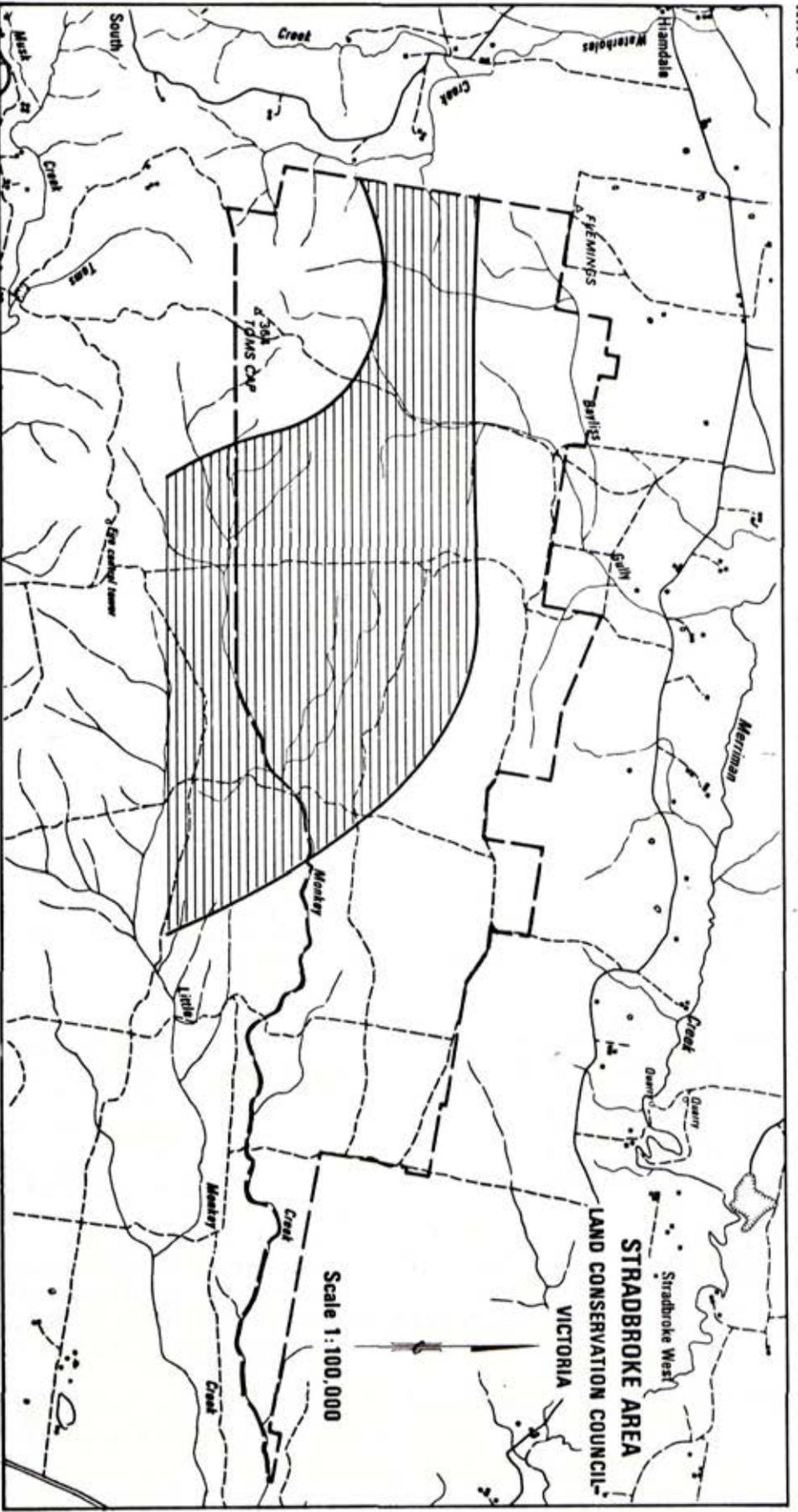
Economic brown coal deposits at Stradbroke

Recent assessments of the deposits of brown coal in Central Gippsland indicate that at least 30,000 megatonnes (Mt) are potentially economic out of deposits totalling some 114,000 Mt proven and inferred. These deposits include the Stradbroke coalfield which is known to contain at least 500 Mt of brown coal that could be readily recovered. This is equivalent to all the brown coal recovered to date in Victoria.

Deposits of economically winnable brown coal, and areas designated as containing them, are to be protected to maintain their potential for extraction in accordance with the Government's Statement of Planning Policy No. 9. An inter-departmental committee is currently examining the extent of the area for designation and the general areas of interest at Stradbroke have been indicated by hatching on Map 7.

MAP 7

STRADBROKE COALFIELD



LEGEND

 STRADBROKE COALFIELD

Brown coal outlook

The conservation and utilization of brown coal is essential to the State's present and future energy needs, particularly electrical energy, and as a feedstock for other special industries including the production of briquettes and char. At present, some 85% of the State's electrical energy is derived from brown coal, while in the future brown coal may become a major source of hydrocarbons for conversion into oil.

The possibility that the Stradbroke coalfield could be required for future development places an important constraint on the interim use of the overlying land.

Limestone

Areas of thick limestone deposits occur at shallow depth in the eastern part of the area. However, since there are already established limestone quarries to the north, along Merriman Creek, there is unlikely to be a great demand for additional development in the near future.

AGRICULTURE

Agricultural use of the region is confined to the better class soils located along Merriman Creek and districts east of the area. Pastures on this land type are reasonably productive and support dairying, beef and sheep industries.

Most of the public land in the Stradbroke area consists of infertile leached sands. Any agricultural development would require specialised treatment, including the use of lime, and heavy applications of superphosphate, potash and trace elements. The likely carrying capacity of any pastures developed would be low, despite the reasonably high rainfall.

Pasture maintenance on such soils would be costly, and in addition to the regular use of superphosphate, would require annual applications of potash and regular applications of trace elements.

Beekeeping sites are generally situated on private property adjacent to the Stradbroke area.

WATER PRODUCTION

Towards the eastern part of the block, aquifers associated with the sand beds of the Latrobe Valley Coal Measures

occur at about 900 m. These artesian aquifers could produce substantial quantities of low salinity water, (total dissolved solids less than 5,000 parts per million), for domestic and agricultural use. This resource is largely untapped because of the high drilling costs associated with its depth.

The catchment within the Stradbroke area, which flows into Monkey Creek and Merriman Creek, is unlikely to produce significant volumes of water. Most of the excess rainfall percolates to the ground water and associated swamps.

OTHER USES

Toms Cap (410 m) is a small knob which lies at the end of a spur on the eastern edge of the Strzelecki Ranges. From this point in 1841 the explorer Angus McMillan sighted the coastline of Corner Inlet. A cairn to commemorate the occasion has been erected on this point, and the site remains popular with local historical societies.

Toms Cap is also a trigonometrical station and was used in the original surveys of Gippsland.

The Australian Army makes use of the Stradbroke area for field training purposes for approximately two weeks of the year. Conditions relating to the use of the area for this period are laid down by the responsible managing authorities.

The proposed route for a pipeline to carry saline waste water from the Latrobe Valley to Bass Strait follows existing road easements along the north of the Stradbroke area.

HAZARDS

Fire

The stunted yertchuk and shining peppermint forests growing mainly on leached sands overtop a layer of scrub species including bracken, saw banksia, heaths and acacias. This vegetation is highly inflammable, particularly if forest fuels are allowed to accumulate.

The scrubby nature of the woodlands and forests, together with adjoining marginally developed farmlands and private softwood plantations, create a high fire hazard.

The many wildfires resulting from natural and human agencies have been a significant factor in the evolution of

native plant communities. The height and density of bracken together with the distribution of heath communities is also related to fire history.

Successful control of wildfire depends on effective initial attack which involves early detection, good access and rapid mobilisation of men and equipment. The area is served by two fire towers and a network of access roads and tracks that subdivide the forest into compact blocks. Men and fire-fighting equipment are located at strategic centres around the area and combine State, private forestry and volunteer resources.

Fuel reduction burning is carried out in the area from time to time under prescribed conditions that result in low intensity fires. However, the nature of the forest cover is such that it is difficult to avoid some damage to the mature forest. This burning reduces the threat wildfire poses to surrounding life and property.

Soil deterioration

The incidence of erosion is confined to sheeting and gully-ing along tracks inadequately designed for water disposal, and to slumping of occasional bare road batters.

In general the water erosion hazard following disturbance of vegetation or soils is low because of the ready entry of water into the sandy soils, gentle topography and ease of re-vegetation. The highest hazard is that of gully-ing on the lower plateau slopes of the Stradbroke land system where impeding clays are relatively close to the surface.

The wind erosion hazard is generally low to moderate but is high on the slopes of sand dunes following clearing of native vegetation. The problem can be controlled by retention of trash or by rapid re-establishment of cover.

The physical condition of the porous sandy surface is not seriously affected by cultivation or other disturbance. There is, however, a severe hazard of intensifying an inherently low fertility by leaching should the native vegetation be replaced by pastures or by long periods of fallow. Such practices would also accentuate waterlogging in the lower sites, and flooding downstream.

The loss of nutrients associated with the harvesting of a first pine crop could be expected to have a bearing on subsequent pine crops. Studies on leached sands in south-west Victoria have shown that with certain cultural practices and fertilizer regimes, productivity on these sites can be at least maintained.

Eucalypt crown die-back

Eucalypts form the dominant tree cover on the area. Areas of crown die-back occur mainly along the southern boundary and in the north-west sector of the Stradbroke area. Die-back is indicated by one or more of the following symptoms:

reduction in leaf density, drooping brown tinted foliage, die-back of fine twigs and branches of the primary crown, and development then deterioration of epicormic shoots.

Eucalypt die-back can be caused by fungi and/or insects attacking the tree roots, butt, trunk and/or leaves. It can also be caused by adverse environmental conditions such as drought, reduced soil fertility, flood and fire.

The cinnamon fungus, *Phytophthora cinnamomi* (P.c.), has been isolated from forest soils of the Mullungdung forest, south of Monkey Creek. The symptoms of crown die-back and death of trees in sections of the Stradbroke area are consistent with those where die-back is known to have been induced by this fungus.

Species most affected at Stradbroke are white stringybark and yertchuk. This pattern corresponds with the known susceptibility of these species to P.c., and as this fungus has since been isolated from the soils of the die-back affected forest to the south of the area, there is little doubt of its implication.

Other species at Stradbroke known to be susceptible, but in which die-back has not been observed, include yellow stringybark, saw banksia, austral grass-tree (*Xanthorrhoea australis*), and a number of heathland plants.

A substantial portion of the Mullungdung forest and the Stradbroke area occurs on flat to undulating, poorly drained leached sands overtopping an impeding cemented sand or clay horizon. It is subject to waterlogging in winter and drought in summer/autumn. Such conditions are known to be conducive to attack by P.c., particularly when warm, moist conditions are followed by drought, as occurred in 1970/71. Since 1970/71 further areas of die-back have been evident in the region but spread has been comparatively minor. A comprehensive series of field experiments has been initiated by the Forests Commission to further study these factors.

Soil disturbance and excess water runoff associated with clearing of vegetation can disperse the fungus to uninfected areas. Infected soils can also be transported on the tracks and chassis of heavy machinery. Where quarantine regulations pursuant to the *Forests Act* 1958 apply, such vehicles must be thoroughly washed prior to their removal from infected zones.

PART IV - CAPABILITIES

AGRICULTURE

The capability of the land for agriculture is low. Increased agricultural production could be obtained by further improvement of the better soils already developed adjacent to the Stradbroke area.

The area has a moderate capability for apiculture. Most of the eucalypts produce a good pollen supply and nectar yields are high, particularly from white stringybark, saw banksia, and a number of the heathland plants.

WATER PRODUCTION

The area has a low capability to supply surface water. It also has a low capability for artesian water production, due to high drilling costs.

HARDWOOD PRODUCTION

The Stradbroke area has a low capability for hardwood timber production, due to the predominance of non-commercial species.

ECONOMIC GEOLOGY

Large deposits of economically winnable brown coal occur beneath a substantial part of the area. The capability of this land, and adjacent areas, for the production of brown coal and its utilization is very high. The presence of the coal deposits restricts the capability of the overlying land to low-intensity short-term forms of use.

The land in the east has a high capability for production of limestone - it is unlikely, however, that stone from this area will be required for extraction in the near future.

NATURE CONSERVATION

The area has a moderate to high capability for nature conservation. The combination of open forests, woodlands, heathlands, and swamps, particularly on the eastern side, provide a high capability for education in and conservation of natural surroundings. The New Holland mouse is also known to occur in this area. In contrast the western portion is considerably less diverse.

RECREATION

The capability for recreation is low to moderate. Few people visit the area at present. Toms Cap has some potential for development as a picnic site or scenic lookout.

SOFTWOOD PRODUCTION

The Stradbroke area contains land capable of growing commercial softwood stands, based on the criteria set out in the Softwood Production chapter. However several constraints operate to reduce the area on which plantations may be established. These constraints are the high capability of the same land for production of brown coal or for nature conservation.

A substantial area of land which is suitable for plantation establishment, and where there is little conflict with other uses, occurs in the west and north-west of the area.

Appendix 1. TWO-WAY TABLE SHOWING SPECIES GROUPINGS
WITHIN VEGETATION UNITS

Species	Vegetation units								
	1c	1b	1d	3b'	1a	3a	2	4b	4a
<i>Eucalyptus radiata</i>	3323								
<i>Eucalyptus viminalis</i>	2233								
<i>Eucalyptus globoidea</i>		443							
<i>Dichelachne sciurea</i>		112							
<i>Eucalyptus obliqua</i>			32						
<i>Eucalyptus muellerana</i>			11						
<i>Eucalyptus consideniiana</i>			3333343333			++			
<i>Banksia serrata</i>			3221222233223						
<i>Eucalyptus nitida</i>						32322			
<i>Eucalyptus cephalocarpa</i>							444		
<i>Lepyrodia muelleri</i>							433		
<i>Lepidosperma laterale</i>							111		
<i>Selaginella uliginosa</i>							432332		
<i>Goodenia humilis</i>							343221		
<i>Schoenus brevifolius</i>							22221	222	
<i>Melaleuca squarrosa</i>								334343	
<i>Blechnum nudum</i>								+1112	
<i>Gleichenia circinnata</i>								223223	
<i>Juncus planifolius</i>								11	112
<i>Juncus procerus</i>								2	222
<i>Lepidosperma longitudinale</i>								333	
<i>Restio tetraphyllus</i>									333
<i>Hakea nodosa</i>									232
<i>Leptospermum lanigerum</i>									33
<i>Eucalyptus ovata</i>									11+
<i>Bossiaea cinerea</i>	11+1		1-1	1+222222		21			
<i>Monotoca scoparia</i>	2112		231111122132221						
<i>Leptospermum myrsinoides</i>	3342		1+1121321	322	1				
<i>Banksia marginata</i>	222312122++12321122					2211			
<i>Lomandra filiformis</i>	2211222232223113222322++								
<i>Pteridium esculentum</i>	2232433		544344543545311+						
<i>Leptospermum juniperinum</i>		12122		22	212	211412222223			
<i>Gahnia radula</i>	221232232				2++12122111+4				
<i>Poa sieberana</i>	323223323				2222322233223				
<i>Leucopogon ericoides</i>	3222				11221				

This table lists some of the species occurring in the Stradbroke area. Each vertical column lists the species found on a quadrat of 100 square metres. Columns are grouped under the vegetation units described in Table 1. Numerals are a measure of foliage cover where + = occasional, cover less than 5%; 1 = common, cover less than 5%; 2 = 5--20%; 3 = 20--50%; 4 = 50--75%.

MAP 8

SUBMISSIONS



LEGEND
 - - - - - Boundary of Stradbroke area

This map may be cut out to accompany submissions